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Project Title: **Application Enhancements**

Location: **Various**

Classification: **Information Services**

Project Cost: **$1,355,000**

This project consists of a number of items as noted.

(a) Business Support Systems

Cost: $189,000

Description: The purpose of this item is to enhance the processes related to the Company's financial, materials management and human resources applications. For 2004, the proposed enhancements include:

1. **Process Improvements**: Process improvements available as part of the upgrade to Microsoft Great Plains (from version 6 to version 7) include:

   - Application security enhancements: Security will be enhanced to provide additional control over sensitive application information. Access can be restricted to pay rates or project information without having to provide separate modified screens. Efficiencies will also be obtained through simplified methods of configuring user security.

   - Increased capabilities for importing data from external sources: This will eliminate re-keying data into Great Plains.

   - Improved access to application information through queries and reporting improvements: Reporting improvements make it easier to track and compare data revisions, access detailed transactions by date ranges and compare general ledger to project accounting information.

   - New multi-bin capabilities for inventory tracking and control at the bin level: This will enable inventory tracking making it easier to locate inventory, move inventory between bins, and track quantites at the bin level.

2. **Bar Coding**: This item involves the implementation of bar coding technology for the central stores location. This includes the use of three portable devices to capture information when receiving, issuing, and transferring inventory, as well as during physical inventory counts. Benefits include:

    - Increased productivity of the storekeepers at Central Stores. Use of bar coding for stock numbers, projects and employee numbers will reduce data entry during the receiving and issuing of inventory, thereby improving the accuracy of inventory records, which will reduce the time to locate inventory and reduce stock outs.

    - Improved management of small tools items, such as gloves and safety glasses, will reduce the inventory for these items.

    - Enabling a storekeeper to perform other duties such as physical inventory counts during the regular working day, thereby avoiding overtime.

    - Less dependence on specific knowledge of individual storekeepers. Material is presently stored and picked based on the storekeepers' knowledge of where the material has been stored in the past. Bar coding will enable staff to quickly and easily locate inventory items in the warehouse without prior knowledge and with less experience.

    - Improved capturing and tracking of warranty information by equipment serial numbers. This would ensure that equipment with warranties closer to expiry are used first.

(b) Intranet/ Internet Enhancements

Cost: $147,000

Description: The purpose of this item is to enhance the Company's internal web site (Intranet) used by employees as well as the Company's Internet site used by the Company's customers and other interested parties. For 2004, the proposed enhancements include:

1. **Changes to the Intranet:** This item involves improvements to document management capabilities, information search and retrieval processes, as well as overall usability improvements. These enhancements will reduce the amount of time spent maintaining the Intranet site as well as allow Company staff to more effectively share documents. Benefits include:

- Reduced dependence on custom code for the Intranet. Internal programming staff will no longer need to perform as many software changes to add functionality or fix problems.

- Decentralized system administration functions. Allows the various Company departments and regions to organize, publish and share documents without the need for technical resources from IS.

- Improved search capabilities will allow employees to find information more quickly.

- An automatic notification mechanism will be implemented to inform necessary personnel when documents have been changed, reducing the time spent reconciling multiple versions of shared documents.

- Enhanced security by incorporating the employees' Company network account and password.

2. **Changes to the Company's Internet site:** This item involves improvements to the customer notification and follow-up process related to customer-initiated emails. Enhancements to the login procedures will make it easier for customers to utilize the on-line services provided in a secure environment, as well as overall usability improvements. Benefits include:

   - Automatic notification of customer-initiated e-mails, whereby customers will receive immediate response from the Company with the expected follow-up timeframe based on the type of request made. This will improve the customer's experience with using the Company's website.

   - Improved customer login process will make it easier for customers to use the secure area on the Company's Internet site, as they can set their password to be something that is more easily remembered. Currently customers must know both their bill account and meter number, and they are unable to access their account without this information. Changing to a customer-defined password enhances customer service and promotes greater usage of the website.

(c) Operations and Engineering Enhancements

Cost: $661,000

Description: The purpose of this item is to implement improvements in the Company's operations and engineering applications in the specific areas of project management, asset management, work order management and outage management. The following are the individual initiatives within this item:

1. **Project Management Improvements**: This involves the implementation of "Microsoft Project Server" and "Project Professional" to enhance the Company's project management practices. Benefits include:

   - Improved consistency in how projects are planned, estimated and tracked by providing company-wide system parameters, project templates and project management guidelines.

   - A centralized database of projects and resources will reduce the manual effort in e-mailing and copying projects by regional personnel into the central projects file located at Head Office.

   - Improved project-reporting capabilities for project leaders responsible for tracking individual projects as well as for managers who track the overall progress of projects.

2. **Crew Scheduling Efficiencies**: This involves enhancements to existing applications in the outage management and asset management areas. This will involve process improvements in the management of field crews during routine asset maintenance and outage situations. To facilitate improvements in the scheduling of crews for routine maintenance, the Company will upgrade the existing Avantis.PRO asset management software. To facilitate improvements in crew efficiency during outage situations, enhancements to the existing outage management data and in-house developed application are proposed.

   Engineering, technical, and skilled trades staff perform work involving maintenance, construction, customer requests and trouble calls. Work planning, scheduling, and tracking methods have been improved recently, especially in the area of maintenance. However, there are still opportunities in the coordination of demands and commitments across a variety of work sources through improved scheduling processes. In coordination with the Project Management Improvements initiative, this item will leverage the capabilities of the existing asset management software to provide more complete management information for workforce planning. Benefits include:

- Operational efficiencies through reduced overtime in outage situations by being able to identify potential trouble spots and dispatching crews geographically closer to the source of the electrical trouble.

- Improved management of maintenance personnel during routine maintenance by being able to associate available personnel and appropriate skill sets with the maintenance work.

- Improved information allowing customers to be better informed during power outages and allow for the better estimation of restoration times.

- Increased reliability by providing more accurate information and statistics to improve decision-making and identification of sections of the distribution system requiring maintenance or upgrading.

3. **Reporting Improvements**: This item involves the replacement of current information analysis and reporting processes with tools and processes better able to manage the financial aspects of projects being conducted by the Company. Benefits include:

   - Consolidation of reporting tools. The proposed reporting tools and processes are currently used to report other Company related information, thereby reducing the need for end-user training.

   - Provision of multiple reporting requirements within the same environment. Reports within Great Plains can be customized to meet specific user requirements, however there is an application restriction that allows only one version of a specific report to be used at a given time. There are several reports that have multiple purposes for multiple groups within the Company. This enhancement would allow the Company to satisfy multiple information requirements within the same reporting environment and reduce the need to modify the core Great Plains reports.

4. **Work Order Tracking**: This item involves improvements to the processes involved with ensuring that customer initiated work is effectively captured, scheduled and tracked. Benefits include:

   - Higher throughput of engineering work within the technical group.

   - Improved scheduling of customer driven work and management of customer's expectations as well as enhanced customer status reporting capabilities.

   - Improved prioritization of workload through the use of software driven priority and project status functionality (currently a manual process), allowing the Company to focus on the highest priority work first.

- Improved process for establishing and meeting project schedules, including requirements for 3rd party work.

5. **SCADA Enhancements**: This item involves enhancements to the SCADA system intended to facilitate improvements to the Company's ability to efficiently and effectively manage the electrical system. Enhancements include:

   - Improvements to the user interface, including consolidating displays and implementing a tiered mechanism for managing SCADA alarms.

   - The development of new displays and the customization of monitoring and control functions.

   - The purchase of a SCADA module that will provide enhanced capability to electronically notify personnel (through cell phones, email, etc.) when there are power outages that have been detected by the SCADA system.

   - Increased integration with other applications such as Asset Management and Outage Management.

   - Expanded access to SCADA historical information.

   Benefits include:

   - Improved productivity of the System Control Center Operators.

   - Improved monitoring and control capabilities essential to ensuring the reliability of the electrical system.

   - Improved planning capabilities related to the Company's distribution system.

(d) Customer Service System Enhancements

Cost: $208,000

Description: The purpose of this item is to implement improvements in the customer service area. The following are the individual initiatives within this item:

1. **Equal Payment Plan**: Two enhancements will be made to the Equal Payment Plan (EPP).

   Weather Adjustment of the Equal Payment Amount: Currently, a customer's actual electrical consumption in the previous year is used to estimate consumption in the coming year. This estimated consumption is used to determine the equal monthly payment. As a result of this enhancement, during initial set up of the equal payment plan and during the annual review process, consumption will be reviewed to determine if the consumption reflects a "normal" year. If abnormal weather conditions existed (e.g. unusually cold or warm), actual consumption will be adjusted for weather. The future payment will then reflect consumption during a "normal" year.

   Equal Payment Review Improvements: Today, the equal payment plan of each of the over 30,000 EPP customers is reviewed four times per year to ensure the annual payments billed reflect actual consumption. This procedure is a mixture of automated and manual steps. If consumption trends indicate the monthly equal payment is substantially low or high, the customer is notified via a letter. The letter provides a new EPP amount, suggests the customer change the payment and explains the impact of not modifying the payment. This process is manually intensive and will be modified and further automated to make it more efficient and to provide more accurate results. Benefits include:

   - Improved service to customers by more accurately estimating their equal payment amount (based on "normal" consumption).
   - Reduced labour required to review a customer's EPP through further automation.
   - Efficiency gains in dealing with customers whose review indicates inadequate history or a significant change in payment. Presently analysts must manually check each situation in CSS, obtain the suggested payment provided there, and then go back to the manual system and add it in.
   - Improved access to customer information (payment, total consumption) regarding the proposed change to the EPP Monthly Payment.

2. **Meter Reading Improvements**: This initiative is focused on changes to the CSS to make the system capable of supporting AMR demand meters that will be purchased in

2004. Justification for purchase of these meters is provided in Volume III, Distribution, Appendix 1.

3. **Scheduling Improvements**: A new module for the current *Aspect* call centre software application that forecasts call centre staffing level requirements will be purchased and installed. This software tracks and analyses historical call volumes, models the required call centre resources to respond to anticipated call volumes for each half-hour increment of the day, and schedules the required shifts to cover the recommended level of customer service agents.

   Benefits include:

   - Optimization of customer service levels to ensure there are enough customer service agents in the call centre to meet customer demand.

   - Efficiency gains in the utilization of customer service agents. Forecasting to ensure the appropriate resources are available to meet customer service demand results in a more efficient allocation of the resources.

   - Additional capability to forecast agent staffing for outbound calling and e-mail responses.

(e) Various Minor Enhancements:

Cost: $150,000

Description: The purpose of this item is to complete enhancements to the Company's computer applications in response to unforeseen requirements such as legislative and compliance changes; vendor driven changes and employee driven enhancements designed to improve customer service or staff productivity. Examples of previous changes included a vendor driven upgrade to hand-held meter reading software, customer monthly consumption edit enhancements to improve customer service and government driven changes to income tax calculation in the payroll applications.

Project Title: **Application Environment**

Location: **Various**

Classification: **Information Services**

Project Cost: **$791,000**

This project consists of a number of items as noted.

Description: This project consists of upgrades to software components and processes related to the operation of the Company's business applications. For 2004, the proposed upgrades include:

1. **The Microsoft Enterprise Agreement**: This Agreement covers the purchase of Microsoft software and provides access to the latest versions of each software product purchased under this agreement.

   Through the Microsoft Enterprise Agreement the Company achieves an overall cost savings. This is a fixed, annual price agreement based on the number of eligible desktops in the Company.

   In 2002 the Company investigated the various types of payment methods available for the purchase of the following Microsoft licenses: Microsoft Word, Microsoft Excel, Microsoft PowerPoint, Microsoft Access, Microsoft Outlook, and Microsoft SQL Server Client Access. The 3 options identified by the Company were:

   1. Do nothing now, and pay for net new licenses to upgrade in the future.
   2. Purchase a Microsoft Select Agreement (SA) for each instance of the software. This provides the Company with the ability to use the latest releases of the identified software for a two-year period. These licenses have to be purchased individually as they are needed.
   3. Renew the existing Microsoft Enterprise Agreement (EA) at the proposed discount. This provides the Company with the ability to use the latest releases of the identified software for a three-year period. These licenses are paid for at the same time once a year following a count of the personal computers.

The following table identifies the costs associated with the above options for approximately 597 personal computers (PCs):

	Cost per PC
Do Nothing	$1,420
Select Agreement	$361
Enterprise Agreement	$288

The EA renewal is the least expensive and least administratively burdensome option for Newfoundland Power at this time.

2. **Database and Development software**: This item involves upgrades to the underlying software components that are used by the Company's application systems. These components include database management software and tools used to develop, modify and operate business applications. For 2004, proposed upgrades include:

   - Database management software.
   - Microsoft SQL Server database software.
   - Application development software.

   These upgrades will ensure the Company's business applications continue to function in a stable and reliable manner as well as ensuring an appropriate level of vendor support is sustained. It will provide the Company's technical support staff with more effective tools for operating and supporting the Company's business applications. One example of this would be increased efficiency in responding to operational problems by having the application system automatically notify one of the Company's technical support staff when a problem is detected.

3. **Environment Management software**: This refers to the technology and processes used to develop, configure, test, implement and maintain applications and hardware throughout the Company. For 2004 this includes:

   - Upgrades to the Company's backup and recovery software used to ensure that the Company's business applications and data are effectively retained for business continuity and retrieval of historical information.

   - Upgrades to the Company's workflow application infrastructure used to operate the "Contribution in Aid of Construction" (CIAC) and "Authorization for Change in Payroll" applications.

   Benefits include:

   - Improvements to the reliability and stability of the Company's backup and recovery processes. The software currently used for backup and recovery (for

Windows platforms) was implemented in 1995 and is unable to effectively meet the required backup cycles needed to manage the Company's more than 1 Terabyte (1,000 gigabytes) of information.

- Reduction in costs associated with data corruption or application downtime. Certain backup procedures have failed in the past, requiring the Company to re-run these backup jobs during peak hours (causing overall system performance degradation).

- Consolidation of software used for backing up information from all operating systems used by the Company. Currently, there are different backup and recovery products for the Company's operating systems (OpenVMS, Windows and Tru64 Unix).

- Consolidation of backup and recovery processes, reducing the overall system administration activities (related to having three disparate products at this time).

4. **Application software**: This involves the upgrade of the Company's application software packages, including Microsoft Great Plains and Invensys Avantis.PRO.

   The Microsoft Great Plains upgrade from Version 6.0 to Version 7.0 was initially included in Newfoundland Power's 2003 Capital Budget Application approved by the Board in Order No. P.U. 36 (2002-2003). Microsoft subsequently extended its support of Version 6.0 and Newfoundland Power therefore deferred this major upgrade till 2004. A minor upgrade to Version 6.08 was completed in 2003 at a cost of approximately $78,000. This was a pre-requisite to the Version 7.0 upgrade and was required in 2003 to facilitate improved third party billing procedures.

   The Avantis upgrade is required to meet a contractual obligation related to the initial implementation of the product (in order to maintain support and maintenance).

   Benefits include:

   - Ensuring that corporate applications continue to operate in a stable and reliable manner and avoid the risk of software failure or obsolescence.

   - Additional and enhanced functionality that will add to the Company's overall efficiency without the cost of installing new software. This item will allow Newfoundland Power to avail of newly developed functional capabilities in newer releases of existing application software and reduce or eliminate the need to acquire additional software, or develop manual workarounds.

   - Reduce the dependence on Company specific modifications. With many of the Company's packaged applications, modifications were made during the initial implementation in order to meet specific Company requirements. Performing

upgrades often includes enhanced (or new) core functionality that would result in the Company being able to remove the modification from its configuration. For example, with the latest release of Microsoft Great Plains, there are two enhancements that the Company can utilize, eliminating the need for custom modifications and process "workarounds".

5. **SCADA Development Environment**: This item involves the setup of an environment to support ongoing development of the SCADA application used by Newfoundland Power to monitor and control the electrical system. This will involve the purchase and installation of additional software licences and configuration of the environment to support application upgrades and enhancements as well as testing and training. Benefits include:

   - More efficient mechanisms for ensuring the reliability and integrity of the production environment.

   - More opportunities for prototyping and near production testing and training.

   - Ensuring that changes affecting the SCADA system are fully tested before being implemented in the production environment.

   - A more effective process for migrating changes to the production environment.

Project Title: **Customer Systems Replacement**

Location: **Various**

Classification: **Information Systems**

Project Cost: **$226,000**

Description: This project consists of several enhancements to the Customer Service System ("CSS") that reduce the dependence on the OpenVMS operating system. Through this project, computer programs will be retired from the OpenVMS system in keeping with the findings of the Customer Service System Replacement Analysis (See Volume IV, Information Systems, Appendix 3, Attachment A). The CSS programs being replaced are:

1. **Customer Bill Design, Format and Print:** Currently the layout of the customer bill is programmed as part of the custom developed software application inside the CSS. The process of defining the layout and formatting each bill for printing will be retired from the CSS by utilizing alternative available printing facilities. Other existing printing facilities will be modified to allow for design and formatting of bills without the need for detailed knowledge of a computer programming language.

   Benefits include:

   - Reduced effort in designing and formatting of customer bills, thereby increasing the Company's ability to modify its bill formats, increase customer satisfaction and respond to customer needs. Since the CSS was implemented in 1992, significant changes to the design of the customer bill have not been given priority because of the extensive effort and resulting cost to re-program the bill layout.

   - Reduced dependence on the OpenVMS operating system through the retirement of software.

2. **CSS Customer Letters:** Currently a special version of the WordPerfect word processing software is utilized on the OpenVMS operating system to format and print many customer form letters. This item will retire the current letter format on OpenVMS and the WordPerfect package.

   Benefits include:

   - Reduced effort to design and format a new letter or to revise an existing letter. This is currently a manual process requiring knowledge of computer programming. Use of the new printing facilities will allow the Company to set up and revise letters with minimal technical support (reducing the reliance on

specific resources).

- Eliminate the need for a special version of WordPerfect on OpenVMS, further reducing the Company's reliance on OpenVMS.

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3. **CSS Reporting:** This item involves implementation of reporting tools to support ongoing ad-hoc reporting requirements. A number of existing production reports and procedures that extract information from the CSS database will be replaced. A number of these reports involve customer collections.

Benefits include:

- Improved access to customer information.
- Improved collections reporting to provide better control of disconnects, write-offs, and bankruptcies.
- Improved flexibility of customized reports by being able to enter specific parameters rather than have to program the specified requirements.
- Reduced dependence on specific individuals to create reports.
- Reduced dependence on the OpenVMS operating system through the retirement of custom programming code.

Customer Service System

Replacement Analysis

July 16, 2003

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Appendices

Executive Summary

Introduction

The Customer Service System Study as planned for in the Company's 2003 capital program was completed in July of this year. The purpose of this study was to examine whether feasible alternatives to replacement exist that would extend the useful life of the Customer Service System (CSS) while mitigating the risk associated with declining industry support of the OpenVMS operating system.

Background

The CSS performs customer billing and payment processing and supports the Company's customer services activities in the Customer Contact Center and throughout the organization. It is the largest and most complex business software application at Newfoundland Power. The CSS is an internally developed software application (as opposed to a software package) that is now over 11 years old. The application runs on the OpenVMS operating system.

OpenVMS is a software tool that is categorized as a server operating system. It controls computer hardware (i.e. servers) and how the hardware functions. It enables software applications to reside on servers and to utilize capabilities such as processing capacity, memory, connections to networks and storage.

The CSS is a large and complicated system and the minimum duration of any project to replace it is 18 months with more than 24 months from initial planning to a working system being not unreasonable. Given the length of time required to replace the system, judging timing of technical obsolescence is a critical issue. Significant, if not catastrophic, consequences in terms of impact on revenues, costs and customer service will result if the existing system ceases to operate before it can be replaced.

In August 2001 the Company provided the Public Utilities Board with a report that identified the declining support for the OpenVMS operating system as an emerging issue at Newfoundland Power. A copy of the report is provided in Appendix A – PUB OpenVMS Obsolescence Report.

The report outlined the implications of the issue and the Company's plans for replacing OpenVMS based applications. At the time it was anticipated that the CSS would need to be replaced in the three to five year time frame, subject to change based on IT industry developments.

Newfoundland Power's Reassessment of the OpenVMS Situation

What IT industry developments have occurred since 2001?

In May 2002, Hewlett Packard Company (HP) merged with Compaq Computer Corporation, the vendor for the OpenVMS software.

Since this merger, HP has provided a detailed roadmap of future support for the OpenVMS operating system. They have been aggressively promoting the OpenVMS operating system as a viable platform and they plan to continue selling and supporting OpenVMS based computer systems for at least another 8 years. HP has sent a personalized letter to Newfoundland Power reiterating their roadmap and support plans.

In addition to OpenVMS, the CSS relies on database software from Oracle Corporation and software development languages from Cognos. The particular software tools used by Newfoundland Power have features that are dependent on the OpenVMS operating system. Both Oracle and Cognos have publicly announced that they will continue to support their tools according to HP's roadmap for OpenVMS.

Is OpenVMS still in decline?

The number of Independent Software Vendors (ISVs) developing and marketing business applications for an operating system is a key indicator of the health of the operating system. Although HP has been very aggressive in showing their long-term commitment to OpenVMS, leading IT industry analysts Gartner Group[1] continue to feel that the number of ISVs that are providing products that run on the OpenVMS is dropping and will continue to drop.

There continues to be little or no coverage of OpenVMS at conventions, conferences and trade shows. As well there continues to be no local college or university academic programs that focus on OpenVMS or dependent technologies.

Other signs of decline previously experienced by Newfoundland Power were slower response to support calls, waiting longer to have software bugs fixed, and very limited access to experienced OpenVMS staff across Canada. Although these concerns are still present, Newfoundland Power has already replaced a number of OpenVMS based systems and therefore the amount of support and assistance required has been reduced. As well, the remaining OpenVMS

[1] Gartner Group is a research and advisory firm that helps more than 10,000 businesses understand technology and drive business growth. Founded in 1979, Gartner is headquartered in Stamford, Connecticut and consists of 4,600 associates, including 1,400 research analysts and consultants, in more than 80 locations worldwide.

dependent applications have been very stable. As a result, there have been few support calls and little need for assistance from OpenVMS qualified resources.

The question continues to be not whether to migrate but when. The Gartner Group's view has moderated somewhat on the timing of migration and they are currently of the opinion that … "OpenVMS is not a sustainable strategy other than for specific and short-term tactical needs or budget needs".

Newfoundland Power's Plan for Replacing the CSS

Newfoundland Power conducted a review of how well the existing CSS is supporting efficient delivery of customer service. It has been determined that although there are a number of opportunities to add enhancements to the CSS, none of the opportunities individually, or as a whole, would require replacement of major portions or all of the CSS. At the highest level the very high customer satisfaction levels and general reduction in operating costs per customer over the past number of years are indicators the existing CSS is meeting the needs of the Company.

At this time any consideration for replacing the CSS is related to the continued decline of the OpenVMS platform and as a result of functional obsolescence.

What are the options?

The Company has identified a number of courses of action. One option is to replace the CSS by purchasing and implementing a software package that is not dependent on the OpenVMS operating system. This may have additional benefits of allowing the Company to improve customer service and obtain efficiencies through the utilization of new functions and features not present in the existing CSS.

As a result of consulting with utility industry analysts, customer service system experts and customer service system software vendors, Newfoundland Power estimates a project to implement a new software package would be eighteen to twenty-four months in duration at a cost in excess of $10 million.

A second alternative is to keep the existing CSS as it is today and migrate the underlying software to a new operating system. Newfoundland Power asked a number of vendors who are experienced at migrating OpenVMS dependent software to new operating system platforms to complete assessments of the approach and costs to migrate the CSS. One of these vendors (Sector7) is a market leader at completing technology migrations. As well the Company asked the assistance of our current major technology suppliers, HP and Microsoft, to identify alternative approaches and costs for a migration. As a result of these assessments and advice from our major technology suppliers Newfoundland

Power estimates it would take eighteen to twenty-four months to migrate the CSS application to a new operating system at the cost of at least $6 million.

A third alternative is to continue to run the CSS on the OpenVMS platform and monitor industry developments and HP's progress on their support roadmap. The Company does not expect to experience any major increases in costs to continue running the CSS on the OpenVMS operating system in the next several years. Although one of the signals of declining support is increased support costs (e.g. to obtain and retain OpenVMS expertise, one of a kind hardware and software licensing and maintenance costs etc.), there are several employees who have OpenVMS expertise and the support costs for hardware and software are not expected to be significantly more expensive than similar costs for a new or migrated application, at least, in the next several years. A key benefit of this alternative is that the existing system will continue to be used to support delivery of service to customers and will not be prematurely replaced with respect to it's functional lifespan.

What will we do?

Newfoundland Power feels the best alternative now is to continue to run the CSS on the OpenVMS operating system, be vigilant to monitor industry developments and react accordingly and reassess the OpenVMS situation again no later than 2006.

It is Newfoundland Power's view that there is acceptable risk associated with the short and medium term viability of the OpenVMS operating system. HP, Oracle and Cognos are committed to supporting OpenVMS over the next number of years. Given the large number of their customers depending on these companies' software, the period of time allowed to remove applications from OpenVMS would be measured in multiple years should these companies unexpectedly announce plans for no longer supporting their OpenVMS software. Accordingly, in our view there is little or no risk that the CSS will be rendered inoperable as a result of OpenVMS obsolescence issues within the next three years.

Finally, in the review of available replacement software packages, the Company did not see functionality that would provide such an advance in customer service or introduce efficiencies to justify a very large implementation project and an investment of more than $10 million at this time.

What are the next steps for the CSS?

In the next several years the Company will continue to enhance the CSS where efficiencies and customer service improvements may be realized and can be justified. The fact that the CSS may be replaced some time after 2006 will be taken into account when justifying such projects. In the course of completing

enhancements the Company will seek to identify approaches to reduce dependence on the OpenVMS operating system. Reduced dependence will be an added benefit to any such project if realized.

All future enhancements to the CSS will be rigorously reviewed and if any new software modules are developed, they will be developed using toolsets that are not dependent on OpenVMS. As well, the Company will look for opportunities to buy "bolt-on" software packages or utilize capabilities of existing non-OpenVMS dependent systems. For example, in 2004 the Company plans to enhance the CSS with a more flexible and efficient bill design and print function and a new customer letter design and print function, utilizing the capabilities of the existing printing facilities that do not reside on OpenVMS. This will allow for retirement of a significant portion of the CSS software that currently formats and prepares customer bills and letters, while improving customers service and obtaining efficiencies. Finally in 2004 the Company plans to utilize non-OpenVMS related technology for Customer Service reports. As new reports are developed and existing reports are revised, OpenVMS dependent report programs will be retired.

By gradually reducing dependence on OpenVMS the Company will be well positioned to minimize migration costs if a migration is required. As well, if a package replacement becomes the wisest future option, the number of modules purchased may be minimized.

To obtain further external validation of the approach and findings of this CSS Replacement Study the Company commissioned Meta Group[2] to review a draft of this report and provide their professional opinion. Meta Group's summary conclusion as a result of their review is as follows: "In conclusion we jointly concur with the findings and recommendations in the aforementioned Newfoundland Power Customer Service System Replacement Analysis Study." A copy of their review is provided in Appendix B – META Group CSS Replacement Study Review.

Update of Plans for Other OpenVMS Based Systems

Are we on track?

The company's plan, as outlined in the report provided in 2001, remains to decommission the OpenVMS environment in an orderly and cost effective fashion through the normal replacement of applications.

In 2002 all Business Support Systems including Human Resources, Financial, Payroll and Material Management systems were replaced as scheduled.

[2] META Group is a research and advisory firm that helps more than 3,300 businesses in 40 countries understand technology and drive business growth. Unlike Gartner and other advisory firms, META Group also provides vertical expertise and coverage of the IT solutions for industries such as energy and utilities.

As a result of application replacements to-date the number of OpenVMS based servers supporting applications has been reduced from five down to three. The only OpenVMS based servers in use today are those required to support the remaining Operations and Engineering applications, CSS and CSS dependent applications and the Problem Call Logging application.

In the last half of 2003, OpenVMS based applications to support the Operations and Engineering areas of the business will be replaced as planned.

The Problem Call Logging System, currently supporting Outage Management, is an in-house developed OpenVMS based application. This application will be migrated to the Windows operating system and will receive significant functional enhancements as a result of the Outage Management project being completed in 2003.

By end of 2003, the only OpenVMS based applications still operating within the Company will be the CSS and CSS dependent applications.

Summary

The Company is continuing to treat the issue of declining support for the OpenVMS operating system very seriously. An overly aggressive response to this risk could result in unnecessary increases in costs to support the customer service function, reduce customer service levels and introduce inefficiencies while employees are distracted with unnecessary changes to the systems supporting the Customer Service function. However, ignoring this risk until it is too late to react effectively will result in exorbitant costs to resolve a crisis, reduced revenues and loss of ability to provide customers with even basic services.

The Company has weighed the high costs of replacement or migration of the CSS against the risks (and therefore potential high costs) of keeping the CSS on the OpenVMS platform. The short to medium term risk of loss of support of OpenVMS is minimal. The Company will continue to run the CSS on OpenVMS for the next several years while reducing dependence where possible and monitoring industry development and acting accordingly.

For all other OpenVMS dependent applications, the plans to remove applications from the OpenVMS operating system are proceeding as expected.

Introduction

1. Purpose of CSS Replacement Analysis

The purpose of this analysis is to assess the functional and technical health of the CSS and make recommendations regarding timing and approach to replacement. The long-term viability of the OpenVMS platform upon which the CSS resides is a current concern, which will be assessed through this analysis.

2. Background

The current Customer Service System was originally implemented in two phases with the first implementation in November 1990 and the final release in June 1992. The system was expected to support the Company's Customer Service business requirements for 20 years. In 1998 a major technical environment refurbishment was completed as a result of Anderson Consulting (now called Accenture) discontinuing their support for the proprietary Install/1 product used to develop and operate the online system.

Given the system is 11 to 12 years old, and therefore past half of it's expected useful life, it is prudent to review how well the system is supporting the Customer Service function and recommend a strategy for future enhancements or replacement as required.

Why is OpenVMS an Issue?

In 1998 Compaq Computers acquired Digital Equipment Corporation (the owner of the OpenVMS Operating System) and merged the companies. As a result of this merger, industry analysts questioned the long-term viability of the OpenVMS operating system to be the operating system of choice to support business software applications. Since that time, Newfoundland Power has been monitoring the concern and initially made the PUB aware of the issue in 2000. In 2001 the Company delivered a report to the PUB identifying the issue and outlining the Company's plans for addressing it. The report can be found in Appendix A - PUB OpenVMS Obsolescence Report .

Given the CSS is the largest corporate application in the Company and it runs exclusively on the OpenVMS platform, the life expectancy of the CSS is directly related to the issue of the life expectancy of the OpenVMS platform.

Technology Background

Advances in technology have continued in dramatic fashion since the CSS was initially developed in 1992. Computing speeds have grown exponentially, computer memory capacity has grown and data storage capacity has seen amazing increases along with major cost reductions. With these advances and with the advent of the Internet and associated Web technologies the way in which software applications are developed, deployed and managed continues to change and therefore the tools to support these activities have also changed. The Technical Migration of the CSS in 1998 is a relevant example of this. This $2 million project involved converting the DBMS from Rdb to Oracle and converting the online transaction software to a new development language. This migration was necessary due to the vendor no longer supporting the online transaction processing software used by the CSS.

Functional Background

Since the CSS was implemented in 1992 the Company centralized the Customer Service function, implemented and subsequently terminated bi-monthly meter reading, implemented multiple EPP options, implemented Pre-authorized payment plans, implemented world class customer contact center technology including IVR, increased support for Outage Management by linking customer premises to distribution feeder and implemented OMR enabled meter reading. All of these changes and improvements have been supported and in many cases enabled by the CSS.

The CSS continues to be enhanced and maintained to support improved customer service and cost reduction opportunities.

3. Overview of the Approach

The approach taken for this analysis includes:

- Complete an internal assessment of the functional and technical health of the CSS.
- Identify the long-term functional requirements for the CSS and adequate technology to support these requirements
- Examine the external environment with respect to the experience of similar and local utilities.
- Reassess the long-term viability of the OpenVMS platform, obtaining information from our major technology partners, industry experts and the market in general.
- Obtain an understanding of Customer Information System (CIS) package offerings with respect to functional fit and cost.
- Obtain an understanding of CIS extensions or "bolt-on" applications with respect to type, functional fit and cost.
- Review what industry experts are saying about CIS for electric utilities.
- Review what industry experts are saying about current technologies used to maintain the CSS.
- Identify Technical Migration alternatives and obtain cost estimates and other significant demographics (e.g. length of project, fit to target technology environment, etc.).
- Among "Package Purchase", "Technical Migration" and "Stay on OpenVMS" alternatives, recommend a future strategy and provide plans and timelines for the recommended strategy.

Assessment of Internal and External Environment

1. Current CSS Functional Assessment Summary

1.1. Customer Service Function Description

The Corporate Communications, Customer Service and Safety Department ("the Department") at Newfoundland Power has a diverse range of responsibilities including corporate, functional and operational responsibility for delivering award winning Customer Service. The Department performs those business functions required to deal directly with customers (e.g., inquiries and service requests), the collection of meter readings, billing, the management of special programs, payment processing as well as credit and collections.

1.2. Customer Service System Description

Developed in-house, with the assistance of a major consulting company (Accenture), the Customer Service System (CSS) provides the Company's primary accounts receivable and direct customer billing for electrical sales. It consists of Meter Reading, Pre-billing, Billing, Cash Processing, Pending Work Queues, Credit and Collections, Accounts Receivable Maintenance, Service Orders, System Controls and Financial Controls. A more detailed description can be found in Appendix C - Customer Service System Functional Description.

1.3. CSS Functional Assessment

On a quarterly basis, the Company conducts a survey to determine its approval rating amongst its customers. The approval rating for the last three years has been on average 90% (89%, 90% and 91%). This gives NP a strong indication there are no major customer service issues driving a replacement of CSS.

However, as evidenced by change requests, notes and the discussion given below, there are gaps and weaknesses within the CSS. The question to be asked is how important are the changes to "doing" our business. Are they simply something nice to have or are they necessary to the efficient operation of the business? Does the value they add outweigh the cost of making the change? Do these changes become the economic driver for replacing the CSS?

Analysis

Interviews were conducted with the CSS users and stakeholders to determine the level of need. This review included all levels of positions, from clerical staff to Directors, and users external to the Customer Service Department. In addition to interviews with staff, existing documentation regarding outstanding issues were evaluated as were change requests identified during user acceptance testing and the original implementation in 1992. Together this review yielded approximately 220 potential functional changes or enhancements.

This list of potential changes were roughly prioritized based on a very high level review of expected benefits. As well an order of magnitude of effort (High, Medium and Low) was estimated to facilitate planning.

Approximately 21 % of the 220 potential changes identified were ranked as a "High" priority. The majority of these potential changes impact the Billing and Credit functional areas. It is expected these high priority changes alone will require approximately 18 years of programming effort (does not include implementation effort or user involvement for design and testing.). One example of a high priority change opportunity, is to implement customer service and efficiency improvements to the Equal Payment Plan procedures.

Although the number and associated effort of potential changes is significant, the nature of the outstanding changes reflects normal system evolutionary requirements to improve customer service or realize efficiencies. None of the potential changes reflect a dramatic change in business requirements. The CSS is adequately meeting the need to support the Customer Service function.

2. Current CSS Technology Assessment Summary

2.1. Information Services Function Description

The Information Services Department consists of approximately forty staff, operating out of a centralized location at Head Office in St. John's. The group is divided almost equally between Operations/Infrastructure and Solutions Delivery. A substantial number of the Company's current enterprise applications run on the Compaq Alpha/OpenVMS platform; other applications and all collaborative, workgroup and personal computing applications utilize the Microsoft NT/Windows 2000/Exchange/Office environment.

Over the past five years the Company has established several processes within the Information Services function. These include:

- Help Desk and Support Call Escalation
- Change Management
- Desktop Renewal
- Disaster Recovery
- Solutions Delivery
- Application Support and Maintenance

2.2. CSS Technology Description

Customer Service System Technical Architecture

The technical architecture of the CSS is described within the context of:

- Online Environment/User Interface
- Batch Environment
- Data Architecture
- Security Architecture
- Reporting Environment
- Development Environment
- Hardware Infrastructure

Detailed descriptions of the technical architecture within these areas can be found in
Appendix D – Customer Service System Technical Description.

Customer Service System Application Integration

The CSS application and the Company's other custom developed and third party applications are integrated. As well, there is an exchange of information with outside agencies.

At the present time, the Company does not use middleware integration products. Most of the integrations are custom developed, batch oriented, point to point data file transfers with upload and download procedures, with the exception being direct database access in certain applications to and from the CSS.

An overview of the various application integrations can be found in Appendix E – CSS Application Integration Description.

2.3. CSS Technology Assessment

Strengths

The following are the major strengths of the CSS technology environment:

1. Response time for most functions in the online environment is now sub-second. As well there are three ways of navigating around the system, which provides a lot of flexibility for different situations and user preferences. The ability to have multiple conversation "threads" open at the same time (called the suspend/resume function) allows for increased productivity by contact center staff.
2. A large portion of the batch processing software is written in COBOL, a language that continues to be in heavy use worldwide and whose future is very stable.
3. The batch-processing environment is heavily tuned for performance and integrity and is therefore very stable. After hours callouts have become rare and usually are related to human error.
4. The data model for CSS is fully documented and very well normalized to support the online and batch processing. The database management system (DBMS) is from a leading vendor (Oracle) and there are deep in-house skills for supporting the database environment. Overall security features are strong with multi-layered security (OS, DBMS and Application) that work well together.
5. The hardware platform and operating system are highly secure, scalable and stable.
6. The development environment is stable and very rich in functionality with very mature environment management procedures and various in-house tools and procedures to support development and testing.

7. The disaster recovery environment is an exact copy of production with up to date procedures in place.

Weaknesses

The following are the major weaknesses of the CSS technology architecture and environment:

1. The operating system platform of OpenVMS will not be a viable platform over the long term.
2. Legacy development tools (Axiant, Powerhouse Quiz and QTP) are being used for programming the online system, most reporting and some core batch processing. Skills for these legacy tool sets have to be maintained in-house but are not required for any of the new systems.
3. There is no user-friendly reporting tool being used (currently using a legacy tool – Powerhouse Quiz) and the data model, although optimized for the online system and batch processing, does not adequately support reporting requirements.
4. There are a huge number of activities requiring operator attention when running nightly batch processes. There are many opportunities to make batch operations much more efficient and less operator dependent. The batch window has less than optimal contingency for having the system available at 8:00 am as a result of inefficient reporting processes and no separate reporting environment.
5. The architecture of the batch-processing environment is extremely complicated and is very inefficient, causing operations problems and difficult recovery when things go wrong.
6. With the current online client/server topology, desktop deployments tend to be complicated and time-consuming.
7. Although we are utilizing a leading DBMS vendor (Oracle) the DBMS is not as well supported on the OpenVMS platform as others and the availability of “OpenVMS specific” deep DBMS skills is problematic. This causes problems with lengthy and costly upgrades, unavailable features and longer times to receive DBMS bug fixes.
8. As Information Services department and Customer Service department staff move onto other technologies, CSS specific skills and knowledge are not being retained. In-depth knowledge rests in a small number of individuals.

Overall the most significant technology issues associated with the CSS are the reliance on the OpenVMS platform and significant dependence on the legacy software development tools of Powerhouse and Axiant.

3. Other Utilities

3.1. Utility Survey Summary

Survey Description

A survey of other Canadian utilities was conducted in the course of this analysis. The purpose of the survey was to gain an understanding of the demographics of CIS systems in use at other Canadian utilities (major features, whether packages or in-house systems, age of systems, technology platform etc.) and the past experience and future plans of other utilities with respect to their Customer Information Systems. An understanding of the experiences of other Canadian utilities provides an inexpensive way of learning about potential pitfalls before we proceed on any path.

Most utilities were included on the basis of whether they were electric utilities and of a similar size to Newfoundland Power. The CEA membership directory was used to identify potential survey candidates. Two other Canadian Fortis sister utilities also were included, as were a small number of smaller and larger utilities to round out the list.

Each utility was contacted prior to sending an actual questionnaire to determine interest in participation and to obtain contact information. The identified contact was sent a questionnaire via e-mail and was followed up with a phone call about week after they received the survey.

Fourteen utilities initially were identified and contacted of which 12 utilities actually received the questionnaire.

The Questionnaire Template is provided in Appendix F - Utility Survey Description.

Survey Results

The response was poor and although initial contacts indicated the utility would respond, eight utilities later decided not to participate. The initial contacts were followed up by email and telephone calls in an attempt to obtain a response. Only four utilities completed the survey in full and one submitted a partial response. Telephone follow up indicated the remaining utilities decided not to respond to the information request due to the state of the utility industry, specifically the deregulation of the industry in Alberta and Ontario (competition and confidentiality).

Given the low number of responses, the usefulness of the information received is limited. The following is a brief summary:

- Software packages are being used with most utilities utilizing specific specialized in-house developed applications to complement the package software.
- All utilities that responded have on-site cashier facilities for bill payment and most had authorized agents collect payments on their behalf as well.
- The Microsoft Windows environment is being utilized as a platform for the CIS for at least one utility.

3.2. Newfoundland and Labrador Hydro

Newfoundland and Labrador Hydro ("Hydro") serves over 30,000 mostly rural customers on the island of Newfoundland and in Labrador.

Various contacts with Hydro have been made in the past year to identify ways of achieving common efficiencies within Meter Reading and other Customer Service functions.

In May 2003 Dale Batstone (Information Services - Project Leader), John Pope (Information Services - Technology Specialist) and Linda Moores (Customer Service – Customer Accounting Specialist) met with Hydro's Glenn Mitchell (Rates & Financial Planning), Donna Smith (Rates & Financial Planning) and Janice Sears (Information Services) to specifically share experiences and plans regarding their respective Customer Information Systems.

Historically Newfoundland Power hosted Hydro's bill calculation and print processing until Hydro implemented it's own system just prior to Y2K. (In the 1970s, Newfoundland Power and Hydro's systems were almost identical and used the same software system.) To meet Y2K compliancy, Hydro implemented a J.D. Edwards Enterprise Resource Planning system for all of their major business applications (Financial, Materials Management, Work Management, CIS, etc.).

The CIS module is a separate module but is heavily integrated with all of the other modules within the ERP solution.

The following are a list of "points" resulting from the discussion:

- o In terms of business requirements, the Rates and Financial Planning group are reasonably satisfied with the system's functionality.

- The current version of the software Hydro is using is a mainframe-based solution relying on older technology such as the RPG development language. This is a “green screen” or text-based system.
- The latest available version of the J. D. Edwards ERP (One World) is browser based.
- The CIS module can be purchased separately; however, many of the benefits associated with it are related to tight integration with the other J.D. Edwards packages, particularly Finance and Work Management.
- AMX International markets and implements a newer up-to-date version of Hydro’s CIS, called Utiligy.
- The future of their CIS is tied directly to the future of their investment in the whole J. D. Edwards ERP portfolio

Based on the level of integration required to realize significant benefits and the older technology being utilized, Newfoundland Power will not pursue Hydro’s CIS as a replacement option.

However further discussion should continue with Hydro on shared opportunities regarding meter reading, cash processing, bill print and other potential “bolt-on” scenarios.

Objectives and Vision

The purpose of this section is to identify business and technology strategies and plans which will influence decision making regarding the replacement or ongoing maintenance of the CSS.

1. Business Objectives

The high-level business objectives associated with the Customer Service function are:

- Continue to optimize customer service costs through fine-tuning existing business processes to obtain efficiencies.

- Continue to provide excellence in customer service through timely delivery of cost effective customer service programs that match the demands of our customers.

2. Business Vision

2.1. Customer Service Vision

Each section of Customer Service has determined its future direction. Frequently, this path crosses functional areas affecting other sections.

Meter Reading:

In response to market trends, Newfoundland Power will leverage the current Handheld Meter Reading System and may continue its pursuit and utilization of Automated Meter Reading (AMR) technologies.

- Continued adoption of and investment in new AMR technologies could impact the current meter reading workforce, both by reducing the number of positions and demanding a new technical competence and/or different work skills.

- As the Meter Reader's daily work reduces, more time will be available for other duties. The Company will continue to "in-source" work that complements the meter reader's position from groups internal and external to the Company. In the past this has included completing meter changes in the field.

- AMR will reduce the need for additional field visits required to obtain meter readings at inaccessible and unsafe locations. In addition to obtaining efficiencies, this may reduce risk of injury to employees.

Customer Payment:

Customers increasingly will rely more and more upon electronic payment options as they become available.

- New customers are more likely to use electronic payment options than their parents (Newfoundland Power's current in-person customers).

- The take up rate for electronic payment options (bank payments, telephone payments) has increased over the past number of years. This trend will continue.

- In response to increasing cost pressures, it may be more economical in the short term to offer in-person payment facilities at sites other than NP offices. In the long term, maintaining in-person cash facilities in all the Area Offices may not be cost justified.

- Current hardware issues make it necessary to replace the front-end cash register systems within the next year or two. The present assumption is in-person cash facilities will be, as a minimum, available in major centers.

Billing:

Billing within CSS will become more complex over time.

- As rates become more complicated, training and retention of this information by staff will become an issue. This will change the knowledge and skill levels of certain positions within the clerical group.

Credit and Collections

Credit and Collections will rely more on technology to communicate with customers and will be impacted by technology changes to other areas of the Company.

- Technology advancements in other areas of the Company, including Meter Reading, Outage Management and Engineering/Operations, may change credit workflows and work processes. For example, advances in Automated Meter Reading may reduce or eliminate the need for field visits to disconnect service.

- Field collections staff may require a new technical skill set.

- Utilization of web and other new technology should decrease the number of field visits required by collections staff.

- New reporting tools will allow management staff to focus credit and collections resources as needed.

- Collection action will be customized according to customer profiles and risk factors.

Customer Contact Center/Customer Service:

The Customer Contact Center will utilize the web and new contact technologies to meet its customer service objectives. Programs and service levels will be weighed against increased operating costs.

- With operating costs likely to increase over the next few years, it is unlikely the Customer Contact Center will expand its operating hours.

- To respond to low demand and to offset increasing budgetary pressures, the Customer Contact Center may withdraw in person service during off peak hours, e.g. after 6 pm.

- Again, due to high operating costs, the focus will be on providing customers with direct access to the information they need to conduct their own business (e.g., request for service, EPP, etc.) or answer their own queries (e.g., high bill complaints). The Web and its technologies will become more and more important.

- Access to on-line services will become more important to rural Newfoundland over time.

- Traditional methods of contact, e.g. phone calls, will decline over time and WEB technology, such as on-line chat rooms, will be used to communicate with our customers.

- Technology advancements in other areas of the Company, including Meter Reading, Outage Management and Engineering/Operations, may move work previously done by field staff to Customer Services staff.

- As the Company moves from a Customer Call Center to a Customer Contact Center for the whole company, staff will require a new skill set, largely technical.

- The Customer Contact Center will take advantage of existing and new Customer Contact Center technology, e.g., voice recognition of telephone numbers.

- Technology likely will be utilized to provide alternate work arrangements, such as work from home and remote agents. This may improve customer service, eg., respond to certain enquiries faster, such as power outage calls. This will change the way supervisors interact with staff and how staff interacts with co-workers.

General:

The role and focus of supervisory positions is changing from completing tasks to managing employees and the work performed. Today, management staff rely heavily on exception and ad hoc reporting to identify issues requiring their attention. As technology advances and the capabilities for audit and self-assessment by clerical staff become realized, supervisors will be better equipped to do the work required of them.

3. Technology Vision

3.1. IT Principles

The following general information technology principles are applied to all major technology investments:

- Partner with leading vendors
- Minimize the diversity of installed technologies
- Buy rather than build technology
- Consider the full cost of the product over it's lifespan
- Invest in proven technologies

The following more specific principles will be used to help guide the definition of the target technology architecture for the CSS and will guide decision making on any replacement or migration project for the CSS:

- Continue to ensure effective and adequate levels of security (network, application and data)
- Continue to improve integration between existing applications and external suppliers and customers; strive to reduce duplication and inconsistency
- Improve access to information by effectively utilizing technologies for improved document and content management, information portals, ad hoc reporting, and online analytical reporting
- Continue to seek efficiency improvements in how we work through the automation of workflow activities (approval processes and notification)

3.2. IT Solutions Acquisition and Development Strategy

IT Solutions Strategy

Moving forward, Newfoundland Power will reduce reliance on niche technology platforms, application and software vendors. To date, Newfoundland Power has standardized its desktops on the Microsoft environment and has made significant investment in Microsoft technologies. This strategy is expected to continue until other platforms have matured (e.g. Linux) and have proven leadership in cost effectiveness and reliability to justify a switch in operating platform of choice.

Based on this strategy, all new in-house developed applications will be developed for the Microsoft Windows platform. As a result, we will:

- Continue to restrain new investments on the OpenVMS platform and in the Cognos Powerhouse/Axiant AD toolset.
- In case an existing Powerhouse/Axiant application requires modification, each situation will be analyzed to determine the feasibility

of utilizing COBOL, DBMS Stored Procedures, Impromptu or Microsoft VB .NET.

Where an existing application resides on a different platform (such as CSS on OpenVMS) the following strategy will apply:

- New modules or purchased modules will be developed to run on a platform other than OpenVMS.
- Where integrations are required the integration will be developed on the target platform (vs. integration code developed on OpenVMS to send to a Microsoft Windows platform).
- When major modifications are made to the existing application and the functional architecture and cohesiveness of the application is not compromised, new and/or revised modules will be developed to run on a platform other than the OpenVMS platform (e.g. develop a "bolt-on" for bill print). However, generally minor modifications and enhancements will continue to be made without migration to the new platform
- Cease utilizing proprietary OpenVMS DCL and the RMS file structure system. We will only utilize such features when they primarily support the core application code. (i.e. Changes to CSS core sub-systems)

The information systems delivery group will continue to maintain its existing application development processes (specification delivery, unit, function and system and integration testing).

Corporate Applications Integration Strategy

The following strategies will be used with respect to integrating corporate applications:

- We will continue to seek improved integration with Microsoft office products (Word, Outlook, Excel).

- We will begin to utilize web services to integrate data.

- Where integrations are required for applications/data residing on other than the Microsoft Platform, these integration procedures will be developed to run primarily on the Microsoft Windows platform. This will insure the investment is not lost when the application is eventually migrated to the Microsoft platform.

- When evaluating a packaged software application we will ensure it supports the various forms of integration. We will ensure the application vendor offers application programming interfaces, adapters, import and export tools and/or supports the use of XML.

CSS Specific Application Integration Strategy

The Company will continue to improve and build on automated CSS integrations with internal company applications. These integrations will be more important as we utilize third party software to enhance the CSS functionality:

The CSS will be required to integrate with the Asset Management System, (Avantis.PRO) particularly once customer's meters are tracked thru the Asset Management System and when customer driven work is managed via the work order functionality of this application.

The CSS will be required to integrate with 'bolt on' CIS packages and other external facilities such as design and print bill software and call centre computer telephony integration software.

The Company will expand the level of integration between the CSS and our Outage Management systems to improve crew response using predictive information regarding the source of an outage based on the location of affected customers.

The Company will continue to expand our use of electronic data transfer methods for the contact to and from our customers. (e.g. interactive voice response, electronic bill presentment and so forth)

Replacement Options Analysis

There are five basic approaches for managing the CSS into the future:

1. Stay on OpenVMS
2. Package Purchase
3. Outsourcing
4. Legacy Extension and Bolt-on Applications
5. Technical Migration

This section describes the most viable alternative within each approach and provides an analysis of the feasibility and cost of each.

1. Stay on OpenVMS

1.1. Description of Alternative

This alternative involves continuing to maintain the “core” Customer Service System on the OpenVMS platform in the short to medium term (2 to 5 years).

However, rather than maintain the system exactly at it is today, this alternative also involves strategies and plans to gradually reduce dependence on the OpenVMS platform through code retirement and modular replacement through the normal course of functional enhancements and maintenance and technology governance.

1.2. Summary of Research

Xwave Report – May 2002

In the spring of 2002 Newfoundland Power commissioned Xwave to complete an in-depth analysis of the OpenVMS issue. A full copy of the report can be found in Appendix G - OpenVMS Research Project Xwave Report.

The research indicated that while OpenVMS was viewed as reliable and stable, the combination of a number of significant factors would limit the potential for OpenVMS to be a mainstream and therefore long-term viable operating system. These factors impact Newfoundland Power’s assessment of the risks associated with future dependence on the OpenVMS operating system. These factors include:

- *Market Share:* Sales revenues and shipments for OpenVMS are diminishing while Windows and UNIX systems are gaining market share.

- *ISVs View of OpenVMS:* Major Independent Software Vendors (ISVs) such as Oracle, have begun to relegate OpenVMS to a Tier 2 platform status, resulting in potential delays in the release of new versions and fixes of ISV software for the OpenVMS operating system.
- *Vendor Technology Roadmap:* Hewlett Packard has committed to sell AlphaServer technology which run OpenVMS until 2006. It has stated that it will continue beyond that date only if the demand is present.
- *Product Availability:* The specific AlphaServer 4100 model used by Newfoundland Power is no longer sold by Hewlett Packard.
- *Replacement Parts Availability:* Replacement components for the AlphaServer 4100 model will become increasingly difficult to obtain.
- *Support Requirements:* Overall less support effort will be required to support a Windows based infrastructure for the CSS vs. the existing OpenVMS based infrastructure.
- *Access to Training:* Training courses for OpenVMS are difficult to obtain without having to travel outside Canada. Due to the low interest generated for OpenVMS training, courses are not regularly scheduled in Canada.
- *Access to OpenVMS Skills:* People with OpenVMS skills are becoming harder to obtain. Graduates from post secondary institutions are entering the job market with little or no OpenVMS experience. Many, however, have had exposure to Windows and UNIX environments.
- *Alternate Environments:* Windows and UNIX platforms have become more accepted by the IT industry. While there is a consensus that OpenVMS is an available and reliable operating system, Windows and UNIX have gained enough momentum to further erode the OpenVMS future.

As a result of these factors, Xwave recommended Newfoundland Power migrate away from the OpenVMS operating system environment and begin deploying its current OpenVMS based applications onto other operating systems.

Industry Research

In October 2002 Gartner issued a research white paper entitled “The Case for OpenVMS: Should You Migrate?”

Significant points from this research article relevant to Newfoundland Power’s situation are:

- For OpenVMS users running custom written code as opposed to software packages (CSS is 100% custom written code), those IS organizations have the flexibility to await the outcome of HP’s migration to the Itanium server (no earlier than 2005).
- IS organizations should be prepared to assess costs of replacing OpenVMS dependent systems via package purchase or code migration to another platform.
- IS organizations should ensure custom code that will eventually be migrated to a new platform is well documented
- All further development on the OpenVMS platform should be “restrained”.
- OpenVMS specific skills will become increasingly difficult to keep and to find.
- Gartner is pleasantly surprised by HP’s development of a detailed roadmap for OpenVMS. “OpenVMS users may feel more breathing room, but they must still remain alert to the roadmap’s progress.”

A copy of this white paper is provided in Appendix H - Gartner Research Note: The Case for OpenVMS: Should You Migrate?

HP’s Commitment to OpenVMS

Every two to three months HP issues roadmap updates regarding the future of the OpenVMS platform.

HP has provided comprehensive information regarding short term upgrade paths and continued functional enhancement improvements and support commitments for database management systems, storage systems, backup systems, networking features, security features, e-business integration and system management tools on the OpenVMS operating system.

The following summarizes the significant points from the most recent roadmap update received from HP in April 2003:

- The HP Alpha Server technology running OpenVMS will continue to be sold until 2006, with support until at least 2011.

- In addition to being available on Alpha Server hardware, the OpenVMS operating system will be available on the latest hardware technology being sold by HP (Itanium), in 2005. As no statement is being made for no longer selling or supporting OpenVMS on Itanium based servers any time in the foreseeable future, it is conceivable that OpenVMS will be available indefinitely.

- HP has provided a portability roadmap (OpenVMS features added to map more closely to Unix operating system features) from the OpenVMS to the market loading Unix platform for now til 2006.

A copy of the most recent roadmap update provided by HP is found in Appendix I - HP OpenVMS Rolling Roadmaps.

Although OpenVMS today only runs on Alpha Hardware servers, HP's roadmap for future operating system deployment is that one type of hardware server (Itanium) will be able to run different operating systems. In effect, OpenVMS will be able to be run on the same hardware that is supporting a Windows platform. This will help reduce risk in the long-term associated with maintaining OpenVMS based applications on aging hardware technology (reliability of hardware, availability of spare parts etc.).

In May 2003, HP provided Newfoundland Power a personalized letter outlining their commitment to OpenVMS and their roadmap for future enhancements and support. The letter reiterates that OpenVMS on Alpha Servers will continue to be supported until at least 2011 and that OpenVMS will be migrated to a newer technology hardware system (Itanium) and sold and supported on that hardware platform. A copy of the letter is included in Appendix J – HP OpenVMS Commitment Letter

HP has provided Newfoundland Power with numerous client testimonials, executive presentations and other white papers supporting the health of the OpenVMS environment, stating HP's commitment to OpenVMS and praising the stability and functionality of the operating system.

HP Technology Assessment Recommendations

In February 2003 Newfoundland Power requested HP to assist in assessing the various options for replacement of the CSS. Newfoundland Power provided HP with a summary of the technology issues, a functional and technical description of the CSS and a description of the target technology environment for the CSS. As well, HP conducted a half-day conference workshop with Newfoundland Power to collect information regarding the CSS. In April 2003 HP responded with a high level assessment report. This report is provided in Appendix K - HP CSS Applications Options Review.

Upon receipt of the report Newfoundland Power requested a deeper analysis of technical migration alternatives and as a result HP completed a second assessment which is described in Section 4, Technical Migration.

However, the following is a summary of the recommendations of the initial report with respect to staying on the OpenVMS platform:

- Adopt newer industry standard tool-sets such as .Net, XML and Java when developing new modules or integrating with the CSS. Utilizing the latest technology toolsets when maintaining and enhancing the CSS will gradually reduce dependence on the OpenVMS platform and leverage the skill sets already being used on the other non-OpenVMS based applications.

- Implement cross-platform management tools such as batch scheduling and back-up/recovery software. If and when there is a decision to migrate the application to another operating system then there will be significantly reduced effort associated with migration of batch processing procedures.

Oracle Commitment

Oracle is committed to maintaining and supporting the DBMS on OpenVMS according to HP's roadmap as evidenced from Oracle's statement of commitment on HP's official website. The following is a quote from the web site: "Oracle has a long and successful history of delivering enterprise solutions to the OpenVMS marketplace for more than 20 years, first with DIGITAL, Compaq, and now HP. After the merger with Compaq in May 2002, HP announced that they will sustain the existing OpenVMS roadmap. The OpenVMS port remains one of Oracle's top platforms, with a large and loyal customer base. Oracle is committed to providing continued ports of its core database to OpenVMS, working with HP on its latest roadmap."

Refer to the website at: (http://h71000.www7.hp.com/solutions/oracle/openvms_sod-10-02.html

In July 2003, Oracle provided Newfoundland Power a personalized letter outlining their commitment to OpenVMS and their roadmap for future enhancements and support. In this letter they have stated they intend to support their Oracle Relational Database Management System product on the OpenVMS platform until at least 2009. A copy of their letter is is provided in Appendix L – Oracle Commitment Information

Cognos Commitment

The CSS online functionality is almost completely written in the Cognos Axiant toolset and significant portions of batch and report processing are written in the Cognos Powerhouse toolset. From a global perspective these tool sets are not common, having a very low percentage of market penetration. Cognos has only identified three ISVs that market business software packages written in the Powerhouse toolset. From this perspective they are niche tool sets.

Cognos Powerhouse and Axiant can be run on the OpenVMS, Unix and Windows operating systems. Cognos has approximately 2900 supported PowerHouse, PowerHouse Web and Axiant customers worldwide. Of these 2900 customers, more customers are running these tools with the OpenVMS platform than other platforms.

Cognos is now primarily a business intelligence technology company whose primary product lines are centered around reporting software offerings and not application development software as it was in the 1980's. The low visibiltiy of the application development products is evident by their lack of presence on their corporate web site.

Cognos has indicated though conference calls that they plan to continue to plan and execute product release strategies as long as there is customer demand and business viability. They currently do not have any end of life timelines for the OpenVMS platform.

Cognos's product plan is to put out a new base release about once a year or year and a half, with maintenance releases in between. The focus of these releases will be customer driven enhancements and database and operating system conformance.

Cognos recently provided Newfoundland Power with a written commitment to the future support of Powerhouse and Axiant on the OpenVMS operating system. This is provided in Appendix M – Cognos Commitment Information.

Cognos continues to have a number of business partners who maintain and deliver Powerhouse and Axiant based solutions. In Canada, there is a concentrated presence of Powerhouse and Axiant users in the Ottawa area.

1.3. Summary Analysis

Based on all of the research and vendor support plans identified above, two major conclusions can be made:

1. There is no immediate urgency to get off the OpenVMS platform. The CSS is a custom developed solution and therefore not dependent on Independent Software Vendors of business applications. HP has a solid long-term OpenVMS support and upgrade roadmap and both Oracle and Cognos are committed to support OpenVMS for their toolsets according to HPs roadmap.

2. However, sales of OpenVMS based systems are shrinking and the long-term viability of the platform is questionable. Newfoundland Power should continue to reduce dependence on the OpenVMS platform and the Cognos Powerhouse and Axiant application development toolsets wherever possible. Reduced dependence will minimize the effort required if and when a technical migration to another platform is required. It will provide the flexibility to support new functionality and utilize more cost effective technologies not available on the OpenVMS operating system. This strategy will leverage new skill sets and new technologies while protecting the heavy investment in business processes already programmed to run on OpenVMS.

2. Package Purchase and Implementation

2.1. Description of Alternative

This alternative involves purchasing and implementing a software package that will replace the existing CSS functionality. This very large project would involve implementing completely new business processes, technology processes and supporting hardware infrastructure.

By purchasing a new CIS software package Newfoundland Power would eliminate reliance on aging technology (the OpenVMS operating system in particular) and could possibly receive additional capabilities and realize efficiencies not possible in the current CSS.

An example of potentially increased capability and efficiency is that typically CIS software packages are highly configurable where programs such an Equal Payment Plan have many flexible options for delivery of the program that can be changed directly by the customer service department, and are not "hard coded" into the software. For example, by adding customer service options (e.g. allow an 11 month payment plan or 9 month payment plan) without relying on expensive technology resources customer service could be improved and efficiencies obtained.

However a comprehensive view must be taken to assess such things as need, costs and project risk to determine whether a package purchase is justifiable.

2.2. Summary of Research

Industry Experts and Reports

As a result of attendance at a Customer Information System Conference in 2002, we received an early understanding that replacement of our current CSS could be expected to cost more than $10 million.

In January and in March two conference calls were conducted with META Group's Energy Industry expert Dr. Zarko Sumic. META Group is a leading provider of information technology research, advisory services, and strategic consulting. An overview of META Group and Dr. Sumic's resume are provided in Appendix N - META Group Information. The topics of these calls were regarding the state of the market with respect to CIS packages and what utilities are generally doing within the market. The following is a summary of the information learned via these conference calls:

- Demand for CIS packages is currently extremely low and vendors are giving deep discounts particularly on license fees.

- The analyst was not aware of any other utility operating a CIS on the OpenVMS platform.
- Very hard to justify new CIS based on pure "Return on Investment". Total project costs for a package implementation ranges from $35 to $65US per customer.
- Technology obsolescence is rarely the only driver of a CIS replacement. There is almost always a business reason to replace.
- Total project costs should take into account system integration services, gap analysis, customization requirements, data migration, hardware purchase, infrastructure tuning and so forth. When getting low project quotes look closely to ensure these have been considered.
- Generally with the lower cost packages you can negotiate a better deal on license fees but functionality will be less complete.
- Bill printing tends to be an external or add-on function.
- Credit and Collection is a functional area that typically requires customization for utility specific features.

In a META Group Energy Information Services paper released in September 2002 entitled "Viewing the CIS Solution Market: 2002 Edition", several relevant points were also made, including: energy utilities are focusing on "more tangible bottom line (cost reduction) impact by improving operational efficiency and customer service efficacy" when looking at package solutions and with the "still high CIS replacement cost (even with deep license discounting) energy executives are seeking hard monetary business case benefits". One example is "they are proceeding only where the current system's cost of ownership is prohibitive". A copy of this article is included in Appendix O – Meta Group Viewing the CIS Market 2002 Edition

Request for Information from CIS Vendors

To gather more information, a Request for Information (RFI) was prepared and sent to major industry vendors of CIS systems and selected other vendors who may have acceptable solutions.

META Group periodically analyzes the CIS product market and publishes a market summary report identifying industry leaders and challengers in the utility CIS market. In a market summary published in early 2002 META Group identified no market "leaders" and eight "challengers" in the market. Of these eight, one is no longer in the North American market place at the time of this writing. The fact there are no leaders, along with major players dropping out of the market, indicates there is consolidation and volatility in the market.

The RFI was sent to the six of these "challenger" vendors with whom contact was able to be made. Of these six, four responded to the RFI. The RFI was also sent to and responses were received from five other CIS vendors with a smaller market presence.

Three of the four vendors (Open-C Solutions, SAP/Deloitte Consulting and SPL/Bearing Point) provided estimated licensing and implementation services costs in excess of $9 million. The average software licensing and services costs quoted from all vendors who responded was $6.7 million.

These costs only refer to package purchase and implementation costs paid out to the vendor and other third parties. Internal labour costs to select the software, configure it, implement the software and new business processes and perform training etc. are not included and must be estimated to obtain a full picture. As well individual responses may not include other significant costs, such as hardware infrastructure costs or travel and living costs for the vendor.

Finally all vendors assumed no customization of their package will be required. Customization is a major contributor to higher cost of package implementation. For the less expensive solutions META Group has indicated during conference calls that there is likely less capability of the package to cover all business requirements and therefore it is more likely that customization will be needed.

Based on these responses and taking into consideration all project costs it is reasonable to estimate that a full package implementation will cost in excess of $10 million.

Energy Planning Network CIS/CRM Utility Consortium

The Energy Planning Network (EPN) is an unaffiliated research and networking company that supports sharing of information among utilities regarding Customer Information (CIS) and Customer Relationship Management (CRM) systems. Software vendors cannot become members and there is no affiliation with consulting companies or any other vendor. The benefit of this type of consortium is that member utilities are able to obtain information about each other's experiences surrounding CIS/CRM systems that they would not share publicly. Given the competitive nature of the North American Utility market, this is an excellent source of information for utilities trying to make decisions on multi-million dollar CIS/CRM projects.

Newfoundland Power became a member of this consortium in May 2003. The EPN was asked to perform a survey of electric utilities with a similar number of customers who have recently implemented a CIS package. These utilities were asked about the costs associated with these projects.

Six utilities responded to the survey. Customers served ranged from 100,000 to over 350,000 with an average of 231,000. Four of the utilities distribute only electricity, one bills for a combination of electric/gas/water/sewer/solid waste/stormwater and one is a water/sewer/stormwater utility.

Of the six utilities one reported a total project cost of over $35 million; one reported a total package cost of over $15 million; one small municipal utility reported a total project cost of over $5 million; one utility reportedly spent over $5 million on just package purchase and services; and another is reportedly spending $3 million for just package purchase and services. These last two were fix priced contracts - with numbers being provided through 'off the record' sources.

The EPN's biggest success factor in being able to provide service to members is strict confidentiality. As a result, EPN has, as a condition of providing the survey results to the Company, not allowed the sharing of the details of the survey results with any other parties.

2.3. Summary Analysis

Several factors were considered when assessing whether the Company should purchase and implement a software package. The primary factor is need; however, cost and risk are major considerations as well.

Need:

Based on the Functional Assessment and Customer Service Vision outlined earlier, the current and near term need for a completely new set of business processes for Customer Service is not a major requirement.

While there are a significant number of identified potential enhancements, few of these changes are related to complete lack of functionality provided by the system. In most cases these requests are for modification of existing functionality to provide improved service offerings or to make existing processes more efficient.

From the Customer Service Vision perspective, the expected future enhancements and new business processes to be implemented in the majority of cases center around functionalities which interface with the "core" CSS. Examples of this are increased investment in off-site meter reading features, new ways of accepting cash, new bill design and presentment methods and expanding customer self-service options via the internet. Also information access (which is not a core CSS functional issue either) is a key theme, particularly in the Collections processes. All of this indicates that the Company does not appear to need a completely new "customer system engine" at this time to support the Customer Service activities, but rather "add-on" capabilities and tweaking of existing capabilities.

Cost:

Based on surveys, vendor RFI responses and industry expert advice, it is reasonable to assume that a replacement of the CSS via a package implementation would cost in excess of $10 million.

Risk:

The major risks associated with full-scale package implementation are primarily centered around project risk. Package implementations for CIS systems are extremely large projects and total project failure (the project is stopped after significant investment has been made with nothing implemented) has been commonly reported in the industry over the years. For projects which do come to completion, major cost overruns and schedule overruns are common as well. Two of the higher cost implementations at utilities surveyed by the Energy Planning Network had cost overruns in excess of 25%. As noted in the very recently released Warren B. Causey 2003 CIS/CRM report: “Utilities …. have become highly risk averse and view large-scale CIS implementations as overly expensive and risky”. As a result, project risk and cost are major deterrents to a package implementation.

In summary, there is a lack of functional need for replacement, extensive risk associated with a package implementation, and a project cost of at least $10 million is to be expected. If package replacement becomes a desirable option, then an extensive and rigorous scoping and selection project will be required to truly ascertain total project costs and minimize risks.

3. Outsourcing

3.1. Description of Alternatives

Alternative outsourcing models applicable to utility Customer Information Systems are usually variations and combinations of the Application Service Provider (ASP) model and the Business Process Outsourcing (BPO) model.

In an ASP model “application hosting” is quite common. In this scenario rather than purchase a software package and implement it in-house, the Company does not actually purchase anything but pays a vendor to allow the Company to perform its CIS functions on their software. They own the software and the Company pays an annual or monthly fee to “rent” their software. There are a number of variations on this scenario, such as running the software in-house or running it at the vendor’s site via the web.

In the BPO model, not only does the Company “rent software”, but the outsourcer also performs the business function as well. A very common example is an outsourced call centre. The people actually answering the

phones, responding to customer inquiries and orders would not be Newfoundland Power employees. Rather, all of these business processes would be performed by the outsourcer. Typical BPO targets include customer contact center operations, IT data centre operations, application support, cash processing, billing, bill print, bill mailing and collections.

3.2. Summary Analysis

For purposes of this analysis, only full scale ASP or BPO alternatives were considered which would involve the elimination of the core of the existing in-house CSS.

According to information received from IT industry advisors such as META Group and Gartner, many organizations tend to take advantage of alternative outsourcing models because:

- They do not already have the capacity in-house. Large mission critical applications such as a CIS (regardless of size of organization) require extensive “care and feeding” to properly run. This would include support staff to respond to functional problems or usability questions, administrative staff to adjust parameters for operating requirements and technical staff to troubleshoot technical issues or extend system capabilities etc.
- They do not already have the skill sets in house to run the system. Intertwined with the capacity issue is the presence of in-house expertise/competence. Such applications may require unique technical infrastructure not already utilized in the organization and, therefore, the organization implementing it would need to maintain new expertise (e.g. Oracle DBA).
- They are willing to adjust business processes to the boundaries of the package/services, are not unique or don’t need to be unique and therefore do not require customization of a solution.

According to META Group, processes that are candidates for outsourcing are those in which the process is not unique (no special requirements or rules) and the organization are not very good at executing today. Given the high level of customer service as evidenced through satisfaction surveys and some of the more unique aspects of the Newfoundland environment (e.g. culture, customer diversity) a full outsourcing of the Customer Service business function is not a practical option.

ASP and BPO model for portions of the Customer Service function should continue to be considered where there is both opportunity and merit.

4. Technical Migration

All technical migration alternatives involve some replacement of technology components without significant change to functionality. The purpose of a technical migration is to retire obsolete technology (costly to maintain or risk of failure) and to take advantage of advancements in technology while keeping the system functionality largely intact.

4.1. Description of Alternative

In the case of the CSS a technical migration is considered a viable option for preserving the business logic already embodied in the current CSS while reducing reliance on the OpenVMS platform and related technologies.

Two basic alternatives for technical migrations were explored:

1. OpenVMS re-platform including redeveloping the major application development technology components according to the Company's Target Technology Architecture (eliminate reliance on Cognos Axiant and Powerhouse proprietary software).

2. OpenVMS re-platform while keeping major technology components (e.g. Powerhouse, Axiant etc.). This is more of an interim step, as the niche development tools would not be migrated.

4.2. Technical Migration Assessments

To help identify viable alternatives and to provide budget level cost estimates of each alternative a number of organizations were engaged to provide assessments of what would be involved for different technical migration scenarios.

Our major technology suppliers, HP and Microsoft were requested to provide assistance in determining feasible alternatives and assessing costs and fit to our technology direction.

According to Gartner, the leading technical migration vendor who has extensive experience with OpenVMS applications is a company called Sector7. Newfoundland Power contracted with Sector7 to provide a recommendation of the most appropriate technical migration alternative and to provide costs for that alternative.

Core, the only software company in the world offering automated migration of Cognos Powerhouse/Axiant code to Microsoft .Net was asked to submit an estimate to convert the code for the CSS.

Finally, although their assessments are not provided, two other companies, Intertech and InBusiness, were contacted to provide information about the feasibility and costs to migrate the Cognos Powerhouse toolset unchanged to the Windows or Unix environment. The Company views this as an interim step in a phased in approach to move the CSS to an acceptable technology environment. These vendors indicated that this small portion of an interim technical migration is both feasible and not a major cost issue.

Microsoft Assessment

As a key partner, Microsoft was invited to review our situation and both assist us to identify viable technical migration alternatives and identify how Microsoft services and tools could be leveraged. A three day on-site brainstorming session was conducted with the project team by a Microsoft Solutions consultant. Prior to the session our internal system functional and technical documentation and technical current assessments and target architectures were provided to the consultant. Microsoft responded with a 32 page report outlining feasible target architecture alternatives, including the pros and cons of each option. A copy of the report is found in Appendix P - Microsoft Newfoundland Power CCS Migration Analysis.

The following summary results were obtained:

- The report recommended a technical migration of the CSS to the Windows environment and a SQLServer database. This was recommended as a result of ongoing DBMS licensing being cheaper and with SQLServer there would be less expensive hardware required than for a Unix solution. It was recognized that DBMS conversion from Oracle to SQLServer would raise project complexity, risk and effort. (It should be noted that since this assessment was received, the Company has successfully renegotiated a much cheaper DBMS ongoing licensing arrangement with Oracle)

- The report identified a second feasible option of a technical migration of the CSS to the Windows environment and an Oracle database.

- The report identified a third feasible option of a technical migration of the CSS to a Unix environment and an Oracle database.

- Batch Job Scheduling and Monitoring is not a strength of the Windows environment. The report identified Windows based Batch Job Scheduling and Monitoring tools that should be investigated if the recommended technical migration were to proceed.

HP Assessment (2nd Assessment – Technical Migration only)

HP is a key supplier of technology infrastructure at Newfoundland Power. The current servers and OpenVMS operating system used by the CSS were supplied by HP. As well, all the current Windows servers (hardware), supporting all Company applications, were supplied by HP.

HP was specifically asked to provide an assessment of an appropriate target operating system platform and technical migration approach. HP was provided a copy of all CSS source code, copies of system description, CSS technology assessment and CSS target architecture to assist in their analysis. In response HP provided a 24 page report with recommendations regarding these topics. A copy of the report is provided in Appendix Q - HP Technical Migration Assessment Report.

The following summary results were obtained:

- The report recommended a phased in migration approach where Powerhouse/Axiant toolsets would be migrated intact (no conversion) to the target operating system platform. The reason for this recommendation is to reduce major project risk associated with a full-scale migration. HP estimated that migration services costs to complete for this option to be approximately $800,000. These costs do not include all project costs such as internal labour, software licensing, hardware and such things as user training and other implementation costs. Redevelopment of the major technology components would be completed as a next phase at some later date. No costs were provided.

- HP estimated that service costs for a full scale technical migration (either to Windows or Unix environment, but keeping Oracle database) would be about $2.5 million. These costs do not include all project costs such as internal labour, software licensing, hardware and such things as user training and other implementation costs.

- It was recommended that if a full scale migration to the Windows environment is preferred, the Company should wait until the .NET development environment matures and Microsoft supports 64 bit hardware. This would be about a two year timeframe.

- It was recommended that, if full scale migration to HP Unix environment is contemplated, to wait until 2005 when certain critical feature improvements to that operating system platform will become available.

Sector7 Assessment

Sector7 was contracted to identify an appropriate target operating system platform and recommend a technical migration approach. Sector7 was provided a copy of all CSS source code, copies of system description, CSS technology assessment and CSS target architecture to assist in their analysis. Sector7 responded with a 35 page report providing recommendations on this mandate. A copy of this report is provided in Appendix R - Sector7 Technical Migration Assessment.

The following summary results were obtained:

- Sector7 recommended a phased in approach whereby the CSS application would be migrated to the Unix Operating System platform with the Powerhouse/Axiant software migrated intact (no conversion). Sector7 estimated the cost of their services for this option to be about $920,000. These costs do not include all project costs such as internal labour, software licensing, hardware and such things as user training and other implementation costs.

- Sector7 feels a full scale migration will be an extremely large effort with high risk of failure. Therefore they recommended that redevelopment of the Powerhouse/Axiant software to a new development language such as Microsoft .NET would be a second phase to be completed some time after the recommended initial migration. No costs were provided for this second phase.

- Sector7 recommended use of Sector7 proprietary tools for emulation of OpenVMS DCL and batch process scheduling on the Unix platform for the initial migration.

- Sector7 provided a number of suggestions for replacing technology components and extending the CSS technical environment once it has been migrated to the Unix platform.

- Sector7 does not recommend migration of the Oracle DBMS to Microsoft SqlServer DBMS. Sector7 feels this would be a major re-engineering project.

CORE Migration

CORE is the only Company in the world that utilizes automated tools to convert Powerhouse/Axiant code to the Microsoft .Net environment. Core was specifically asked to provide a cost estimate to convert the online Axiant functionality and various Powerhouse batch processing procedures to the .Net environment. Core was provided a copy of all the CSS source code.

Core estimated a 12 month fixed price, $2.1 million project to convert all Powerhouse/Axiant software to the Microsoft .Net environment and deliver as unit tested and functionally tested software. This estimate does not include migration of COBOL, DCL or any other non-Powerhouse code. In addition, these costs do not include other project costs such as internal labour, software licensing, hardware and such things as user training and other implementation costs.

4.3. Newfoundland Power Detailed Analysis

Newfoundland Power has some experience with technical migrations as a result of the Technical Migration project completed in 1998. As previously noted, this $2 million project involved converting the database management system used by the CSS from “Rdb” to “Oracle” and converting the online transaction software to a new development language. As a result, the whole online portion of the CSS was re-written and minor changes to every batch processing module was completed. In contrast, a full scale technical migration of the CSS involves not only a re-write of the whole on-line system but extensive re-designing and re-writing of the batch processing procedures (currently well over 1 million lines of code) to retro-fit them to the new platform as well. It is the opinion of the project team that the effort and costs required to perform such a full scale migration would likely be in the two to three times range of the cost of the 1998 Technical Migration project.

Based on all the assessments provided and past experience, a detailed technical migration assessment was completed by the project team outlining the feasible options along with strengths and weaknesses, estimated total project cost and project duration of each option. This more detailed analysis is provided in Appendix S - CSS Technical Migration Alternatives.

The project team considers the most appropriate target environment for the CSS, which optimizes the utilization of operating systems, hardware infrastructure and market leading technology components to be the Windows operating system, utilizing Microsoft technology components on an Oracle database management system.

It is expected that a single project to migrate the CSS to this environment would cost about $6 million dollars and would be 18 to 24 months in duration.

However, the recommendation from this analysis, as supported by HP’s and Sector7’s recommendations in their assessments, is a multi-phase migration to achieve this target environment.

4.4. Summary Analysis

As previously noted, both HP and Sector7 recommended a phased in migration approach to reduce project effort, complexity and therefore risk of failure. As well HP recommended to wait to migrate to either the Windows environment or the Unix environment to take advantage of maturation of technology that would better support the CSS.

Therefore, if a technical migration is the preferred option, the recommended approach is to utilize a multiple project approach to migrate the CSS off OpenVMS and to a long-term sustainable technology environment.

The “Phase 1” project would involve migrating the CSS to the Unix operating system while retaining the Powerhouse/Axiant technology components.

The “Phase 2” project would involve redeveloping the online Powerhouse/Axiant technology components to a Microsoft technology environment while retaining the batch processing procedures in the Unix environment.

The “Phase 3” project would involve migrating the batch processing procedures from the Unix environment to the Microsoft technology environment.

The individual projects range in cost and duration, however collectively they would exceed $6 million in cost and would take 30 to 42 months to complete.

"Bolt On" Applications

"Bolt-on" applications are less of a replacement alternative in themselves as they allow for utilization of new technologies while fulfilling a functional requirement. Implementation of separate modules to extend the capabilities of the existing CSS may be used in conjunction with any of the alternatives being analyzed as a means of efficiently supporting the business function with the most appropriate technology. An example of "bolt-on" functionality commonly implemented with both packages and custom in-house software is bill design and printing software.

A Request for Information was issued to identify applications that may be interfaced with, or "bolted on", to the current CSS. Once compiled, this inventory of bolt-on applications will be evaluated when considering alternatives to future reprogramming of a particular component or functional area of the CSS.

The list of vendors was prepared from a number of sources, including the Skipping Stone Fall 2002 CIS/CRM Software Report, exhibitors from the 2002 CIS Conference, TMG Presentation to Newfoundland Power in the fall of 2002 as well as others. (See Appendix T – Summary of Bolt-on Vendor Responses) The RFI was distributed to 54 CIS and related vendors.

The response rate was disappointing with only 15 vendors provding a response.

Several package vendors responded with information on their full system; however, on closer inspection it is doubtful their systems could be implemented in a modular fashion.

Because the vendor information was general and high level, evaluating the product for fit and functionality was not possible. However, it did give the Company an understanding of what was available the marketplace and may enable the Company to identify alternatives to reworking the CSS. No vendor was identified as providing an outstanding solution for a particular area.

Vendors responded with standalone bolt-on modules in the following functional areas:

- Field Services
- Bill Print
- Industrial Billing
- Load Management
- CRM features

Recommendation

1. Scenario Analysis

The Company has no current functional requirement that would require a wholesale replacement of Customer Service business processes either through package purchase or outsourcing. Although there are a significant number of functional improvements to be completed, the current CSS is adequately supporting the business and it is expected to continue to do so over the next few years.

If a package were purchased, the total project cost would be in excess of $10 million. Project duration would expected to be in the range of 18 to 24 months and there will be a significant period during the project when all but absolutely urgent software change will be suspended. A key benefit is that many of the outstanding functional enhancements for the existing system would be delivered as features of the package. However, for large package implementations the impact on the organization and project risk tend to be very high as a result of both a change-out of technology and business processes at the same time. It is questionable whether the need for a functional replacement is sufficient to deal with these issues at this point in time.

The recommended phased-in technical migration, in total, would exceed the $6 million estimated cost of a “big bang” full-scale technical migration. Unlike a package implementation, the resulting system will not have any major feature enhancements added, as the least risky approach to executing a technical migration is to leave all business processes intact. As well there will be a significant period during each project when all but absolutely urgent software change will be suspended. Overall the business would be severely restricted in the ability to react to a change in the business environment or to even implement a major functional upgrade over the as much as 42 month period it could take to complete all phases of the migration.

An analysis of the current situation shows it is clear that although the Company should continue to reduce dependence on the OpenVMS platform, there continues to be time to get the CSS off the platform in an orderly and cost effective fashion. Support for the OpenVMS environment will continue to be at acceptable levels to run this mission critical application for the next two to five years and possibly longer. However the evolution of HP’s roadmap and overall industry support for the environment needs to be continuously monitored.

2. Recommendation

2.1. Description of Recommended Scenario

The recommended scenario is to continue to run the CSS on the OpenVMS platform while making evolutionary changes to reduce dependence on the OpenVMS platform.

Where possible, any additional functionality will be modularized and developed according to the Microsoft technology environment. Utilizing "bolt on" applications to meet functional needs will be a standard alternative to be evaluated, where practical. Significant changes to existing modules will be evaluated and re-written in platform independent technology if practicable.

Significant changes in business direction or change in commitment to the OpenVMS platform will be monitored annually and the timing of replacement identified accordingly. A reassessment similar to this analysis will be completed in 2006. The timing of this reassessment makes sense as some of the major milestones in HP's OpenVMS roadmap will have been reached and the CIS Package vendor environment may have stabilized.

Each year, until the ultimate timing of replacement is identified, there will be specific projects identified which will both give business value and will actively reduce dependence on the OpenVMS environment.

2.2. Evolutionary Changes

The following types of evolutionary changes will reduce dependence on the OpenVMS platform and/or address several of the weaknesses identified in the Technology Assessment:

- Write new functionality as "stored procedures" rather than Cobol or Powerhouse. Rewrite existing modules as "stored procedures" where practicable.
- Utilize existing standard reporting and business intelligence toolsets (Impromptu, Powerplay) in the CSS environment, thus eliminating reports written in Powerhouse and DCL
- Develop a reporting environment that is friendly to user reporting tools (Impromptu), thus eliminating existing production and ad-hoc reports.
- Purchase and implement "bolt-on" software for functional enhancements rather than custom development in-house.
- Leverage existing in-house technology to extend the CSS. Examples include existing printing facilties, Itron Meter Reading System, Aspect Customer Contact Center technology and the current Internet and Intranet.
- Increase integration with Microsoft Office products.

- Develop new integration in the new, adopted technologies rather in traditional CSS code.

2.3. Cost Analysis

The project team conducted an analysis of the project/implementation costs and the annual costs associated with a package purchase scenario, technical migration scenario and remaining on the OpenVMS platform.

This analysis concluded that although the annual costs to maintain and operate the systems are comparable, the very high projects costs associated with a package purchase and with a technical migration makes staying on OpenVMS the clear choice from a cost perspective.

Following is a comparison table of the project and ongoing costs associated with the major alternatives. As well, explanations of the various cost items and a more detailed analysis is provided below.

Alternative Cost Comparison Table			
	Stay on OpenVMS	**Package**	**Technical Migration**
Total Project Costs	**$996,000**	**$10,000,000**	**$6,000,000**
Annual Enhancements/Upgrades			
Infrastructure	100,000	50,000	50,000
Application	340,000	200,000	340,000
Annual Support Costs			
Hardware Maintenance	150,000	150,000	150,000
Software Maintenance	132,000	400,000	75,000
IT Support Labour	424,000	250,000	375,000
Cust. Service Support Labour	105,000	175,000	105,000
Total Annual Costs	**1,251,000**	**1,225,000**	**1,095,000**

The following are explanations of the costs provided:

Total Project Costs:

For the “Stay on OpenVMS” option all projects from 2004 to 2008 which will reduce dependence on the OpenVMS platform are provided. These projects will also provide functional improvements.

A baseline of $10 million for a package purchase and implementation is used, however total costs could be much higher. This project would deliver functional improvements.

To simplify comparison, the costs of a full technical migration, rather than a phased in technical migration (where the project costs would be higher) is assumed. No major functional improvements would be delivered.

Total Annual Costs

Annual Enhancements/Upgrades – Infrastructure: These are capital items which would enhance the Infrastructure environment related to the CSS. It is expected that for the Stay on OpenVMS scenario, more hardware purchases would be required to keep the CSS infrastructure viable, whereas for the Package and Technical Migration scenarios, major upgrades would be included as part of the original projects.

Annual Enhancements/Upgrades - Application: This includes major package software upgrades and enhancement projects for the CSS. For the Stay on OpenVMS scenario, functional improvements will proceed but will be less than for the Technical Migration scenario as justification will require a short payback period and the majority of enhancements also reduce dependence on OpenVMS platform which are included in the Replacement Project above. For the Package scenario, there would expect to be limited functional improvements required however a major product version upgrade will be required every two to three years.

Annual Support Costs – Hardware Maintenance: This includes maintenance agreements required to maintain all hardware infrastructure related to the CSS.

Annual Support Costs – Software Maintenance: This includes Database Management System (DBMS), bolt-on software and package software annual maintenance agreements. The Package scenario would be much higher than the other two as a result of the package maintenance agreement which typically is 20 to 25% of original package cost. The Technical Migration scenario is expected to be cheapest as a result of the reduced annual maintenance costs required to support the Microsoft tools used by the CSS (already covered by current Microsoft Enterprise Agreement)

IT Support Labour: This involves Information Services Department (IS) labour to deal with problems with the application and perform maintenance. Given the “hard coded” nature of the existing CSS, the IT labour to support the application is much higher than for the Package scenario. Technical Migration would be somewhat less than for Stay on OpenVMS as some benefits will be derived from utilizing the new software tools.

Cust. Serv Support Labour: This involves Customer Service Department labour to deal with problems with the application and perform maintenance. In the Package scenario, as a result of a Package being highly configurable, the Customer Service support labour will rise as a result of being able to support the application without IS involvement.

Analysis

It is expected that post-implementation support costs in the first two years after large Package and Technical Migration projects are completed would be higher than normal. This was not included when developing annualized support costs for these two scenarios.

Overall, annual costs for all three scenarios are not too far apart. A more detailed analysis indicates each scenario has it's pros and cons. So for example, for a Package scenario, less functional enhancements are expected and therefore lower costs in that category, however Vendor support costs are much higher than if the Company supported the application internally. Regardless, this reflects that significant resources are required for this large and complex application.

The high initial project costs associated with the Technical Migration and Package scenarios relative to the comparable annual costs associated with the Stay on OpenVMS scenario indicates that neither a replacement nor a migration are justified at this time.

2.4. Risk Mitigation Strategies

In the course of reviewing the OpenVMS issue a number of concerns were raised which will need to be addressed as long as the OpenVMS environment is maintained. The following are the risk mitigation techniques planned for a number of these areas of concern.

Retention and Scarcity of OpenVMS Skills Sets

Currently there are three employees within the Company who have OpenVMS experience (two with current up-to-date knowledge). OpenVMS knowledge will continue to be fostered in these two employees. If these resources become lost to the Company in the next three to five years, we will work with HP on developing an arrangement whereby HP provides day to day support. This would be costly if required, but an acceptable risk in the short-term.

Retention and Scarcity of Powerhouse/Axiant Skill Sets

There are several employees who have extensive experience in the Powerhouse/Axiant tool sets. Although we prefer otherwise, at least one

employee will work regularly on initiatives which will allow them to retain their expertise. As well, Xwave, the local consulting company, has several employees with extensive Powerhouse/Axiant experience. Finally, companies such as InBusiness and Intertech can be retained to perform Powerhouse/Axiant enhancements and changes.

OpenVMS and Powerhouse Available Training

Current expertise is such that no additional training is required in the future. If new employees require specific training then, as has been done in the past, an appropriate training course will be brought in from the mainland or the employee will be sent wherever it is offered in North America.

As well, the strategy of gradually rewriting components of the system will reduce dependence on the OpenVMS platform such that employees with the newer skill sets can perform maintenance and enhancements.

Maintaining Hardware Infrastructure

As previously noted, although HP will be continuing to sell Alpha Server technology until at least 2006 the specific Alpha Server model currently in use at Newfoundland Power is no longer being sold by HP.

HP has provided assurances that in the short-term, as a result of widespread use of this model, they have a healthy supply of spare parts available. As well, as contingency, the Company will conduct a search for critical spare parts and set up a small inventory of these parts in case they cannot be obtained from HP in a timely manner. As well, availability of spare parts will be rigorously monitored and if required newer model Alpha Server technology will be purchased.

Finally the Itanium hardware platform is planned to be available for OpenVMS in 2005. If cost justified and necessary as a result of reduced reliability of the Alpha Server platform, purchase of the Itanium hardware technology may be made.

2.5. Functional Enhancement Strategy (1 – 5 Years)

The following is the functional enhancement strategy in light of continuing to maintain CSS on the OpenVMS platform.

Since a complete replacement of the CSS is not planned within the next one to five years, some components of the system will require a significant upgrade or replacement within that time period. In addition, during this period, the Company may pursue new programs and technologies to advance customer service and reduce ongoing costs. Such upgrades must be justified

within a short payback period, considering the potential for a CSS replacement as early as 2008 (assuming the 2006 study recommends replacement and the project begins immediately).

It is expected that to meet the needs of its customers and to realize efficiency opportunities, Customer Service will require at least one major upgrade or replacement project per year, in addition to other "smaller CSS changes". A major replacement/upgrade project requires significant IS resources, in the range of 1 to 2 or more Full Time Equivalents (FTEs). Corresponding Customer Service resources also are assigned; these usually range from one-third to one-half the assigned IS resources.

Changes due to compliance with external agencies, such as the PUB or the federal government, are not included as part of an enhancement project. This could include requests such as seasonal rates or a change in the application of the HST. These changes are dealt with as they arise; however, they can displace other work, including projects and small upgrades. Resources and time required to resolve a compliance issue may need to be transferred from other CSS changes.

As an aid to determine if an enhancement to a specific area of the CSS is required, one or more of the following characteristics should be present:

- a particular CSS component is causing significant problems or errors such as incorrect information or billings.
- the problem affects the general population of customers as a whole.
- significant manual intervention is required to administer the program correctly and/or keep it on track.
- the CSS component is limited in its ability to respond to specific requests on a timely basis.
- the CSS component does not meet the Company's business objectives.
- Expected benefits outweigh costs assuming a relatively short payback period.

During any given time period, there are competing projects for the same resources. Meeting regulatory requirements and reducing operating costs are the primary drivers when setting priorities.

The CSS Functional Assessment identified a number of small effort, high priority items. These should be implemented as soon as possible in 2003 or 2004 as part of the Small Upgrades.

In addition, the CSS Functional Assessment identified a number of high priority opportunities of significant effort that fit the above criteria. Due to this large number of high priority projects, at least one large project opportunity

should be addressed on an annual basis as the “main” project for the year. However, there needs to be other smaller changes made as well.

The high priorities list should be maintained and reviewed each year according to the above criteria and one opportunity selected as the “main” project for the year.

Bug fixes and small changes (eg. edits) will continue as usual.

2.6. Implementation Plan

The following are replacement related enhancements planned in 2004 and expected to be scheduled from 2005 to 2008.

In 2004:

- Bill Print – utilize existing printer capabilities, retire bill print software
- Form Letter Print – utilize existing printer capabilities; retire WordPerfect on OpenVMS and extensive DCL procedures.
- Reporting – Adopt standardized reporting tools and retire a number of existing production and ad-hoc reports.

2005 – 2008:

- Implement cross platform batch processing procedures; retire significant amounts of DCL
- Implement a more sophisticated reporting environment with Data Warehouse features; retire numerous reports.
- Implement new cash register system; retire some OpenVMS cash processing procedures.
- Implement Customer Relationship Management functionality; will eliminate portions of existing online functionality inside CSS (Customer Inquiry screens).
- Reassess the status of CSS and OpenVMS Obsolescence in 2006.

Appendix A - PUB OpenVMS Obsolescence Report
Internal

Obsolescence and the OpenVMS Operating System
An Emerging Technology Issue at Newfoundland Power

August 2001

Table of Contents

Introduction

Information technology is a necessary and vital component of the resources required to provide low cost, efficient and reliable customer service. The need to replace and modernize information technology infrastructure is fundamentally the same as the ongoing requirement to replace and modernize any other component of the Newfoundland Power's (the Company) electrical system infrastructure as it deteriorates or becomes obsolete. One of the major components of the Company's information technology infrastructure is the OpenVMS operating system.

In recent years there has been a gradual trend away from the OpenVMS operating system in the information technology industry. The increasing popularity of operating systems such as Microsoft Windows and Unix, as well as the rapid developments in Internet technologies, have been key factors in this trend.

Many of Newfoundland Power's business applications are installed on OpenVMS. This report examines the issue of declining software vendor support of the OpenVMS operating system, and the implications of its obsolescence within Newfoundland Power.

Background

Newfoundland Power's information technology (IT) investment is comprised of two basic components: 1) applications, and 2) technology infrastructure.

The applications component consists of a range of technology tools that support business processes at the corporate, workgroup and individual employee level. Applications include common business tools such as electronic mail, while others such as the Customer Service System (CSS) provide functionality that is specific to Newfoundland Power.

The technology infrastructure consists of a variety of components including personal computers (PCs), larger multi-user computers known as shared servers, peripheral devices such as printers and scanners, and a variety of software tools such as OpenVMS and Windows that allow the various components of the infrastructure to work together to form a network infrastructure.

What is OpenVMS?

OpenVMS is a software tool that is categorized as a server operating system. It is a critical component of Newfoundland Power's current technology infrastructure and its purpose is to:

- control server hardware and manage how this hardware functions;
- enable applications to reside on servers and to utilize capabilities such as processing capacity, memory and storage;
- manage how the server connects to the network infrastructure;
- manage server security and application access by computer users;
- allocate server resources between multiple users and applications; and,
- manage the performance of the server and applications.

The History of OpenVMS

OpenVMS and its predecessor, VMS, have a long history dating back to 1977 when it was first made commercially available by Digital Equipment Corporation (DEC). Through the 1980's, DEC's OpenVMS operating system, along with its mainframe hardware and first-rate support, enabled DEC to compete with the best offerings of other leading vendors such as IBM.

In the mid-1990's, OpenVMS evolved to support the movement from mainframe computing to client-server computing with personal computers playing a larger role in supporting computing requirements. OpenVMS, together with other DEC assets, were sold to Compaq Computer Corporation in 1998.

Since the mid-1990's, Microsoft has emerged as a leader in the operating system software market with its Windows line of products. There has also been a rapid expansion in the development and use of Internet technology. A combination of these and other factors has led to the decline in market acceptance of OpenVMS as a leading operating system platform.

Technology Obsolescence

The rapidly evolving information technology industry produces a continual stream of new products focused on identified or perceived needs. Like many other industries, information technology products generally follow a cycle of market introduction, assessment, acceptance or rejection and ultimate replacement by a new or substantially changed product. The timeframe involved varies greatly by product but is generally based on market interest and momentum.

Technology obsolescence occurs when a product is no longer able to meet market needs. The actual reasons can vary from limited technical capabilities to a lack of alignment with industry standards. Regardless of the cause, the result is the same. Independent software vendors will discontinue further development of the technology on the grounds that there is insufficient market to justify additional investments. As vendors abandon older technologies to pursue new market opportunities, support for the technology will eventually be discontinued.

What are the signs?

Leading IT analysts such as the Gartner Group[1] often provide early warning signs of the potential decline of a technology. Through regularly published articles, seminars, conferences, and client consultations, these groups project the success or failure of specific technology vendors and products.

A key indictor of the position of a technology in the market is the extent to which the technology is considered strategic by major application vendors. The strongest advocates of the decline of OpenVMS indicate that the lack of development of OpenVMS-based products among these vendors is a major concern.

Other indicators include:

- the lack of coverage of the product at conventions, conferences and trade shows;
- training is no longer available;
- consultants with OpenVMS skills are increasingly more difficult to find and the costs are increasing; and,
- colleges and universities have removed the technology from their academic programs.

What are the implications?

The impact of a technology becoming obsolete is complicated by the fact that most IT environments consist of a variety of interrelated software products. This is particularly the case

[1] Gartner Group is a research and advisory firm that helps more than 10,000 businesses understand technology and drive business growth. Founded in 1979, Gartner is headquartered in Stamford, Connecticut and consists of 4,600 associates, including 1,400 research analysts and consultants, in more than 80 locations worldwide.

when referring to an operating system since it comprises a significant portion of the platform (the other major component being the shared server) upon which most other products operate.

This interrelationship between software products is critical to ensuring that the software applications they support remains efficient and capable of supporting the specific function of the Company for which the application was developed, such as customer service. If a vendor for one of these software products decides to stop developing newer versions of its product on OpenVMS, the entire application becomes unstable thereby jeopardizing customer service and operating efficiencies.

Newfoundland Power's Assessment of the OpenVMS Situation

When will OpenVMS decline?

To date Newfoundland Power has received two OpenVMS related notifications of discontinued support for a specific software technology. The first was from Andersen Consulting in 1995 relating to their discontinuation of development, and eventually support, for some of the technical components of the CSS. In July 2000, StarGarden, the Company's Human Resources and Payroll software vendor, advised that they were discontinuing support for components of their software that use proprietary data storage on the OpenVMS platform. This notification of discontinued support was a factor in the decision to replace the Human Resources and Payroll software in 2001.

Newfoundland Power has experienced other signs that OpenVMS is in decline. This includes slower response to support calls, waiting longer to have software bugs fixed, and very limited access to experienced OpenVMS staff across Canada. The Company recently had to conduct an exhaustive search to find qualified resources to assist with a very technical OpenVMS problem with an Oracle database software product.

The Gartner Group holds the view that "..*organizations with high third party software dependencies should plan to be off OpenVMS by 2003; organizations with maintainable owned source (in-house developed) should plan to be off OpenVMS by 2005.*" Gartner bases this recommendation on its broad knowledge of the enthusiasm for OpenVMS among its 10,000 clients and the declining investments that vendors are making in OpenVMS-based products.

Gartner Group acknowledges that COMPAQ itself maintains a commitment to OpenVMS and in fact may see the OpenVMS environment survive to support very specific applications such as e-business for an indefinite period of time. However, software industry support for OpenVMS as a general-purpose operating system platform for new application development is in decline.

While the decline of OpenVMS has already begun, its duration is likely to be a long and drawn out process because of the large number of vendor products currently installed. Predicting the timing of the decline is also complicated by the many contributing factors and the volatility of the IT industry.

What are the risks?

Applications written by third party software vendors represent the most significant risk for Newfoundland Power. The Company is highly dependent on the vendors to provide support for these applications and to complete enhancements to ensure that their software continues to work with other dependent technologies. The loss of support from a key vendor would substantially reduce the reliability of these applications and would subsequently affect customer server levels and operating efficiencies.

The implications of changing a well-established operating system like OpenVMS are significant. In addition to the effort required to replace the existing applications, all components of the technology infrastructure must also be addressed. In addition to the potential costs involved, there is also the potential for business interruptions through the transition process.

Newfoundland Power is using research, experience and the advice of industry experts in planning for the risk associated with OpenVMS. There is the possibility that support for OpenVMS could be discontinued on a large scale sooner than expected. This would shorten the period of time available to change out existing applications and build the new infrastructure to house these applications.

Newfoundland Power's Plan for Addressing the OpenVMS Issue

Overall Approach

As part of its 2001 business planning process, the Company began to develop plans for addressing the Company's dependence on OpenVMS. The main strategies the Company will employ in guiding the decommissioning of OpenVMS are:

- allow normal application attrition to be a key determinant in the replacement of most applications;
- complete the work over a five to seven year period to facilitate an orderly decommissioning of the OpenVMS environment and to minimize any potential negative impact on customer service;
- capitalize on opportunities to improve operating efficiencies and customer service while replacing applications;
- maintain normal investment diligence by continuing to apply the principles of the IT strategy the Company has adopted to guide its IT investment decisions; and,
- maximize the life of IT assets to the extent possible.

In the next three to five years, many of the Company's existing applications will require a major upgrade or replacement because they lack required functionally to support current or anticipated future business needs. This normal application attrition will resolve much of the OpenVMS issue as major upgrades or replacements will include migrating off of OpenVMS. The Business Support Systems project that began in 2001 is an example of how normal application attrition will contribute to the resolution of the OpenVMS issue.

Replacing critical applications presents an opportunity to improve or enhance the functionality of existing applications. For example, when replacing the materials management system newer electronic commerce capabilities can be added at a reasonable cost as newer solutions are considered. Application change-out decisions will consider opportunities to improve Company operations.

Moving forward, Newfoundland Power will continually monitor developments in the IT industry, particularly as they relate to OpenVMS. It will be important for the Company to maintain sufficient pace to complete the decommissioning of OpenVMS over the planning period and to be well positioned to adjust its overall strategy if the need arises.

Schedule

A high-level schedule for replacing OpenVMS based applications is provided in the following table.

	2000	2001	2002	2003
Business Support Systems				
Facilities Management				
Operations Support Systems				

The Company has chosen to focus initially on its Business Support Systems including its Human Resources, Financial, Payroll and Materials Management applications. These applications represent a particularly high risk due to their high level of dependence on OpenVMS, their high level of dependence on third party vendors for support and maintenance, and the limited number of similar installations of the application in other organizations. The Company has included funding to support this phase of the plan in the 2001 and 2002 capital budgets.

In 2002 and 2003, the Company plans to address applications that support the Operations and Engineering areas of the business. These include Facilities Management and Operations Support Systems. In addition to addressing the modest dependence on OpenVMS in this area, the Company expects to realize significant benefits in this area through operating efficiencies facilitated by the improved use of technology. The proposed capital budget for 2002 contains a provision to initiate the Facilities Management and Operations Support Systems aspects of this schedule. Additional funding will be required in 2003 to complete these initiatives.

There are two other OpenVMS systems to be addressed: Outage Management and Customer Systems. Newfoundland Power expects the Outage Management and Customer Systems phases to be the most challenging due to the complex nature of the applications that comprise these portfolios and the importance of these applications in providing high quality customer service. Existing Outage Management and Customer Service applications are highly dependent on OpenVMS but for the most part were developed in-house by Newfoundland Power staff. The risk associated with the dependence on OpenVMS platform for these systems is acceptable for the next three to five years, since Newfoundland Power staff supports these applications.

Experience gained through the previous phases of the OpenVMS initiative will help ensure these applications are addressed in an efficient and effective manner.

Projected Costs

A schedule of estimated budgetary requirements to support the decommissioning of the Company's OpenVMS environment is provided in the following table:

	2001	2002	2003
Business Support Systems	1,303,000	590,000	-
Facilities Management	-	939,000	270,000
Operations Support Systems	-	1,322,000	636,000

The costs for the replacement of the Outage Management and Customer Systems are difficult to estimate at this time, since the potential vendors for these projects have not yet been evaluated. The anticipated replacement period for these applications is in the three to five year time frame, subject to change based on IT industry developments. This is a manageable level of risk since these applications have been written and supported by Newfoundland Power staff. As well, moving the replacement of these applications out into the three to five year timeframe will allow the Company to maximize the lives of these assets.

Summary

Independent software vendor support for the OpenVMS operating system is in decline. Newfoundland Power has experienced several examples of the impact of this issue, and is responding accordingly. The Company anticipates this issue will continue to emerge in the near term and has initiated plans to mitigate the risks, thereby minimizing any negative impact on customer service and operating efficiencies.

Moving forward, Newfoundland Power will continue to monitor IT industry developments, especially with respect to OpenVMS, and adjust its plans accordingly.

Appendix B - META Group CSS Replacement Study Review

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Mr. Peter Collins
Manager, Information Services
Newfoundland Power

July 1st, 2003

Dear Mr. Collins,

META Group has been retained to offer an expert opinion on the evaluation process, market and product assessment accuracy, platform viability, and final recommendations provided in Customer Service System Replacement Analysis study, created by Newfoundland Power team in May 2003.

META Group is a leading provider of information technology research, advisory services, and strategic consulting. Delivering objective and actionable guidance, META Group's 250 experienced analysts and consultants are trusted advisors to IT and business executives around the world. Our unique collaborative models and dedicated customer service help clients be more efficient, effective, and timely in their use of IT to achieve their business goals. We had 116.5 Million US$ sales Y2002, and currently have operations in 40 countries with 3300 clients Worldwide, which we provide with actionable advice covering the entire IT spectrum. In addition to our core IT technology coverage, one feature that set us apart from other IT research and advisory service providers (e.g. Gartner, GIGA, Forester, Jupiter), is our vertical expertise and coverage of the specific IT solutions for industries such as energy and utilities. More then 120 energy companies worldwide subscribe to our Energy Information Strategies service and we log yearly more than 1500 advisory contacts with energy IT organizations covering a broad range of specific business and technology issues along the energy value chain.

As a member of the Energy Information Strategy team, which contains five dedicated analyst with an average 25+ years executive experience in energy business and IT, I personally provide advice to in excess of 100 energy clients globally on the best practices and technology solutions in the energy retail area, including customer care and billing, handling roughly 300 client inquiries annually. Additionally I am a trusted adviser to all leading Customer Information System (CIS) vendors in the energy space helping them to define product and technology roadmaps, "go to market" strategy and market messaging.

To provide you with a comprehensive assessment of the Customer Service System Replacement Analysis Study, we have formed an interdisciplinary IT team covering all aspects of Customer Service System replacement including the CIS packaged solution, platform viability issues, and tool migrations issues. In addition to myself with primary focus on packaged replacement options, Brian Richardson, Program Director with META Group Infrastructure Strategies Services was retain to cover server platform replacement options, and Mr. Thomas Murphy, Senior Program Director with META Group Integration and Development Strategies was responsible to cover tool migration options. Our short bios and coverage areas are included in the Addendum.

Following are our findings:

Package replacement options (Zarko Sumic):
Based on my knowledge of the energy retail market, business drivers, vendors positioning, product capabilities, market activities, product pricing and contract structures for packaged commercial of the shelf (COTS) software in the CIS space, I find the conclusions and recommendation provided in the Customer Service System Replacement Analysis study, pertinent to packaged replacement option, to be sound and based on accurate interpretation of the relevant market information. I concur with report's assertion that at this point, based on the lack of significant business drivers, complete replacement of the CSS with a packaged COTS CIS is not an optimal solution for Newfoundland Power.

This can be substantiated with:

- Energy retail market restructuring (deregulation) as a main catalyst for CIS replacement has slowed down consequently removing the two most compelling reasons for CIS replacement in North America (customer centricity and competitive energy products time to market)
- The average CIS replacement projects, although streamlined since emergence of the commercial of the shelf (COTS) CIS products, continue to be costly and long. Our survey of the energy industry customer care and billing market and involvement in numerous CIS replacement projects have consistently showed average replacement cost to be $50 US per customer and average implementation duration to be 24 months.
- Due to the financial scrutiny and reduced access to capital, energy companies are much more careful about capital expenditure including IT investments.
- New CIS products, without regulatory mandates or market restructuring imperatives, usually offer only incremental performance improvements that cannot justify CIS replacement cost. Cost benefits analysis and NPV ROI do not favor replacement option.
- CIS solution total cost of ownership (TCO) contributes to the cost benefit analysis but it is never an exclusive reason for CIS replacement.
- In the last 12 months there have been only three major CIS contracts awarded in the North American market placing extreme pressure on the vendors. As a result tier 1 vendors are moving into the already crowded midtier CIS market segment.
- A flat market cannot support the existing number of vendors and it will lead to market consolidation. Therefore, vendor viability is a critically important.
- A flat market has resulted in significant discounting both on the product and service side additionally eroding vendors financial viability.
- Most of the activities in CIS market, rather then replacement, can be characterized as legacy solution extensions aimed at prolonging legacy system life expectancy by dealing with functional inadequacy (e.g. complex billing, credit collection, user interface enhancement). That is achieved in a phased manner through bolting on niche solutions or partially configured COTS solutions.
- Rather then traditional “Big Bang” implementation approach, energy companies are more inclined to “phase in” new products leveraging the existing CIS as long as possible.

Platform Viability (Brian Richardson):

Based on my knowledge of general server market trends, future HP OpenVMS product roadmaps, and fundamental business and cost drivers, I concur with the conclusions and recommendations provided in the Customer Service System Replacement Analysis study.

This conclusion takes into account the following factors:

- HP will manufacture Alpha thru 2006, and Alpha-based systems will be supported until at least 2011
- Longer term, we believe migration from OpenVMS to a more mainstream operating system platform is appropriate; however, there is no immediate or urgent need to migrate
- Accordingly, we recommend a controlled, phased approach, rather than a “big bang” plan (where several infrastructure components are all changed at the same time).
- Near term migration costs are typically several times more than staying on existing infrastructure.
- Newfoundland Power is currently only on low-end to midrange sized Alpha systems, so future scalability issues are negligible.
- Windows is far more mature today than just a few years ago, and there are minimal scalability or manageability issues (particularly when compared with Unix for 4-8 processor systems).
- A key factor is picking an operating system that can leverage “Intel economics” for performance and price/performance.
- New applications are primarily being developed on Windows and Linux (which is currently displacing Solaris, which was by far the leading enterprise Unix).
- We believe that HP will successfully execute on the OpenVMS transition from Alpha to Itanium processors, with minimal disruption to customers.
- However, we believe that OpenVMS on Itanium will not attract significant new ISV interest.

Tool migration options (Thomas Murphy):
Newfoundland Power currently maintains a large portfolio of applications running on OpenVMS and created with Powerhouse. While the company recognizes a need to create a migration strategy (due to concerns over long-term support for OpenVMS) the existing code base has reasonable customer satisfaction and migration costs will be high. Our review of the existing planning documents find the conclusions to be well researched and in-line with current practices.

Issues that should be considered by Newfoundland Power as strategies are set:

- Obtaining skilled developers who are familiar with many of the utilized technologies (e.g. Axiant, Powerhouse) will become increasingly difficult.
- While the vendor continues to support and extend Powerhouse, a limited market will create limitations on vendor's ability to keep pace with technology change
- The package software market is evolving rapidly bringing broader selection of functionality and components that may better fit the companies needs
- A large quantity of "high priority" requests are logged (~220 months of work) Outside of existing functionality, what constraints does the system place on business agility

Given these considerations we believe that:

- Migration towards .net is advisable as a development platform. Developers with RAD and Cobol backgrounds tend to be more successful with this transition than a transition to Java.
- MicroFocus will deliver this year a version of Cobol integrated to .net (Fujitsu already has a product in this space) and this will enable migration of most Cobol code to the .net platform.
- MicroFocus also has tools to help harvest "components" from existing Cobol applications and the migration plans should evaluate the ability to utilize these tools.
- The majority of large enterprises are shifting towards buy vs. build strategies especially for non-core applications (i.e. applications where the business does not differentiate itself) and this would be advisable for Newfoundland Power
- While the transition of developers from Cobol and other legacy platforms to .net is possible, the organization should expect to incur significant training costs. The majority of these developers will take 6-8 months to be fully productive and comfortable in the new environment. The organization should seek to train developers and deploy them on new projects before attempting code migrations.
- Significant talent for doing application migration exists in off-shore development houses located in India. These may offer a much more cost effective option for code migration, however the company must evaluate the ability to manage code created by an outside group and the ability to communicate and deal with time and location barriers.
- Because any action to change will involve a significant effort, the IT group should coordinate closely with business operations to ensure that the new Enterprise Architecture meets long-term business direction and needs.

In conclusion we jointly concur with findings and recommendations in the aforementioned Newfoundland Power Customer Service System Replacement Analysis Study.

Respectfully,

Dr. Zarko Sumic, VP Energy Information Strategies
META Group

Addendum
Analyst Biographies

Analyst Biographies

Mr. Richardson has more than 20 years of experience in systems evaluation, cost/benefit analysis, contract negotiation, systems design and implementation, performance analysis, and strategic planning. Before joining META Group in April 1992, he was assistant vice president of information systems with WR Berkley Corp., an insurance holding company, and was responsibility for coordinating IT nationwide for all locations. Previously, he held various project management positions with several consulting companies, serving financial services clients. Mr. Richardson received a BS in Computer Science from Rutgers University.

Mr. Murphy has more than 15 years of experience in the software development market, developing software and leading product and marketing teams. He is a leading authority on e-business application development and enterprise application integration, especially relating to distributed application infrastructure, component middleware, and application frameworks. Mr. Murphy specializes in integrated development environments suitable for large-scale Web applications, object-oriented analysis and design, repositories, and component object models. He was a contributing author to IEEE's The Handbook of Software for Engineers and Scientists and contributes articles for several industry publications. Prior to joining META Group in September 1999, Mr. Murphy was director of e-business technology marketing for Seagull Software Systems. Previously, he directed product development efforts at ObjectShare (previously ParcPlace-Digitalk) and held various programming, consulting, and editorial positions. Mr. Murphy studied at the University of Utah and Ohio State University.

Dr. Zarko Sumic has more then 27 years of energy industry information technology experience with energy companies, software vendors, and universities. Prior to joining META Group in March 2001, he was vice president and chief technology officer of an unregulated subsidiary of a large energy company, where he was responsible for design, development, and deployment of a new customer information system. Dr. Sumic's background also includes experience with geographic information systems, EMS/SCADA systems, artificial intelligence (AI), and application service provider offerings. He received a B.S. from the University of Split, Croatia; an M.S. from the University of Zagreb, Croatia; and a Ph.D. from the University of Washington, Seattle. Dr. Sumic is a senior member of the IEEE Power Engineering Society and holds three patents in AI and Internet application to power systems.

Appendix C - Customer Service Function Description Internal

Developed in house, the Customer Service System (CSS) provides the Company's primary accounts receivable and direct customer billing for electrical sales. It consists of meter reading, prebilling, billing, cash processing, credit and collection, accounts receivable (AR) maintenance, service orders, system controls and financial controls.

The following is a brief description of major functional aspects of the CSS.

Service Orders (SO)

Of the 308,000 calls to the Call Center in 2002, approximately 50,000 to 70,000 calls utilized the service order features of CSS.

SO provides the ability to capture information regarding the customer, such as their identify and what the customer requires (e.g. the type of service: residential, commercial and whether to supply power to a new service or to an existing account). Also the SO schedules customer requests.

SO then allows users to issue the requests to the field. Users are able to manipulate and update the information already captured as well as enter the field results upon completion of the request.

General Data Maintenance (GDM)

The GDM function provides the user with the ability to edit and update information collected on the customer, the bill account, the premise and the service. In addition, information regarding prior contacts is displayed.

Meter Reading (MR)

During the year, the Company reads approximately 210,000 residential or commercial meters every month. Reading and some initial editing of meter readings is done at the handheld level using the Itron Premierplus 4 System and the G5 Handheld, a 2002 acquisition. The Company is also reviewing radio frequency meter reading alternatives using radio equipped hand-held devices to read automated meter reading (AMR) meters (e.g. Schlumberger Centrons).

On-line Meter Reading functionality within the CSS is limited. Within the CSS, users are able to add and maintain meter reading instructions and other meter reading information not contained elsewhere. They are also able to enter meter readings outside the handheld system and view a 13 month history of meter readings.

Batch processes control and edit the flow of information to and from the handheld.

Prebilling

Prebilling serves two important functions; it applies the read to the account and it conducts a series of edits and checks against that meter reading, the bill account and the premise. If a meter reading was not obtained, Prebill will attempt to apply an estimate for that month. If the read (or estimate) fails one or more of the edits and checks, the premise is sent to a Pending Work Queue (see below for description) for review. Any reads which pass Prebill editing are sent directly to Billing. Prebill occurs primarily in batch, however, on-line prebilling is frequently called when clearing entries from the Pending Work Queues.

Billing

Billing occurs during batch processing. Accounts which have passed Prebill editing are sent to Billing. During Billing, rates are applied, charges are calculated and records updated. Different rate classes allow for calculations of residential charges and more complex (with more options) commercial rates. Once calculated, this information is fed into the Print Bill programs which format the bills for printing or emailing.

There are a number of billing on-line conversations which enhance the normal bill processing. These include a number of billing options, including the Equal Payment Plan (spread payments equally over 10 or 12 months) and Group Billing (combine bills for same customers and issue one bill) and printing options such as multiple copies, email notification and bill on website.

Billing allows for the calculation and debiting of non-electric charges, including one-time charges (e.g. Statement of Account fees), re-occurring non-financed charges (e.g. the corporate charity) and financed charges (e.g., contribution in aid of construction and hot water tanks). These programs are supported by on-line conversations which allow the user to set up, maintain, inquire, cancel or final these charges.

Pending Work Queues

The Pending Work Queue (PWQ) is a function whereby a user can assign, view or complete action requests sent to a particular PWQ by another user or by batch processes. The PWQ can be thought of as an “in basket” in which work a user has to complete is stored. Customer inquiries that have to be passed onto someone else and accounts failing the prebill edits are two examples of the “work” stored on the PWQ. If the work order should be completed by another authority level, we are able to refer it to the appropriate PWQ using a screen within the PWQ conversation.

Cash Processing

Cash Processing allows cash payments to be posted against customer accounts. Approximately 2.4 million payments are processed per year broken down as follows:

- 20% are made via the mail
- 19% are paid in person at Company offices
- 32% are paid via telephone banking
- 17% are paid at a Bank or other financial institution
- 8% are paid via Preauthorized programs
- 4% of payments are received directly from government/crown corporation assistance programs

Payments received via the mail or paid at financial institutions are encoded through the Creditron Remittance Processor, implemented in 2000. The remittance processor reads bill stubs and transmits a file to the CSS. Payments received via front-end cash also are batched and a file is transmitted to the CSS at the end of the workday. When the remittance processor or the Cash Register system cannot be used, the CSS provides a screen for data entry of payments.

These payments are processed by batch overnight and applied against particular charges based on a predetermined priority.

The Company accepts cash, cheques (including post-dated), electronic payments and money orders. It does not accept VISA at this time.

CSS supports the cash function by providing screens to set the cash processing date, input non-scannable payments, correct out of balance batches and correct cash payments that are rejected at posting time.

Credit and Collections

The current Credit and Deposit policies and procedures are enabled through a combination of on-line and batch processes. Batch processing procedures assess the balances outstanding and automatically generate reminders on electric service bills or generate individual notices and letters. Users also have the ability to capture payment commitments made by the customers. When customers fail to meet a commitment or the conditions outlined in these Notices/Letters, the account is brought to the attention of Credit staff via a Pending Work Queue. Credit staff follow-up on the account by attempting collection and making suitable payment arrangements. When all attempts have been exhausted, serious collection action may be taken (e.g. disconnection of service).

The CSS also provides the ability to calculate, bill and manage Deposits.

Accounts Receivable Adjustment and Inquiry (AR)

The AR component of CSS consists of a series of conversations which contain either a history of like financial transactions or group of conversations allowing users to make these transactions. In many instances, conversations are bundled together to make a work process. For example, to inquire upon a charge, the user may look at the charge details, payments applied against that charge and the transfers of that charge - all within the same conversation. Users are able to view the details of charges created, credits applied, transfers, refunds and bills issued. Users are able to adjust charges, issue credits, transfer charges and credits, and issue refunds. Users are able to issue and approve adjustments within predetermined approval limits. Refunds, which require approval regardless of the position, are the exception to this rule.

There also are a number of AR nightly batch processes. The majority of these processes are preventative controls which ensure bill accounts, bills, charges, payments, etc. are balanced. The Transfer Adjustment batch process mimics the on-line conversations and transfers credit and charge balances automatically on terminated accounts, to active accounts.

Appendix D - Customer Service System Technical Description Internal

Online Environment/User Interface

CSS is a thin client GUI application comprised primarily of Cognos' Axiant 3.0 on the client PC and Powerhouse 820.d3. There are calls to OpenVMS COBOL version 2.4 and Oracle's ProCOBOL version 1.8.51.0 on the OpenVMS server for primary business logic execution.

Embedded Software

PC Lookup Correction (v1.10) from COMDATA Services Ltd. is the software used to ensure mailing addresses comply with Canada Post standards.

Communication with a number of windows software programs is enabled via DDE (Dynamic Data Exchange). This includes Microsoft Excel, Visual Basic program and integration with Aspect system (Screen Pop). No OLE, ActiveX or custom DLL's are used.

Architecture Principles

Screens – A series of related screens to perform a single function such as to "Issue Credit Adjustment" is called a "Conversation". Control of which screen is displayed next within a conversation is determined by the application and is based on user input and pre-programmed routing within the application.

Database updates are initiated through the following sources:

- The Axiant on-line forms will perform updates for specific conversations. The form is put into edit/entry mode for data entry and an update transaction is executed when the user initiates a save/update operation.
- The calls to the COBOL back-ends for specific conversations perform some of the more complex business logic and database updates. These routines are executed real time.

General Navigation – The system utilizes a "Standard Account Data" area whereby an account is retrieved and standard account information such as name and bill account etc. are displayed on the top two lines of all screens in all conversations thereafter. The retrieval of an account is required with few exceptions to run a conversation.

A conversation may be initiated via menus or a four-character code enterable from any screen. As well, dropdown boxes can be used to access menus and groups of conversations.

Suspend/Resume Navigation – This navigation technique utilizes a Visual Basic module that resides on the client PC. This code interacts with the core CSS software and tracks the screen calls for the user.

- *Suspend* function allows the user to leave a conversation in progress and start another conversation to accomplish a different (or similar task). The user can suspend up to 6 times within the application and have multiple levels of conversations open within each suspended session.
- *Resume* function, when activated, will bring the user back through the conversation levels to each originating suspend point starting with the latest in the stack and returning until the stack is cleared.

Read Only Environment – This process is controlled by the application. The computer operator has an option to bring down the online CSS application and re-start it with no updates allowed. The procedures set a parameter flag to "Y". The online conversations are designed to recognize this flag and when a "Y" is recognized, the conversation will not allow updates to the database. This allows for information viewing and therefore some simple Call Center activities to continue during running of nightly batch procedures.

Reporting – Some limited reporting within the online environment is available via a batch launch interface (Powerhouse Quiz). The reports are sent directly to the printer defined by the user's profile. As well reporting from the desktop is performed with tools such as Microsoft Access, Microsoft Excel and Cognos Impromptu.

Demographics:

Program Information:

Axiant:

- The total number of Axiant programs -165
- Total lines of Axiant code - 250,000

COBOL:

- Number of online COBOL programs - 67
- Total lines of online COBOL code - 95,000

Response Time: The majority of on-line forms have a sub second response time. Specific "heavy" functioning forms could have a response time up to 4-6 seconds at times.

Availability: The on-line availability service level agreement requires at least 99% availability, which is currently being met. The on-line system runs in update mode from 8:00 am to 8:00 pm Monday to Friday with extended view-only capabilities available outside this window.

Batch Environment

The batch processing is performed to complete high volume transactions and larger reporting requests. (e.g. post readings, post cash payments, edit accounts, calculate late payment charges, calculate forfeited discount charges, calculate

bills, print bills, perform audit checks, populate collection queues, issue form letters, produce daily, weekly and monthly reports etc.)

There is a regular nightly batch “window” (8pm - 8am daily) during which full online system availability is limited. As well there are weekly, monthly, quarterly, yearly and numerous specialized processes. Nightly and most other batch processes are computer operator attended.

The batch technical architecture consists of the following software/versions: OpenVMS COBOL 2.4, Oracle’s ProCOBOL 1.8.51.0.0, Powerhouse 820.d3 QUIZ, QTP, and OpenVMS DCL.

Embedded Software

PC Lookup Presort v1.04 from COMDATA Services Ltd. This is software to sort mail to obtain postal incentive rates.

Architecture Principles

Batch Submission and Control Process - Batch job submission and error handling processing is an in-house developed batch processing architecture (written in DCL) utilizing control, error reporting and check-point architecture. OpenVMS job control features such as “Synchronize” commands are utilized as well.

Load Programs - The batch windows frequently utilize “load programs” to perform data updates. Many jobs, rather than update the database immediately, stream updates to the same table into an RMS file. These files are then “loaded” into the database immediately after the “read only” job is completed. This technique was originally used to resolve performance problems when the system was first implemented.

“A” and “B” jobs – To address performance concerns, cash posting and other types of transactions are separated into “A” and “B” jobs. The “A” job for example, posts all cash for accounts being billed that night. The “B” job posts the rest of the cash. The idea is to run the comparatively very short “A” job before billing so that the nightly billing job can get started as early as possible. Meanwhile the “B” job can be run while billing is processing.

Demographics:

Program Information

Powerhouse:

- The total number of batch powerhouse programs by type:
  - QTP -120
  - QUIZ - 520
- Total lines of batch powerhouse code by type:
  - QTP - 8,500
  - QUIZ - 45,000

COBOL:

- Number of batch COBOL programs - 276
- Total lines of batch COBOL code - 430,000

DCL:

- Number of DCL command procedures - 1400
- Total line of DCL command code - 60,000

Batch Window Length: The full batch average window length is 10hrs and 20min. This is from the start of the first job to the last read-only report each day. The online system is made available much sooner, however the system response time is often too degraded for general call center use till full batch is completed. If the full batch window goes beyond the 8:00am start time for call center opening, some read only jobs are sacrificed to ensure performance is maintained.

Bills Printed:

- 192,000 bills are printed per month.
- On average 10,100 bills are printed per night assuming a 19 cycle billing period.
- On average there are two nights per month (non-reading days) where less than 3,000 bills are printed.

Collection Notices and Form Letters:

- 14,600 Payment Reminder Notices are printed per month. About 730 per day.
- 10,500 Delinquent Account Letters are printed per month. About 525 per day.
- 1,400 Various form letters are printed per month.

Transactions Posted:

- Approximately 200,000 cash transactions are posted per month or about 6,500 per day.
- 205,000 readings are posted per month or about 10,800 per cycle day.

Batch Support Calls:

- There are approximately 5 call-outs (operator to on-call application support person) per month.

Data Architecture

The current data model for the CSS is fully documented and is based on a Customer/1 model, which was highly customized when the system was developed. The separation of Customer, Customer Location and Bill Account is preserved. The data is relatively normalized and modeled accordingly.

With few exceptions, all customer related data is stored in one Oracle database residing on an OpenVMS server. RMS files are primarily used to hold interim transactional data, control data, some reporting information and to load database tables during batch processing.

File System:

Data of an ad hoc, reporting, and batch processing nature is stored in the OpenVMS RMS file subsystem. The RMS files are a mixture of sequential, indexed or relative. Powerhouse sub-files are also utilized.

RMS file demographics:

- Approximate number of files - 1350
- Approximate size - 8,300,000 blocks (VMS block = 512 bytes – approx. 4 gigabytes)
- Approximate number of Powerhouse sub-files - 410. The remaining files are normal OpenVMS .DAT, .TXT or .BCK files

Database Management System:

The primary customer application data is stored in an Oracle Server Enterprise Edition (version 8.1.6.0.0) database instance, residing on an OpenVMS server. The Oracle SQLNET protocol is used for client connections.

Database Tuning and Monitoring Tools:

Oracle DBMS tuning routines are developed in-house, using DCL procedures utilizing OpenVMS operating system features, calling SQL scripts, and supplemented with Oracle Enterprise Manager running on the windows platform.

Program Information:

DCL:

- Number of DCL command procedures - 150
- Total line of DCL command code - 8500

SQL:

- Number of SQL procedures - 40
- Total lines of SQL command code - 15000

Database Backups:

In-house written DCL procedures utilizing OpenVMS operating system features are used to back up the Oracle DBMS. Database backups consist of daily hot backups with archive logging, and weekly cold backups and exports. The database is first backed up to disk and then the disk backup is backed up to tape and stored offsite.

Program Information:

DCL:

- Number of DCL command procedures - 20
- Total lines of DCL command code - 2700

Architecture Principles

Business transaction integrity is maintained via transaction level read consistency ("set transaction read only") and statement level read consistency. There are coded "for update" clauses that acquire row level write locks.

Database level triggers are utilized to perform data validation and editing during the online window. Database constraints are utilized to enforce primary keys, and data validation. A limited number of foreign keys constraints are used to enforce referential integrity.

Stored procedures are used to a limited degree to perform data validation and editing.
Two Oracle communication listeners are configured to improve database connection performance.

Demographics

- Approximately 300 named users
- Approximately 100 concurrent users daily
- Approximately 6500 database connections per day
- 170 database tables
- 209 Indexes
- Database is 26 gigabytes in size with growth at 2.5 gigabytes of data per year with a purge of 2 gigabytes annually
- Database Reserved Memory is 1.438 gigabytes

Security Architecture

Multi-level security features have been developed to prevent unauthorized access at the application or database level. These include application, DBMS and Operating System level security.

Configuration:

Operating System Security: OpenVMS user names and passwords are required to access CSS. The user name and password is validated and based on the users, specific access is given via VMS identifiers. This sets the level of access allowed on the system.

Application Security: The CSS application has security features built in through code. It has security tables set up in the database that define functional groups and the individual screens that are accessible to the group. An administrator assigns users to a group. This is a function within the application. Code is written to identify the user logged in and the group they belong to. This is maintained throughout the session. As the user navigates from screen to screen common code is executed to ensure the user can access the particular form. If not authorized, a message is presented to the user as notification that access is denied.

Database Security: Application level database security is enforced through the operating system using trusted connections. Oracle table level security is enforced through Oracle password protected roles. Database views are used as a security technique to protect sensitive data.

File Security: File security is controlled with VMS identifiers. The identifiers are granted during application start-up and are only available while running the application. If access is required outside the application a separate identifier is assigned to the user and is restricted based on the users requirements.

Reporting Environment

Production Reporting is handled through the on-line environment and through the nightly batch processing. Reports are developed through Powerhouse Quiz and COBOL on the OpenVMS platform and are executed either from the online environment or in the batch environment in a scheduled manner (nightly, weekly, or monthly).

Customer Service Information System (CSIS)

This is a small reporting application written in DCL on the OpenVMS platform. It consolidates some of the production reports generated during batch processing into a central area for users to print via a menu. The menu has various options that print the pertinent report based on the user's logon id.

Ad Hoc End User reporting:

There is no dedicated reporting database or data warehouse available to users. All reporting is generally done from the production data source. From time to

time the Disaster Recovery/Test server is refreshed with the current production database to support intensive reporting efforts. This takes pressure from the production machine and allows the users some flexibility in when and how the reports are developed and executed. Users primarily use Cognos Powerhouse Quiz on the OpenVMS platform as the ad-hoc reporting tool. Some users utilize the Cognos Impromptu GUI report writer tool on the windows platform. The company has standardized on the Cognos BI tools for its reporting needs to date.

The total number of end user written reports is 899.

The total number of Powerhouse report programs by type:

- QTP - 10
- QUIZ - 900

Total lines of Powerhouse code by type :

- QTP - 850
- QUIZ - 31,000

OLAP reporting:

An OLAP cube is created from daily revenue files generated from our nightly batch processing for billing/revenue analysis and the Cognos Power Play product is used.

Development Environment

There is a dedicated development OpenVMS server call “ORION” that is used to support all development and maintenance activities for the CSS. The Axiant Development Tool Set is installed locally on each developer’s PC. There are various in-house written DCL, Powerhouse QTP, Quiz and Quick screens to manage programs and transfer data. “Synergex PVCS version 6.0” is utilized as a source code manager for the CSS.

Axiant is a repository based development environment. There is a development repository, which is refreshed from production periodically, and there is a main production repository. All development work is maintained within the development repository on the development server.

Once tested and signed off, the changes are exported from the development repository and imported into the production repository where a recompile is initiated to produce production executables.

Because this is a thin client application, all executables are on the server. The production executables are also maintained on the development server but are migrated to the production server. The production executables are segregated from the development environments on the development server.

There are various in-house developed routines written in DCL and Powerhouse that refresh development databases and extract pertinent data from the production database and populate one of many development databases. This process executes a series of Quick screens, QTP and Quiz code to perform its work.

The Disaster Recovery/Test server is used to execute large-scale tests if warranted. Typical use would be to perform upgrade testing, performance testing or major functional testing.

Customer Accounting Testing System (CATS): This is an in-house developed testing environment that allows Customer Service personnel to check and test changes to customer electricity rates. It allows the users to modify the rates Newfoundland Power charge to customers and put them through the bill calculation and print bill functions from the batch processing procedures. This allows the Customers Service group to assess impact and accuracy for customer bills prior to implementing any changes. The environment is a combination of Axiant/Powerhouse, COBOL and DCL.

Program Information:

Powerhouse:

The total number of batch powerhouse programs by type:

- QKS - 36
- QTP - 13
- QUIZ - 13

Total lines of batch powerhouse code by type :

- QKS - 3,500
- QTP - 550
- QUIZ - 340

COBOL:

- Number of batch COBOL programs – 15 (utilizes existing CSS batch programs)

DCL:

- Number of DCL command procedures - 85
- Total line of DCL command code - 8,000

Training environment:

The training environment is established on the Disaster Recovery server. The data is loaded/refreshed periodically through custom written routines. When the Customer Account Representatives need training for new modules or update training on existing modules, they can be accommodated here.

Deployment:

There are two aspects to the deployment process:

- While this is a thin client application, all executable code is moved to the production server through a migration routine. This routine is written in DCL and identifies the files to be moved to production. The DCL routine is then put in a batch queue and released at the appropriate time. When it executes, it copies the files identified from the development server production area, to the actual production server executable area.

- The second aspect of deployment is getting the modified forms on the users desktop. This is generally done through Microsoft's Systems Management Server (SMS). All identified clients receive the updates automatically.

Hardware Infrastructure

CSS runs in a 2-tier architecture (client and application/database server) for production with a duplicate hardware infrastructure for disaster recovery. A separate hardware infrastructure supports development and testing efforts. The disaster recovery environment is also used to support full size functional and performance testing. The following describes the existing hardware infrastructure:

<u>Production Application/Database Server (DRACO):</u>

- Type: Compaq Digital Alpha Server 4100
- Processor: 3 5/533
- Memory: 6 Gb Ram
- Disks: Internal 7 @ 9GB 1@ 18GB 3 @ 4.3GB SAN 18@36.4GB
- Controller: 1 SE SCSI, 2 FC Controllers, 1 Raid KZPSC 1 DE500 10/100 Ethernet
- Tape Drive: TZ88, 2 DLT 7000
- TCPware version 5.4-3

<u>Disaster Recovery Application/Database Server (CORVUS)</u>

- Type: Compaq Digital Alpha Server 4100
- Processor: 3 5/ 533
- Memory: 6 Gb Ram
- Disks: Internal 8 @ 9GB 1@ 18GB 1 @ 4.3GB
- SAN 18@36.4GB
- Controller: 1 SE SCSI, 2 FC Controllers, 1 Raid KZPSC 1 DE500 10/100 Ethernet
- Tape Drive: TZ88, 2 DLT 4000

Development/test Server (ORION)

Type: Compaq Digital Alpha Server 4100

- Processor: 2 5/ 300
- Memory: 1.5 Gb Ram
- Disks: 17 @ 9 Gb, 1 @ 4Gb total 157Gb
- Controller: 1-10/100 ETH,2 SE SCSI, 1 Raid KZPSC 1 DE500
- Tape Drive: 1 @ TZ88, 1 @ TZ87

Typical Client Desktop Configuration:

- Platform/OS: Windows NT
- Type: Dell Optiplex GX110+/L Pentium III
- CPU: 733
- Hard Drive: 12.4 gigs
- Monitor: 17 inch Dell Monitor
- Memory: 256 MB

Appendix E - CSS Application Integration Description Internal

Refer to a diagram below in Appendix A CSS Integration Model, which graphically depicts the current integrations with the CSS application.

Integration with Other Internal Applications

Hand Held Meter Reading (Itron's Premierplus 4)

The CSS interfaces with a third party hand held meter reading application, "Itron's PremierPlus4 (version 2.8.01)". This interface performs data file transfers to and from both applications. Files of meter readings taken during the day by meter readers are downloaded to the PremierPlus 4 system and sent via FTP to a CSS data area, for processing by the CSS nightly batch procedures. Files of meters expecting to be read on the following reading day are sent (via FTP) from a CSS nightly batch procedure to the Hand Held Meter Reading server.

Cash Remittance Processors

The Cash Control section processes all payments from the bank and the mail through the remittance processor "Creditron RP$2000 (version 5.07.0135)". The interface with the CSS is a file based transfer. A file of all entered payments is created daily, copied to and processed by the CSS nightly batch.

Cash Registers

Each area office has the capability of accepting payments in person. The payments are processed through cash registers and included in a file. The interface with the CSS is a file based transfer. Each cash register transmits this file by 3:00 pm every day. These payments are included with payments from other sources (eg. remittance processor) and posted to customers' accounts during the CSS nightly batch processing.

Weather Normalization

Weather normalization is an in-house developed application. This system tracks actual and normal temperatures and wind speed data. This information is used by the CSS for bill estimation and responding to customers' high bill inquiries. The interface with the CSS is through a data file transfer. Files of updated weather information are sent to the CSS daily and processed by the CSS batch.

Internet Application: Customer Account Inquiry

An in-house custom developed Customer Account Inquiry function is available to customers via the Company's corporate Internet site. The CSS nightly batch process downloads a data file of all active customer billing and payment data each night. A separate staging database (WEB Oracle 8.1.7 on NT) is populated using these files. This database is then used by the external Internet application, the internal Intranet Customer Inquiry application and the Call Center Aspect CTI application.

Objectif Lune Document Distribution Modules

The CSS batch environment interfaces with a third party electronic document distribution line of products. This line of products provided by Objectif Lune includes "PlanetImage (version 3.3.0.251), PlanetWatch (version 3.3.1.683), PlanetPress (version 3.3.1.737), PlanetSearch (version 3.5)".

The "PlanetWatch" and "PlanetImage" modules are used to co-ordinate the physical printing and electronic presenting of the customers electric bill. The nightly CSS batch process sends the

print file of customer's bills to the "PlanetPress" server. On a daily basis, a current file of customers' email addresses for those on eBill is sent to the "PlanetPress" server. "PlanetPress" formats the data in a predefined form and coordinates the printing via the IKON printer. For those customers signed up on eBill, this product will notify them via email that their bill is ready for pickup online through the Company's corporate website. Here, customers can log in to pick up their copy of their electrical bill in the Customer Inquiry application.

Customer Account Inquiry

The Customer Account Inquiry application is an in-house, custom developed, browser based function. This application is available to customers via the Company's Internet web site and is also available to internal employees via the corporate Intranet site. The application utilizes the WEB staging database in both cases

Disconnect for Debt

This is an in-house, custom developed, browser based, application used to list customers due for disconnection. It is used after business hours by the System Control Center and others who are responsible for organizing line crews to disconnect/remove meters for non-payment. The application accesses the CSS database in a real time mode for customer, location and current balance information.

Call Center Technology

The Customer Services Call Center utilizes a third party Computer Telephony Integration product called "Aspect Automatic Call Distribution System (version 3.1)".

The application is integrated with the CSS utilizing a "screen pop" to the CSS based on bill account number entered by the customer on the phone or phone number lookup. This application utilizes the Customer Internet database (WEB) in real time for Customer Bill Account, Meter Number, payment and phone number information for interactive voice response and data directed routing.

Meters (MES)

The in-house custom developed Metering Equipment system is used to record and control electrical meters that record electric consumption. The CSS accesses the Meter database in real time in read-only mode for both online and batch processing. The meter multiplier and installation information is retrieved and used in the calculation of electrical consumption. Meter readings and dates for metering installations, which have had a change to their configuration, causing a recalculation of the installation multiplier, are recorded in the Meters application. This information is sent daily to the CSS via a data file transfer method and uploaded to the CSS database. The annual Compliance Sample Orders and Government Retest Order processes create a file used to insert service orders in the CSS database. A file is sent from the CSS to the Meters application to update the meter inventory based on completed service orders in which a meter was installed at a customer location.

Street Lighting

The in-house custom developed Street Lighting system manages information regarding area lighting facilities, including assembly, installation, removal of light fixtures and underground wiring. It has various functions for tracking specifications (type, size, style), installations (install/remove dates, billing effective/expiry dates, location of street light for customer billing). The CSS accesses the Street Lighting database real time in read only mode in both the online and batch environment for the purpose of area light inquiries and billing customers for area lighting services.

The Street Lighting system directly accesses the CSS database in read-only mode for customer, location and service order information.

Poles

The in-house custom developed Poles System is used to record installed pole characteristics. The CSS accesses the Poles database directly in read-only mode for the purpose of billing customers for the use of the pole for dedicated area lighting. The Pole System also directly accesses the CSS database in read-only mode for customer, location and service order information.

Problem Call Logging/Outage Management (PCLS)

The in-house custom developed problem call logging system was developed to record calls from electrical customers experiencing outages. The application maintains a direct database access to the CSS database in read-only mode to customer, location and service information. CSS also has direct update access to the Problem Call Logging database. A screen in CSS allows call center users to enter problem calls directly (a similar screen exists in PCLS).

Financial Application - Microsoft Great Plains e.Enterprise Suite

The Company's financial application, Microsoft's Great Plains e.Enterprise version 6.08, is integrated with CSS through a batch oriented point-to-point data file transfer.

A data file of vendor numbers from Great Plains e.Enterprise is sent to a CSS data area, uploaded and used by the on-line environment to validate vendors for the various financing programs available to customers. This file is uploaded to the CSS database on a nightly basis through the nightly CSS batch procedures.

The nightly CSS batch procedures send RMS data files of daily and monthly financial transactions, customer refunds and petty cash recorded in the CSS to the e.Enterprise application data area for uploading by the e.Enterprise integration manager.

Various CSS financial reports are created by the nightly batch procedures and copied to the financial area.

Integration with External Organizations (B2B)

COMDATA Services Ltd

Electronic data files are sent to CSS on a monthly basis with valid addresses and postal codes from Canada Post. These address files are used by CSS on-line conversations to correct addresses. The postal code files are used by the CSS nightly batch billing process to add walk routes information and sort bills and other correspondence for mailing. PC Lookup Correction (v1.10) software is called in the CSS on-line environment. The PC Lookup Presort (v1.04) is used in the CSS batch processing environment to sort mail to obtain postal incentive rates.

Newfoundland and Labrador Housing Corporation

This Crown corporation provides an electric service subsidy to its clients. An electronic file of the subsidies available per customer location is received three times monthly from the Corporation. The CSS batch process creates a file of electrical subsidies actually credited to customers to be sent back to the Housing Corporation.

Department of Social Services

The provincial Department of Social Services, when necessary, will deduct electric service payments directly from a client's assistance cheque. A file of these direct payments is received and processed twice per month and posted with cash from other sources (eg. cash registers, remittance processor).

The Royal Bank of Canada

Electronic payment files flow back and forth between the CSS and the Royal Bank daily. This includes electronic files, such as ebanking and telephone payments, which are received and processed by CSS nightly batch. Newfoundland Power also offers customers the option of preauthorized payment withdrawal. This file is created by the CSS batch daily and sent to the bank for payment processing. Electronic files of rejected preauthorized payments also are processed by the CSS nightly batch.

Large Client Electronic Billing

An electronic version of the bill for one of the Company's larger clients is emailed directly to the client. As part of CSS weekend batch processing, a file of the client's bill information is created, converted to a Microsoft Excel file and emailed directly to the designated client contact.

Miscellaneous User Developed Applications

There are a number of user developed applications and reports which supplement and complement the existing CSS application. These systems have been designed to retrieve information from CSS and store additional information pertaining to the subject area. User developed applications use MS Access to perform automated balancing procedures for cash payments, month-end revenue reporting, and credit summaries, etc. User developed reports exist in Powerhouse Quiz on the OpenVMS platform and MS Access as well as Cognos Impromptu/PowerPlay via ODBC on the windows platform.

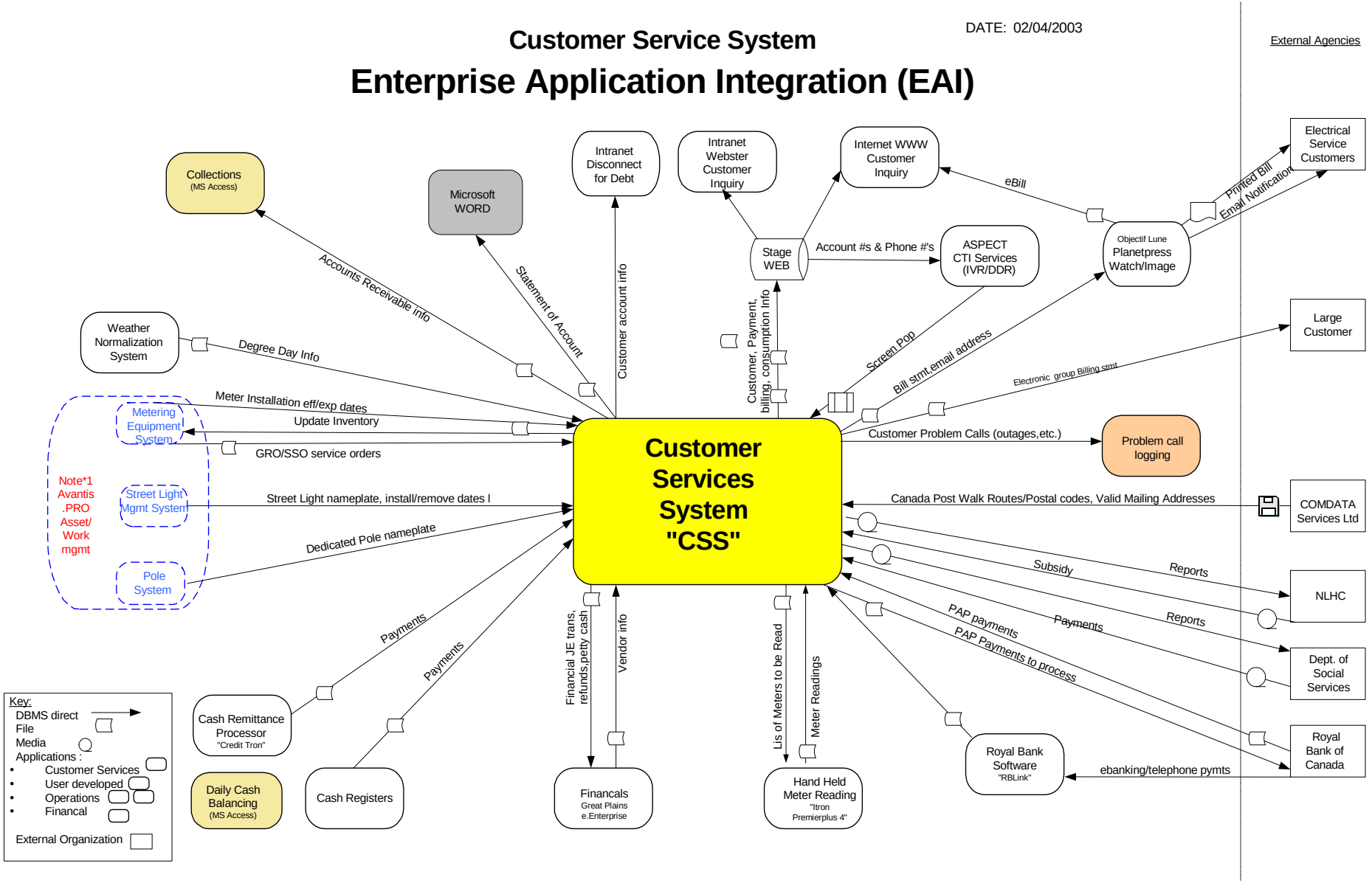
Future Integration

Avantis.PRO (Metering, Street Lights, Poles and Customer Driven Work Management)

The Metering, Pole, and Street Light applications are scheduled for replacement as outlined in the OpenVMS migration plan. A third party enterprise-wide asset management application from Invensys, "Avantis.PRO (version 3.2)", is being implemented in the 2003 - 2004 timeframe. The metering data and possibly the area light assets will be placed into this application residing on the Microsoft platform with an Oracle database. The CSS application will have to interface with this data.

Work management activities (customer driven work) will be implemented in the Avantis.PRO application. The CSS application will generate customer service orders that will create work orders in the Avantis.PRO application. The CSS application must be able to query the status of service orders/work orders within the Avantis.PRO database inside of the CSS online user interface.

Appendix A - CSS Integration Model



Appendix F - Utility Survey Description
Internal

Survey of Canadian Utilities
March 2003

Introduction

Newfoundland Power is conducting research on Customer Information Systems (CIS) in use at utilities across Canada. Newfoundland Power is currently examining several options with regards to the future of its CIS system including partial package replacement via commercial "bolt-on" products, and custom re-coding of the application. To aid the decision-making process, Newfoundland Power is interested in learning what its peers have done, or are doing, in this important business/technology area.

Newfoundland Power has engaged **xwave**, a Canadian information technology services company, to facilitate this survey on their behalf. Survey responses, as well as questions or comments about the survey, should be directed to the following:

Andrea Marshall
Business Analyst – **xwave**
St. John's, Newfoundland
Phone: (709) 570-1900
Fax: (709) 726-1831
Email: Andrea.Marshall@xwave.com

Newfoundland Power greatly appreciates your cooperation in the completion of this survey.

Survey Results

Newfoundland Power will summarize survey results and distribute to respondents, if desired. Information provided to Newfoundland Power will be included in the summary only if authorized by the respondent (see below). In addition, summary information will be confidential, i.e. individual utilities will not be linked to specific response information. Rather, responses will be grouped, e.g. *" Five out of ten utility companies surveyed currently print their own electric service bills"*.

Please answer the following questions pertaining to survey results:

1) Would you like your responses included in a shared survey summary? Yes / No ____

2) Would you like to receive a survey summary? Yes / No ____

Contact Information – Person(s) Completing Survey

Name		Name	
Position		Position	
Company		Company	
Phone		Phone	
Email		Email	

Part 1: Customer Information Systems

Objective: To profile the current customer information solutions of select Canadian utilities and identify the future directions for these solutions.

Part 1-A Customer Information Systems (CIS)

Number of internal staff in Customer Service: ____
Number of internal staff in Information Technology: ____

Our CIS offers:

CIS Component	Developed In-House or Vendor (if Vendor, give Vendor name), N/A	Application Name	Version	Date Installed
Service Order Processing				
Customer Data Maintenance				
Customer Billing				
Specialized Billing (e.g. industrial billing, group billing)				
Bill Printing				
High Bill Inquiry/Analysis				
Credit and Collections				
Accounts Receivable				
Cash Receipt/Point of Sale				
Analysis/Decision Support Tools				
CRM				
Field Action Processing/Tracking				
Area Lights/Special Products Tracking				
Load Management				
Web self service				
Electronic bill viewing				
Other:				

Additional Information/Comments:

Part 1-B Specific Applications of Interest

1. Do you currently offer customers onsite Cashier facilities for bill payment? **Yes/No** ____
2. If Yes to question 1, do you utilize commercial cash receipt/point of sale software (i.e. as opposed to software developed in-house)? Yes/No ____
3. Does your company have authorized agents who collect payments on your behalf (e.g. drug stores, supermarkets, etc.)? **Yes/No** ____
4. Do you currently print and mail your own Electric service bills? **Yes/No** ____
5. If Yes to question 4, do you utilize commercial printer software to format bills? **Yes/No** ____

If you answered *Yes* to either question 2 or 5, please complete the following table.

	Commercial Cash Receipt/ Point of Sale	**Commercial Print Bill**
Application Name and Version		
Vendor Name		
Vendor Location		
Vendor has Canadian offices? (Yes/No)		
Utility's Cash Receipt Hours of Operation (e.g. accept payments 9 – 5, 8 – 8, 24 hrs, etc.)		
Utility's Volume of Daily Transactions		
Hardware Components (e.g. PC, optical scanner, cash drawer, printer,etc.)		
Was an RFP Issued for this purchase? (Yes/No)		
What was the main reason for selecting this vendor? (Cost, Functionality, Usability, Compatibility)		
Original Purchase Date		
Overall Evaluation of the product (M – Meets needs; E – Exceeds needs; D – Does not meet needs)		

Additional Information/Comments:

Part 1-C Technology Profile

On what infrastructure platform does your CSS operate?

Platform Component	Modes of Operation		
	Online	Batch	Report Processing
Hardware (e.g. Compaq Alpha, AS 400, Windows servers, etc.)			
Operating System (e.g. Unix, Windows, OpenVMS)			
Database Management System (e.g. Oracle, DB2, file based, relational, etc.)			
Development Tools (VB, PowerHouse, etc.)			

Additional Information/Comments:

Part 1-D Future Plans/Directions

What are your future plans with regards to your CSS system? In particular, are any of the following activities planned:

Activity	Planned? (Y/N)	Brief Description
Enhancement/extension of legacy application.		
Full replacement.		
Re-Platform.		

Additional Information/Comments:

Part 2: Other Applications in Use

Objective: To gather high-level information regarding applications being used by other Canadian utilities.

Using the following table, please indicate which of the application types your organization currently uses. Of these applications, please note whether they were developed in-house or purchased from a vendor. For purchased applications, please include vendor name, as well as application name and version.

Application Type	In-Use? (Y/N)	Purchased or In-House?	Vendor	Application Name and Version
Outage Management				
Asset/Facilities Management				
Meter Equipment Inventory				
Work Management				
Human Resources Management				
Financial Management (GL/AP/AR)				
Materials Management – Purchasing and Inventory				

Additional Information/Comments:

Appendix G – OpenVMS Research Project Xwave Report External

xwave, An Aliant Company
ISBU Enterprise Server Team
Higgins Line
St. John's, Newfoundland
Telephone: (709) 724-7500
Fax: (709) 724-7555

OpenVMS Environment Research Project

FOR

July 28, 2003

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1.0 EXECUTIVE SUMMARY

Newfoundland Power Inc. ("the Company") operates an integrated generation, transmission and distribution system throughout the island part of the province of Newfoundland and Labrador. The Company serves approximately 220,000 customers in more than 600 communities, representing 85 per cent of all electrical consumers in the province.

Newfoundland Power's vision is to **be a leader in electrical transmission and distribution services in North America.** To support this vision and achieve business goals, the Company's IS Department has established an "I.T. Roadmap" to identify and prioritize deployment of IT solutions. These solutions will provide increased operating efficiencies, additional functionality and will ensure suitable technology to support new business growth.

A critical factor determining the successful use of IT at Newfoundland Power is the availability and reliability of applications and supporting infrastructure. The application can provide the greatest functionality possible, but if the infrastructure, especially the server, is not available or does not provide adequate performance, the solution will not provide business value.

Newfoundland Power currently utilizes the OpenVMS environment for a number of its corporate applications including the Customer Service System (CSS). OpenVMS has been the primary application development environment for more than 15 years and has offered reliability and stability. However, Newfoundland Power is at a critical juncture with respect to selection of a computing platform for much of its core production environment.

The primary objective of the OpenVMS Research Project (the Project) was to investigate the prevalence and future direction of the OpenVMS environment. These research findings are intended to assist Newfoundland Power in making a decision regarding whether to migrate from the OpenVMS environment. A second objective of the Project was to identify high-level technical architecture alternatives to maintain the current level of stability, reliability and availability.

Information for the Project was gathered from both primary and secondary sources. Interviews and questionnaires were used to gather information from industry consultants, hardware and software vendors, OpenVMS customers and Newfoundland Power staff. Secondary sources included white papers, research opinions and strategy documents.

While conducting the research for the Project, **xwave** discovered the following key findings:

OpenVMS Environment: Various generations of OpenVMS have been available since 1977.There are more than 30 OpenVMS customers in Atlantic Canada.

OpenVMS at Newfoundland Power: Newfoundland Power has six OpenVMS servers ranging in age from three to seven years. The AlphaServer 4100 server line that Newfoundland Power runs OpenVMS on has been discontinued and spare parts have to be purchased from third party vendors. One Full Time Equivalent (FTE) is required to support the six OpenVMS servers compared to two FTEs to support the Intel environment consisting of 57 Compaq servers. While it is not always appropriate to assume a one-to-one relationship between OpenVMS and Windows server support, total server support effort would likely be reduced by migrating from OpenVMS to Windows or UNIX. The OpenVMS platforms provide a highly stable, reliable and available environment for the applications residing on them. However, they require a significant level of manual care and intervention, which adds to the resource requirements for the servers. By the end of 2003, all the applications on the OpenVMS servers except CSS will have been replaced.

OpenVMS Roadmaps: Hewlett Packard has stated that OpenVMS will be sold on the AlphaServer technology until at least 2006, and will be supported on this platform until at least 2011. The AlphaServer will be marketed at least until 2006 and supported for an additional 5 years. Hewlett Packard will release a production version of OpenVMS on the Itanium technology around 2004-2005.

OpenVMS Revenues and Shipments: The Gartner Group, a leading IT industry consulting firm, expects revenues from new sales of OpenVMS in 2006 to decline to $36 Million from $806 Million in 1998. During the same period, Windows NT/2000 will rise to $16.3 Billion from $6.9 Billion and Solaris to $9.9 Billion from $4.9 Billion. OpenVMS shipments are projected to decrease from 19,000 units in 1998 to a projected 1,100 units in 2006. In contrast, during the same period Windows NT/2000 (and its successors) are expected to increase from 1,350,000 units to 3,364,000 units and Solaris from 142,000 to 470,000. By 2006, OpenVMS will account for less that 2.5% of Intel Itanium-based server sales

Industry Consultants: In March 2002, prior to the Hewlett Packard/Compaq merger, the Gartner Group allocated a “strong negative” rating to the OpenVMS operating system. However, the merger affirmed Compaq’s commitment to porting OpenVMS to Itanium by 2004 and as a result, Gartner revised its overall rating to “caution”. The negative rating still applies to any new business solutions. Giga, another leading IT consulting firm, presents a more optimistic view of the future of OpenVMS. The potential immense backlash from existing OpenVMS customers may be enough for Hewlett Packard not to discontinue marketing and supporting the operating system. IT trade journals presented few articles focused on OpenVMS (except those in OpenVMS journals). Unlike Windows and UNIX, there is a lack of coverage and hype/excitement about OpenVMS.

Independent Software Vendors (ISVs): Despite the commitment from Oracle to continue deploying its products on OpenVMS, Oracle has relegated the OpenVMS operating system to a Tier 2 status platform for its database. As a result, OpenVMS customers can expect to have a longer wait than other customers for updates and software fixes. Cognos has declared that OpenVMS is a Tier 1 operating system for Powerhouse. Despite the 100 ISVs proclaiming support for OpenVMS on Itanium, ISVs may not follow Hewlett Packard’s lead and instead opt to concentrate on developing their applications on more Open-Standards based operating systems or on OS’s with a higher percentage of market share. The prime mission critical application currently located on the OpenVMS servers at Newfoundland Power is the Customer Support Service (CSS) application. Through interviews and documentation, **xwave** found that major CSS and CIS providers were supporting Windows NT/2000 and UNIX platforms as application servers. Those who are supporting OpenVMS tend to use the platform as a database server only.

xwave Internal Research: An investigation of **xwave** sales activity within Atlantic Canada has shown that in August 2002, **xwave** received a request to provide four OpenVMS workstations/servers for a local customer. These computers will be deployed in South America as part of a niche offshore oil application. Prior to this order, the last OpenVMS server sales occurred in January 2001. In contrast, the Sales teams within Atlantic Canada alone have sold hundreds of Intel and UNIX based solutions in the last 18 months. **xwave's** clients often require the services of our IT professionals in order to build or support IT solutions, and to provide consulting services. Throughout 2001 and up to the first half of 2002 there were 154 Windows NT/2000 resource requests issued to the Resource Coordination group. This number contrasts sharply with the two requests issued for OpenVMS resources. One request was from Newfoundland Power, while the other was from a client in Ontario. Each year, **xwave** receives thousands of resumes from IT professionals. Of the 3000 resumes online, only seven indicated that they had any OpenVMS (or VMS) experience. This is in sharp contrast to the nearly 2200 claiming to have some Windows NT experience. Most of the customers who had OpenVMS applications have had them in place for at least 5 – 10 years. Many of these systems were upgrades from older VAX/VMS applications. Customers who were looking to replace the applications on the OpenVMS based servers were considering migrating to other operating systems such Windows 2000, HP-UX, or Solaris if the newer applications were available on these platforms. While most customers were pleased with the level of availability and reliability of their OpenVMS systems, OpenVMS was not seen as a strategic operating system for deploying new mission critical applications.

Education/Training Centres: Education centres and training companies offer a wide array of training courses for companies. The most popular, or "hot", courses reflect what skills are in demand in the IT industry. Currently, the hottest courses are in the Windows, Database, and UNIX categories. Many learning centres are not offering OpenVMS curriculum.

The research indicated that while OpenVMS was viewed as reliable and stable, the combination of a number of significant factors would limit the potential for OpenVMS to become a mainstream operating system in the midrange market. These factors include:

Market Share: Sales revenues and shipments for OpenVMS are diminishing while Windows and UNIX systems are gaining market share.
ISVs View of OpenVMS: Major Independent Software Vendors (ISVs) such as Oracle have begun to relegate OpenVMS to a Tier 2 platform status, resulting in delays in the release of new versions and fixes of ISV software for the OpenVMS operating system.
Vendor Technology Roadmap: Hewlett Packard has committed to sell AlphaServer technology until 2006. It has stated that it will continue beyond that date only if the demand is present.
Product Availability: The AlphaServer 4100s at Newfoundland Power are no longer sold by Hewlett Packard.
Replacement Parts Availability: Replacement components for the AlphaServer technology will become increasingly difficult to obtain.
Support Requirements: It requires one FTE to support the six OpenVMS servers while two FTEs are supporting the approximately 57 Windows servers at Newfoundland Power.

Diversity/Trend away from OpenVMS: Although there are six OpenVMS servers in use at Newfoundland Power, PROD1 and its disaster recovery server VOLANS host the legacy financials system FASBE as well as SRS, SWITCH, and HRIS. A newer financials system has been deployed on a series of Windows 2000 servers. With the migration of the financials away from OpenVMS, there is further erosion in the prevalence of OpenVMS applications.
Access to Training: Training courses for OpenVMS are difficult to obtain without having to travel outside Canada. Due to the low interest generated for OpenVMS training, courses are not regularly scheduled in Canada.
Access to OpenVMS Skills: People with OpenVMS skills are becoming harder to obtain. Graduates from post secondary institutions are entering the job market with little or no OpenVMS experience. Many, however, have had exposure to Windows and UNIX environments.
OpenVMS Alternatives: Due to the delays in development and limited availability, Itanium has yet to gain mainstream acceptance and its prime target will be software development and high technical computing, neither of which is the computing direction for Newfoundland Power.
Alternate Environments: Windows and UNIX platforms have become more accepted by the IT industry. While there is a consensus that OpenVMS is an available and reliable operating system, Windows and UNIX have gained enough momentum to further erode the OpenVMS future.

These factors indicate that OpenVMS's future as an operating system for critical business applications is limited. Despite assurances from Hewlett Packard, continuing to use OpenVMS contains an unacceptable level of uncertainty and risk. **As a result of the analysis of the Project's research, xwave recommends that Newfoundland Power migrate away from the OpenVMS operating system environment and begin deploying its current OpenVMS based applications onto other operating systems.**

The Project also included the creation of a high-level infrastructure architecture to replace the current CSS infrastructure. By the end of 2003, all the applications on the OpenVMS servers except CSS will have been replaced. The two alternative environments presented in Section 5 are based upon Microsoft Windows 2000 and UNIX. These operating systems were chosen as alternatives because Newfoundland Power has experience with both - Windows through the deployment of applications such as the Great Plains application and UNIX through the Tru64 SCADA implementation. It is important to note that the configurations and prices reflect current technology as of August 2002.

The Windows 2000 alternative involves the deployment of two production servers, as well as two additional servers that would accommodate application development and disaster recovery. The following table summarizes the server infrastructure and provides a high-level estimate of hardware and software required to implement this solution.

CSS Windows 2000 Environment		
Environment	Requirements	Cost
Production	One Compaq DL580 database server One Compaq DL380 application server 437 GB external storage One server rack One communications switch	$132,800
Development / Disaster Recovery	One Compaq DL580 database server One Compaq DL380 application server 437 GB external storage One server rack One communications switch	$120,500
	Total (excluding tax)	$253,300.00

The servers would connect to the Storage Area Network (SAN) solution proposed recently by **xwave**. As a result, 874 GB of external disk storage would be installed in the SAN for use by the servers.

The UNIX alternative involved the deployment of two production servers, as well as two servers that would accommodate application development and disaster recovery.

CSS UNIX Environment		
Environment	Requirements	Cost
Production	One Sun Microsystems Sun Fire V480 database server One Sun Microsystems Sun Fire V480 application server One Sun StorEdge D2 Array One server rack One communications switch	$175,300
Development / Disaster Recovery	One Sun Microsystems Sun Fire V480 database server One Sun Microsystems Sun Fire V480 application server One Sun StorEdge D2 Array One server rack One communications switch	$142,600
	Total (excluding tax)	$317,900.00

At this time, **xwave** does not make a recommendation between Windows 2000 and UNIX as the preferred alternative. The final decision on which platform to deploy depends upon the future direction of applications such as the Customer Support System (CSS). Specifically, future replacements for these applications will determine which operating systems should be used and the level of hardware to be deployed.

The remainder of this report details **xwave**'s investigation into OpenVMS as well as an analysis of the information gathered.

2.0 INTRODUCTION

2.1 PURPOSE

Newfoundland Power currently utilizes the OpenVMS environment for some of its corporate applications. OpenVMS has been the primary application development environment for a number of years offering maturity and stability. However, Newfoundland Power is at a critical juncture with respect to selection of a computing platform for much of its core production environment. Its OpenVMS servers are from four to seven years old and are becoming limited in their scalability. Applications such as Great Plains have been implemented in the Windows environment. While much of the decision around future platforms for supporting a 7/24 operational environment will be tied to the selection of the application vendor, this is also a fundamental decision on the horizon that must be addressed.

The primary objective of the OpenVMS Research Project (the Project) was to investigate the prevalence and future direction of OpenVMS environment. These research findings are intended to assist Newfoundland Power in making a decision regarding whether to migrate from the OpenVMS environment. A second objective of the Project was to identify high-level technical architecture options to maintain the current level of stability, reliability and availability.

Information for the Project was gathered from both primary and secondary sources. Interviews and questionnaires were used to gather information from industry consultants, hardware and software vendors, OpenVMS customers and Newfoundland Power staff. Secondary sources included white papers, research opinions and strategy documents..

With any decision to migrate from OpenVMS to another platform, it is necessary to ensure that the associated level of processes, security, reliability, manageability and scalability exists. It is also important to promote an “open” computing environment that will allow various platforms (NT, 2000, UNIX, etc.) to share technology. The adoption of “open” technology will ensure any solution/application selected will address business needs and determine the technology platform. This is important to ensure solutions are business driven and not technology driven.

The Windows/Intel Platform is the other major application environment at Newfoundland Power. Driven by office productivity tools, email and smaller applications this platform already plays an important role in the delivery of IT services and solutions. Currently, the growth of the WinTel environment is based on a single server–single application or multiple server–single application model. The results have been an increase in the physical number of servers and associated cost, labour, maintenance and monitoring required.

2.2 SCOPE

The scope of the Project was limited to Newfoundland Power's OpenVMS infrastructure located at the Kenmount Road and Pippy Place offices in St. John's, Newfoundland.

In order to complete the investigation, a number of specific areas of investigation were undertaken. The scope of investigation included the following:

- Reviewing Newfoundland Power's current position on migrating away from OpenVMS;
- Reviewing the current OpenVMS infrastructure including core business applications and supporting infrastructure;
- Reviewing pertinent business application options with respect to OpenVMS, including identifying application manufacturer's preferred platform, configuration, and supporting infrastructure (email, Database Management System (DBMS), Storage);
- Reviewing alternative platform options (Operating Systems & Hardware) with respect to OpenVMS, including a comparative review of Newfoundland Power's preferred solution;
- Reviewing project summaries of active or planned projects that are deemed by Newfoundland Power to have an impact or be impacted by a migration away from OpenVMS;
- Reviewing primary business drivers that influence business application directions;
- Reviewing supportability of the OpenVMS platform including such key points as skill set, availability and installation base; and,
- Creating a high-level infrastructure architecture to replace the current OpenVMS based infrastructure.

2.3 ASSUMPTIONS

In order to ensure the Project was completed in the time allowed, **xwave** made some key assumptions, which were:

- Newfoundland Power was earnest in considering a migration away from OpenVMS as part of their IT strategy.
- The required resources would be made available on the mutually agreed upon times.
- Infrastructure diagrams (in electronic format) would be made available to **xwave** prior to commencement of the engagement.
- All existing planning documentation (Return on Investment / Total Cost of Ownership Studies, Strategic Plans, and Road Maps) would be made available to **xwave** prior to commencement of the engagement.
- A system inventory of the pertinent systems existed and an electronic copy would be made available to **xwave**.

3.0 RESEARCH ACTIVITIES

3.1 PRIMARY AND SECONDARY SOURCES

In order to facilitate the successful completion of this research project, a series of meetings and interviews were held which consisted of a combination of primary and secondary sources.

Primary sources were a series of technical interviews and questionnaires. Secondary sources consisted of the collection of technical white papers, research opinions, strategy documents and technology roadmaps.

xwave gathered information from four opinion groups while conducting the research. These included:

- Newfoundland Power
- **xwave**
- Vendors
- Industry Consultants

3.2 NEWFOUNDLAND POWER

A technical questionnaire was developed and provided to Newfoundland Power. The questionnaire focused on the OpenVMS computing environment at Newfoundland Power. The questions involved:

- OpenVMS server configurations
- Age of the servers
- Business functions and applications on each server
- Software located on each servers
- Server locations
- Resourcing required to support the OpenVMS environment
- Vendor support agreements
- Levels of availability expected by the user community
- External interfaces
- The user community
- Hardware and software licensing

The questionnaire and the responses can be found in Appendix A.

Keith Lefeuvre, an Infrastructure Analyst, was assigned to complete the questionnaire. Once completed, the questionnaire was returned to **xwave** for investigation. The responses to the initial questionnaire generated a number of follow-up and clarification questions.

The completed questionnaire was input to an interview session between **xwave** and Mr. Lefeuvre. The aim of the interview was to obtain a better understanding of the role of the OpenVMS technology in Newfoundland Power. While acting as a clarification session for the questionnaire, the interview also produced information on the processes surrounding the OpenVMS servers. These processes include:

- File and system backup
- Batch processing
- Change management
- Disaster recovery

In addition to the questionnaire and the technical interview, there were a series of correspondences between **xwave** and Mr. Lefeuvre. These correspondences also provided valuable information on the OpenVMS environment at Newfoundland Power.

Mr. Lefeuvre also provided the document *Obsolescence and the OpenVMS Operating System: An Emerging Technology Issue at Newfoundland Power,* dated August 2001. The document discussed the implications associated with remaining on, and migrating away from, the OpenVMS environment.

3.3 XWAVE

Interviews were held with people in various departments within **xwave**. These included:

- Sales teams
- Resource coordinators
- Technology consultants
- Server support resources
- Trainers
- Recruiters

The focus of these interviews was to gain an appreciation of the demand for OpenVMS from clients and within the IT industry. **xwave** has over 2590 employees in centres across North America and in Europe. In addition to the interviews, **xwave** has developed a repository of technical information, technology roadmaps, and best practices.

This extensive knowledge base enabled **xwave** to provide valuable insight into the demands and the trends within the Information Technology industry.

3.4 VENDORS

Interviews were held with key software vendors that were identified as those vendors whose products directly affected the OpenVMS environment at Newfoundland Power. The interviews centred on the level at which they considered OpenVMS to be a strategic platform. The vendors also provided technology roadmaps for their products, detailing the relationship of their software to OpenVMS.

Vendors were categorized as either application providers or software toolset vendors. An example of an application provider would be Microsoft (Great Plains). Oracle Corporation would be considered a toolset vendor.

3.5 INDUSTRY

An important indicator of the prevalence of OpenVMS can be obtained by gathering information from various industries. **xwave** has customers in most major industries. **xwave** used the relationship it has with these customers to gather information on the prevalence of OpenVMS within these organizations and whether or not OpenVMS is part of their strategic IT plans.

Through a series of customer and account manager interviews, **xwave** was able to develop some insight into our clients' views on OpenVMS.

4.0 RESEARCH FINDINGS

This section presents the findings of the primary and secondary research completed by **xwave**. Detailed findings are outlined in Sections 4.2 through 4.9 and supporting appendices. Section 4.1 presents a summary of research findings.

4.1 SUMMARY OF RESEARCH FINDINGS

OpenVMS Environment

- Various generations of OpenVMS have been available since 1977.
- There are over 30 OpenVMS customers in Atlantic Canada.

OpenVMS at Newfoundland Power

- Newfoundland Power has six OpenVMS servers ranging in age from three years to seven. The AlphaServer 4100 server line has been discontinued and spare parts have to be purchased from third party vendors.
- One Full Time Equivalent (FTE) is required to support the six OpenVMS servers compared to two FTEs to support the Intel environment consisting of 57 Compaq servers. While it is not always appropriate to assume a one-to-one relationship between OpenVMS and Windows server support, total server support effort would likely be reduced by migrating from OpenVMS to Windows or UNIX.
- Newfoundland Power's current plan is to replace all the applications on the OpenVMS servers except CSS by December 2003.
- The OpenVMS platforms provide a highly stable, reliable and available environment for the applications residing on them. However, they require a significant level of manual care and intervention that adds to the resource requirements for the servers.

OpenVMS Roadmaps

- Hewlett Packard has stated that OpenVMS will be sold on the AlphaServer technology until at least 2006, and will be supported on this platform until at least 2011.
- The AlphaServer will be marketed at least until 2006 and supported for an additional 5 years.
- Hewlett Packard will release a production version of OpenVMS on the Itanium technology around 2004-2005.

OpenVMS Revenues and Shipments

- By 2006, revenues from new sales of OpenVMS are expected to decline to $36 Million from $806 Million in 1998. During the same period Windows NT/2000 will rise to $16.3 Billion from $6.9 Billion and Solaris to $9.9 Billion from $4.9 Billion.
- OpenVMS shipments are projected to decrease from 19,000 units in 1998 to a projected 1,100 units in 2006. In contrast, during the same period Windows NT/2000 (and its successors) are expected to increase from 1,350,000 units to 3,364,000 units and Solaris from 142,000 to 470,000.
- By 2006, OpenVMS will account for less that 2.5% of Itanium sales.

Industry Consultants

- In March 2002, prior to the Hewlett Packard/Compaq merger, the Gartner Group allocated a "strong negative" rating to the OpenVMS operating system. However, the merger affirmed Compaq's commitment to porting OpenVMS to Itanium by 2004 and as a result, Gartner revised its overall rating to "caution". The negative rating still applies to any new business solutions.
- Giga presents a more optimistic view of the future of OpenVMS. The potential immense backlash from existing OpenVMS customers may be enough for Hewlett Packard not to discontinue marketing and supporting the operating system.
- While researching the prevalence on OpenVMS, IT trade journals were investigated. Few articles focused on OpenVMS except those in OpenVMS journals. Unlike Windows and UNIX, there is a lack of coverage and hype/excitement about OpenVMS.

Independent Software Vendors (ISVs)

- Despite the commitment from Oracle to continue deploying its products on OpenVMS, Oracle has relegated the OpenVMS operating system to a Tier 2 status platform for its database. As a result, OpenVMS customers can expect to have to wait longer than other customers to receive updates and software fixes.
- Cognos has declared that OpenVMS is a Tier 1 operating system for Powerhouse.
- Despite the 100 ISVs proclaiming support for OpenVMS on Itanium, ISVs may not follow Hewlett Packard's lead and instead opt to concentrate on developing their applications on more Open-Standards based operating systems or on OS's with a higher percentage of market share.
- The prime mission critical application currently located on the OpenVMS servers at Newfoundland Power is the Customer Support Service (CSS) application. Through interviews and documentation, **xwave** found that major CSS and CIS providers were supporting Windows NT/2000 and UNIX platforms as application servers.

xwave Internal Research

- An investigation of **xwave** sales activity within Atlantic Canada has shown that in August 2002, xwave received a request to provide four OpenVMS workstations/servers for a local customer. These computers will be deployed in South America as part of a niche offshore oil application. Prior to this order, the last OpenVMS server sales occurred in January 2001. In contrast, the Sales teams within Atlantic Canada alone have sold hundreds of Intel and UNIX based solutions in the last 18 months.
- **xwave**'s clients often require the services of our IT professionals in order to build or support IT solutions, and to provide consulting services. Throughout 2001 and up to the first half of 2002 there were 154 Windows NT/2000 resource requests issued to the Resource Coordination group. This number contrasts sharply with the two requests issued for OpenVMS resources.
- Every year **xwave** receives thousands of resumes from IT professionals. Of the 3000 resumes online, only seven indicated that they had any OpenVMS (or VMS) experience. This is in sharp contrast to the nearly 2200 claiming to have some Windows NT experience.

- Most of the customers who had OpenVMS applications have had them in place for at least 5 – 10 years. Many of these systems were upgrades from older VAX/VMS applications. Customers who were looking to replace the applications on the OpenVMS based servers were considering migrating to other operating systems such Windows 2000, HP-UX, or Solaris if the newer applications were available on these platforms. While most customers were pleased with the level of availability and reliability of their OpenVMS systems, OpenVMS was not seen as a strategic operating system for deploying new mission critical applications.

Education/Training Centres

- Education centres and training companies offer a wide array of training courses for companies. The most popular, or "hot", courses reflect what skills are in demand in the IT industry. Currently, the hottest courses are in the Windows, Database, and UNIX categories. Many learning centres are not offering OpenVMS curriculum.

The following sections provide more detail to the findings summarized above.

4.2 OPENVMS ENVIRONMENT

4.2.1 OpenVMS

OpenVMS, originally called VMS (Virtual Memory System), was first conceived in 1976 as a new operating system for the then-new, 32-bit, virtual memory line of computers, eventually named VAX (Virtual Address eXtension).

The first VAX model, the 11/780, was code-named ‘‘Star’’, hence the code name for the VMS operating system, ‘‘Starlet’’, a name that remains to this day the name for the system library files (STARLET.OLB, etc.).

VMS version X0.5 was the first released to customers, in support of the hardware beta test of the VAX-11/780, in 1977. VAX/VMS Version V1.0 shipped in 1978, along with the first revenue-ship 11/780s.

OpenVMS was designed entirely within Hewlett Packard and specifically within the former Digital Equipment Corporation (DIGITAL). Two of the principal designers were Dave Cutler (the Architect of Microsoft's Windows NT) and Dick Hustvedt, though with a wide variety of other contributors. OpenVMS was conceived as a 32-bit, virtual memory successor to the RSX-11M operating system for the PDP-11. Many of the original designers and programmers of OpenVMS had worked previously on RSX-11M, and many concepts from RSX-11M were carried over to OpenVMS.

OpenVMS VAX is a 32-bit, multitasking, multiprocessing virtual memory operating system. Current implementations run on VAX systems from Hewlett Packard and other vendors.

OpenVMS Alpha is a 64-bit multitasking, multiprocessing virtual memory operating system. Current implementations run on Alpha systems from Hewlett Packard, and other vendors.

Work to port OpenVMS to systems based on the Intel IA-64 architecture and specifically to the Itanium Processor Family is presently underway.

Itanium is Intel's newest microprocessor based on 64-bit architecture. The 64-bit design provides access to very large memory, in effect allowing a 64-bit application to access memory in excess of 4 gigabytes in size. With databases becoming larger and having a more important role in applications, many of software and hardware vendors are in the process of developing systems and applications for the Itanium.

Hewlett Packard states that the OpenVMS operating system is deployed on over 400,000 servers today, although industry analysts believe that this number may be comprised of the following types of systems:

1. Online production and development OpenVMS systems;
2. Older VAX/VMS systems;
3. Offline, or not in use, OpenVMS systems.

Although unwilling to provide exact numbers or names of customers in Atlantic Canada, Hewlett Packard has stated that they have over 30 OpenVMS customers in the region. These customers include private companies, government departments, post secondary institutions, and utility companies.

In April 2002, Hewlett Packard and Compaq announced that the two companies have merged into a single organization. As a result, there were impacts on technologies that had been previously marketed by the individual companies. Products such as the AlphaServer line and OpenVMS from Compaq and Itanium development by Hewlett Packard are within the scope of this investigation. Other products such as the UNIX operating systems – Hewlett Packard's HP-UX and Compaq's Tru64, fall outside the scope of this research. However, it is important to note that the current plan for Tru64 is to migrate its functionality into future releases of HP-UX, eventually discontinuing the Tru64 operating system in favour of HP-UX. This action impacts Newfoundland Power because the software that runs its SCADA network is based upon Tru64. Newfoundland Power will have to consider the migration of its SCADA software prior to the removal of Tru64 from Hewlett Packard's product line.

4.2.2 Current OpenVMS Environment at Newfoundland Power

The current OpenVMS environment at Newfoundland Power consists of six Compaq AlphaServers. The tables below detail the server configurations as well as the applications and software located on the servers.

Server	Compaq Model	CPU (MHz)	Memory (GB)	Disk Storage (GB)	Purchase Date
DRACO	AlphaServer 4100	2 X 533	6	226	1998
PROD1	AlphaServer 4100	2 X 466	2	110	1998
ORION	AlphaServer 4100	2 X 300	1	125	1997
CORVUS	AlphaServer 4100	2 X 533	4	226	1998
VOLANS	AlphaServer 4100	2 X 466	2	110	1999
CYGNUS	AlphaServer 2100	2 X 250	1.28	130	1995

Table 1 – OpenVMS Servers at Newfoundland Power

OpenVMS Applications at Newfoundland Power	
Server	Application
DRACO	Customer Support System (CSS) Problem Call Logging System (PCLS/Interruptions) Joint Use System (JUS) Street Light Management System (SLMS) MES
PROD1	Spill Reporting System (SRS) SWITCH FASBE HRIS PES TLIS
ORION	Development for all applications on DRACO and PROD1
CORVUS	Disaster Recovery for DRACO
VOLANS	Disaster Recovery for PROD1
CYGNUS	Disaster Recovery for ORION

Table 2 – OpenVMS Applications at Newfoundland Power

OpenVMS Software at Newfoundland Power						
Software	DRACO	PROD1	ORION	CORVUS	VOLANS	CYGNUS
COBOL Developer			X			X
Cobol Runtime	X	X	X	X	X	X
BASIC Developer			X			X
BASIC Runtime	X	X	X	X	X	X
FORTRAN Developer			X			X
FORTRAN Runtime	X	X	X	X	X	X
Oracle Enterprise	X	X	X	X	X	X
DECnet	X	X	X	X	X	X
DECEvent	X	X	X	X	X	X
DECForms Developer			X			X
DECForms Runtime	X			X		
DECWindows	X	X	X	X	X	X
AdviseIT	X	X	X	X	X	X
TCPWare	X	X	X	X	X	X
PVCS			X			X
Cognos Powerhouse	X	X	X	X	X	X
Wordperfect	X			X		

Table 3 – OpenVMS Software at Newfoundland Power

The Customer Support System is the most mission critical application in the OpenVMS environment at Newfoundland Power. The application must be available between 8 AM and 8 PM Monday to Friday for the front line CSS users.

There is a maximum outage of .5 hour allowed during the prime shift except in rare emergencies. Scheduled outages can be longer on the weekends. Environmental considerations such as inclement weather or problems with the electrical grid will impact planned outages.

DRACO and PROD1 are production servers. ORION houses the development efforts for the applications on DRACO and PROD1 and is also considered a production environment in the sense that a failure in ORION results in developers becoming unable to work.

The three remaining servers – CORVUS, VOLANS, and CYGNUS are disaster recovery servers for the three production servers. In the event of a failure in one of the production servers, the nightly backup from the previous night is used to recover the applications onto the corresponding disaster recovery server.

The servers are backed up using a DLT tape drive and the tapes are taken off site to the server's disaster recovery site. Full backups are performed once per week and incremental backup on the other four days. Backups are coordinated and initiated by the Computer Room operators.

Due to the high level of availability required for the production servers, they have 24 X 7 hardware and software maintenance agreements with the vendors. These agreements include a 2-hour callback for problem determination and a 4-hour delivery of replacement parts.

The disaster recovery servers have 9 X 5 hardware and software maintenance agreements.

Hewlett Packard OpenView and in-house developed scripts are used to alert support staff of problems with the servers.

DRACO, PROD1, ORION, and CYGNUS are located at the Kenmount Road datacentre. CORVUS and VOLANS are at Duffy Place.

One Full Time Equivalent (FTE) is required to support the six OpenVMS servers. This role is divided between two resources, Keith Lefeuvre and Sean Kearley. As a comparison of the effort to maintain this environment, the Intel environment at Newfoundland Power consists of 57 Compaq servers. Support for this infrastructure requires two FTEs. It is important to note that it is not always appropriate to assume a one-to-one relationship between OpenVMS and Windows server support. A single OpenVMS server may be able to accommodate a number of applications, as is the case with the Newfoundland Power servers, while the same applications ported to a Windows environment may require multiple servers. However, the magnitude of the difference between the support requirements for the OpenVMS and the Windows environments is large enough that overall support requirements can be reduced by migrating the OpenVMS applications to the Windows or UNIX environments.

The OpenVMS platforms provide a highly stable, reliable and available environment for the applications residing on them. However, they require a significant level of manual care and intervention. Batch job processing at night is a manual process in which the computer room operator releases each batch job, reviews the output for errors, and makes the decision whether to continue with the successive job.

Newfoundland Power's current plan is to replace all the applications on the OpenVMS servers except CSS within the next 18 months. FASBE and HRIS will be replaced by June 2003 and the remaining eight applications by December 2003.

Newfoundland Power has been considering a migration away from the OpenVMS environment. In August 2001, a white paper entitled *Obsolescence and the OpenVMS Operating System: An Emerging Technology Issue at Newfoundland Power* was created. The document discussed the advantages and disadvantages of migrating away from OpenVMS. While not explicitly stating that Newfoundland Power is abandoning the operating system, the following excerpt reveals Newfoundland Power's concern with the future of OpenVMS:

"Independent software vendor support for the OpenVMS operating system is in decline. Newfoundland Power has experienced several examples of the impact of this issue, and is responding accordingly. The Company anticipates this issue will continue to emerge in the near term and has initiated plans to mitigate the risks, thereby minimizing any negative impact on customer service and operating efficiencies.

Moving forward, Newfoundland Power will continue to monitor IT industry developments, especially with respect to OpenVMS, and adjust its plans accordingly."

Obsolescence and the OpenVMS Operating System:
An Emerging Technology Issue at Newfoundland Power
August 2001, Newfoundland Power

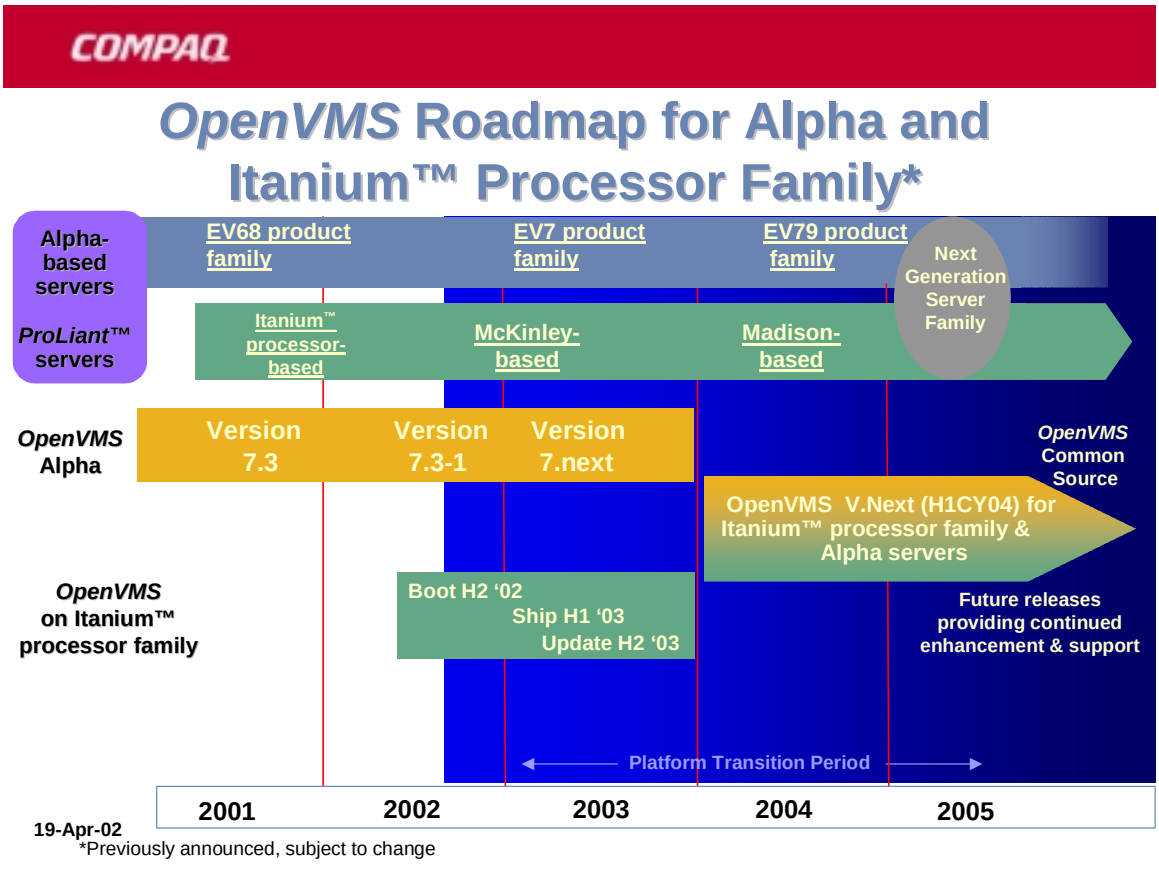
4.3 OPENVMS ROADMAPS

The roadmaps for OpenVMS over the next 4 years follow both the AlphaServer and the Itanium processors.

4.3.1 AlphaServer and Itanium Roadmap

Hewlett Packard plans to continue to release new processor functionality on the upcoming EV7 and EV79-based AlphaServer systems, and intends to sell the AlphaServer line until at least 2006, with support through to at least 2011. Hewlett Packard already has Itanium based servers available and will develop new generations of the Itanium chip in the future.

The diagram below details the AlphaServer and the Itanium Roadmap. Following the Hewlett Packard – Compaq merger, Hewlett Packard publicly stated that the current roadmaps for AlphaServer and Itanium are still valid, it has reserved the right to subject the roadmaps to change.



Courtesy of Hewlett Packard

Table 4 – Alpha and Itanium Roadmap

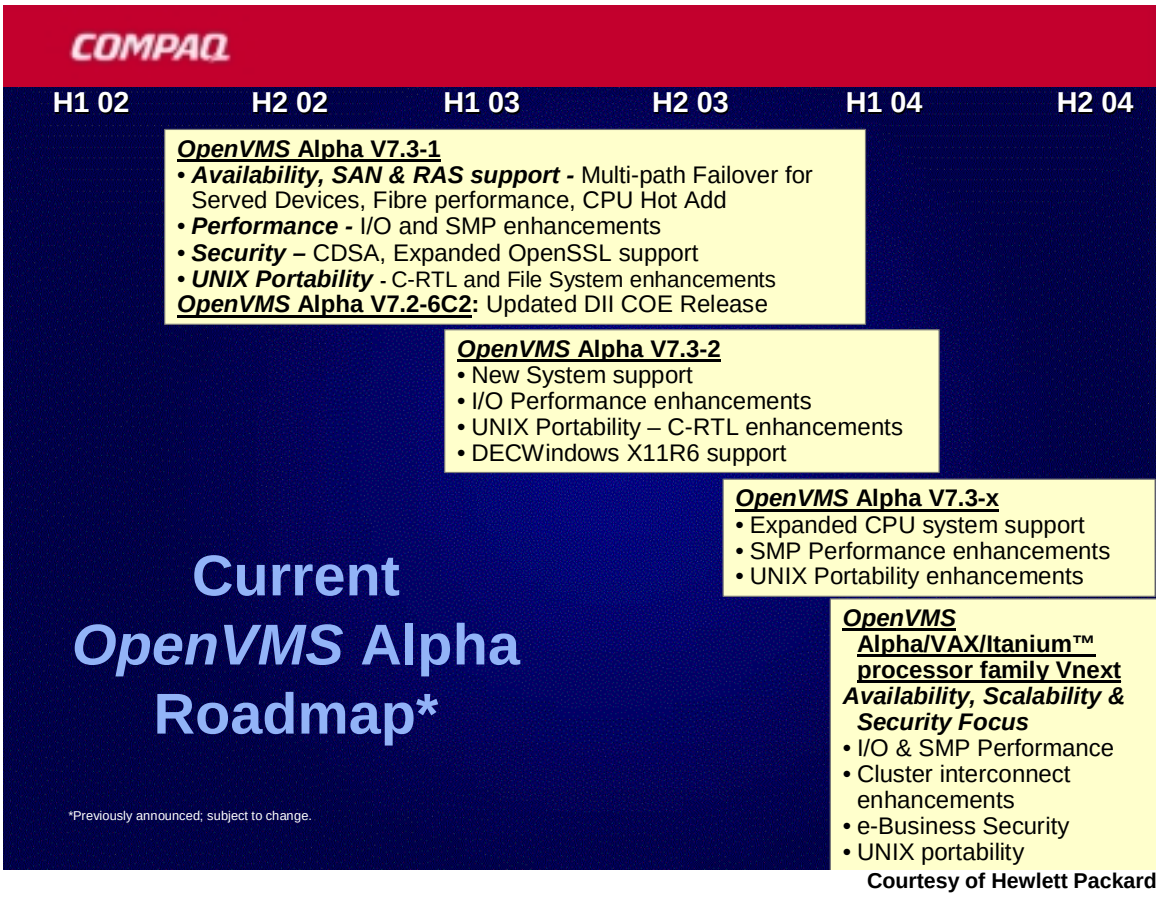
4.3.2 OpenVMS on Alpha Roadmap

Hewlett Packard also plans to continue to release new OpenVMS functionality on the upcoming EV7 and EV79-based AlphaServer systems. Sales of OpenVMS on the AlphaServer will continue until at least 2006, with support through to at least 2011. The table below indicates the versions of OpenVMS that will be supported on each generation of the AlphaServer processor.

AlphaServer Generation	Release Date	OpenVMS Version Supported
EV68	Available	7.3
EV 7	2003	7.3-1
EV79	2004	7.X

Table 5 – OpenVMS Versions on Alpha

The OpenVMS systems at Newfoundland Power are currently at version 7.2-1. The diagram below details the current OpenVMS Roadmap for AlphaServer.



Courtesy of Hewlett Packard

Table 6 – OpenVMS on Alpha Roadmap

4.3.3 OpenVMS on Itanium Roadmap

On June 25 2001, Compaq announced that its OpenVMS operating system would be ported to Itanium architecture. Development would start in 2002 with a full release of the operating system in 2004.

The porting would be a gradual process, with multiple releases during the 2.5-year schedule. Each succeeding release would provide more functionality until a “Production Quality” release became available to customers in 2004.

After the Hewlett Packard/Compaq merger, Hewlett Packard reaffirmed the previously announced roadmap for OpenVMS on Itanium.

The diagram below details the rollout schedule for the various components of OpenVMS on Itanium.

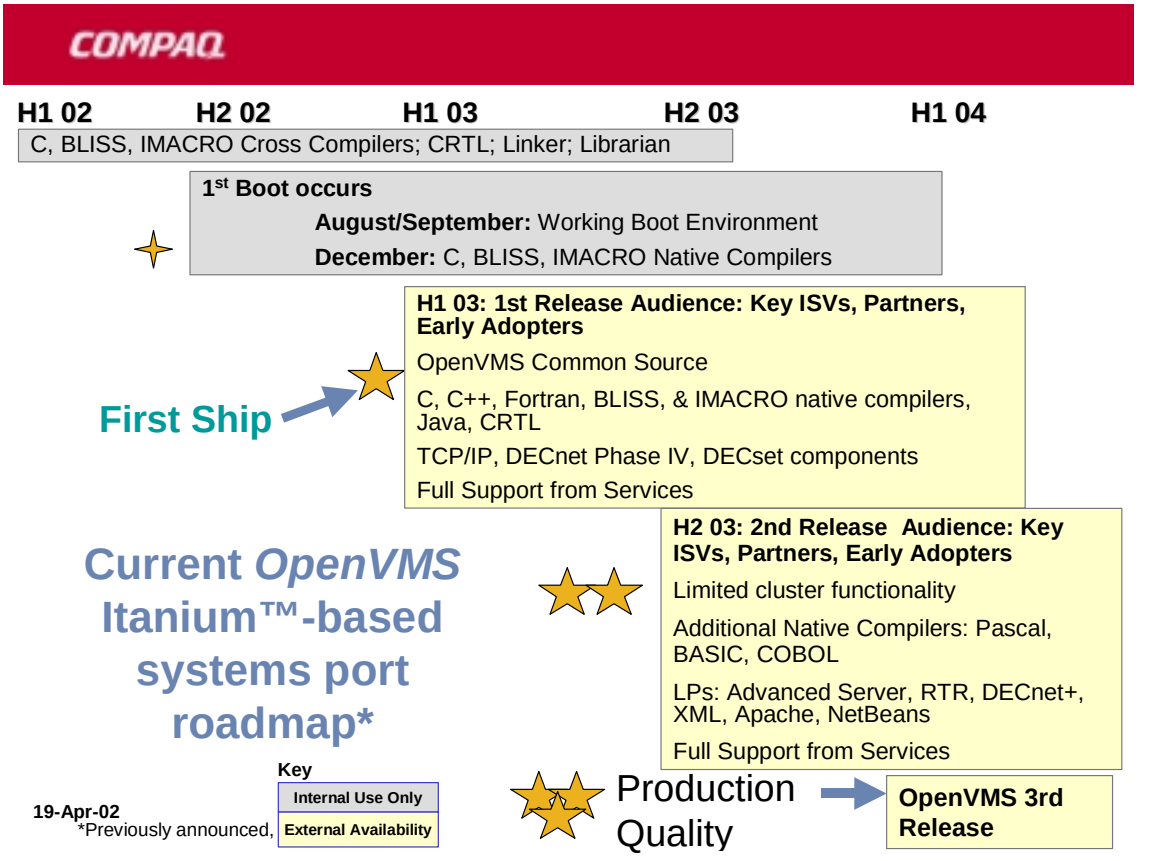


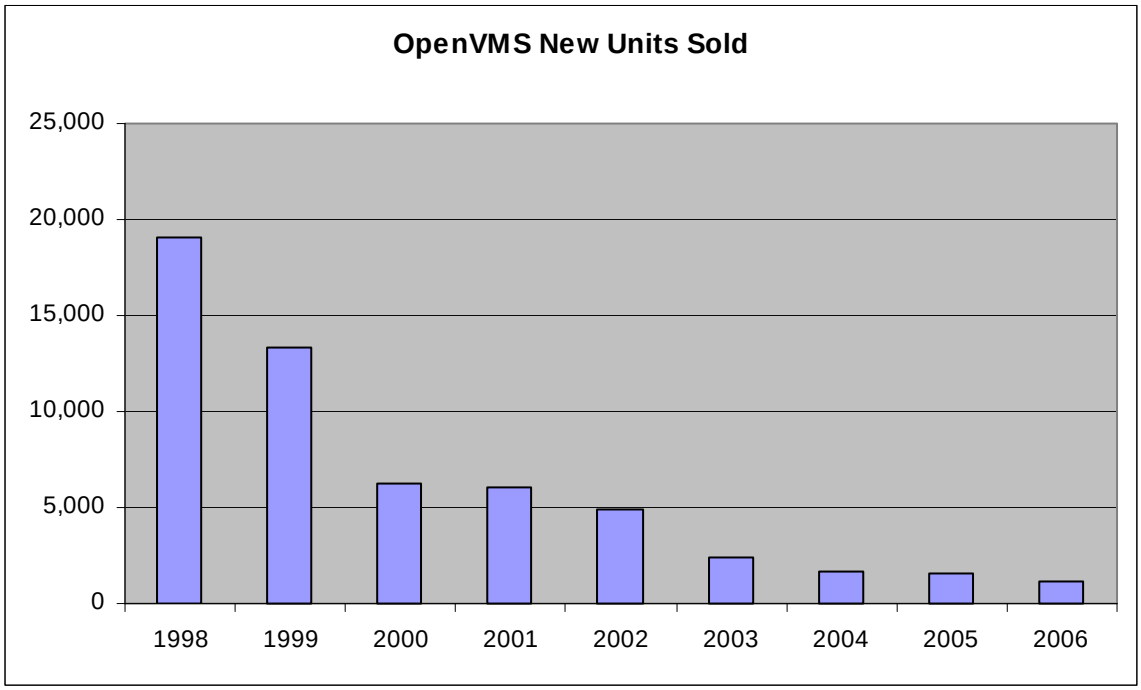
Table 7 – OpenVMS on Itanium Roadmap

Hewlett Packard indicates that there is excitement among its ISVs over the porting of OpenVMS to the Itanium Processor family platform. Testimonials from more than 100 partners indicating their intent to continue to support OpenVMS can be found on the Hewlett Packard website.

4.4 OPENVMS REVENUES AND SHIPMENTS

OpenVMS has seen a decline in the numbers of units shipped as well as the revenue for new units sold. Industry analysts predict that this trend will continue, reducing OpenVMS's share of the marketplace for midrange operating systems.

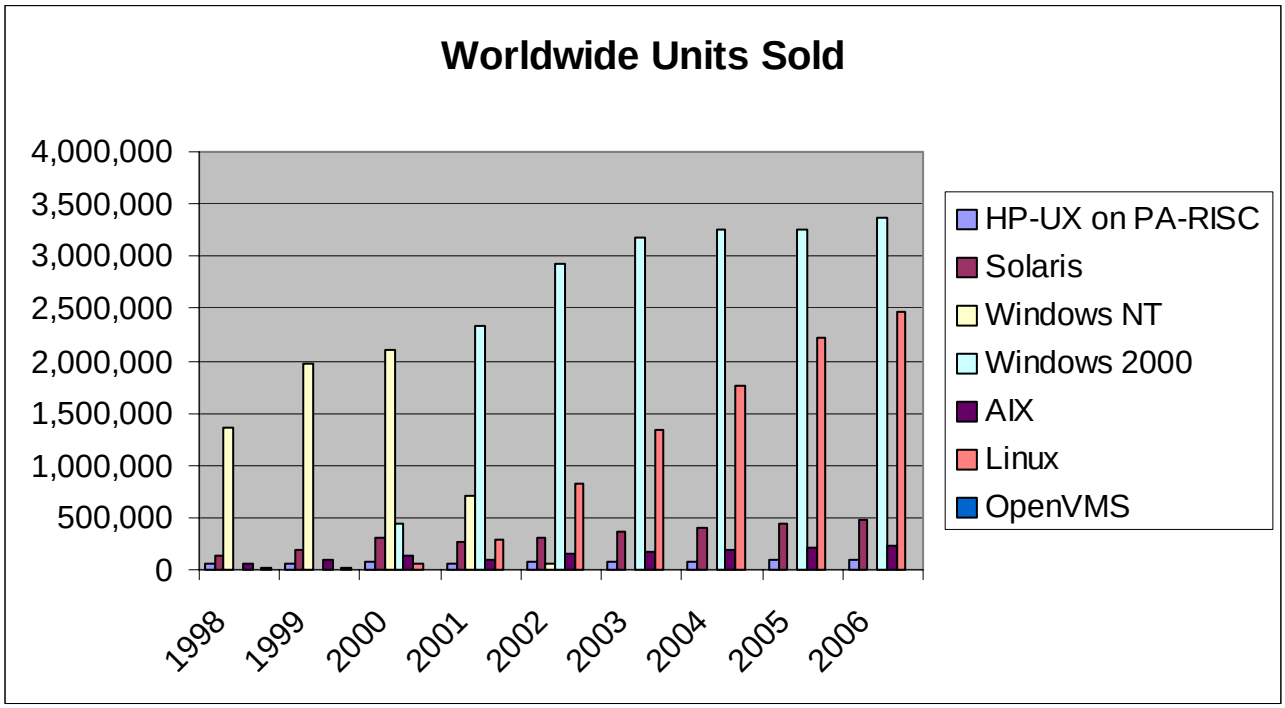
The chart below details the number of OpenVMS operating systems shipped since 1998 and makes projections out to 2006.



Courtesy of Gartner/Sun Microsystems

Table 8 – OpenVMS Units Sold from 1998 - 2006

OpenVMS is expected to go from 19,000 units shipped in 1998 down to 1,100 units in 2006. OpenVMS's diminishing impact on the marketplace for operating systems is underscored when the number of OpenVMS units shipped is compared to other operating systems. The chart below shows the number of midrange and Windows operating systems shipped since 1998 and makes projections out to 2006.



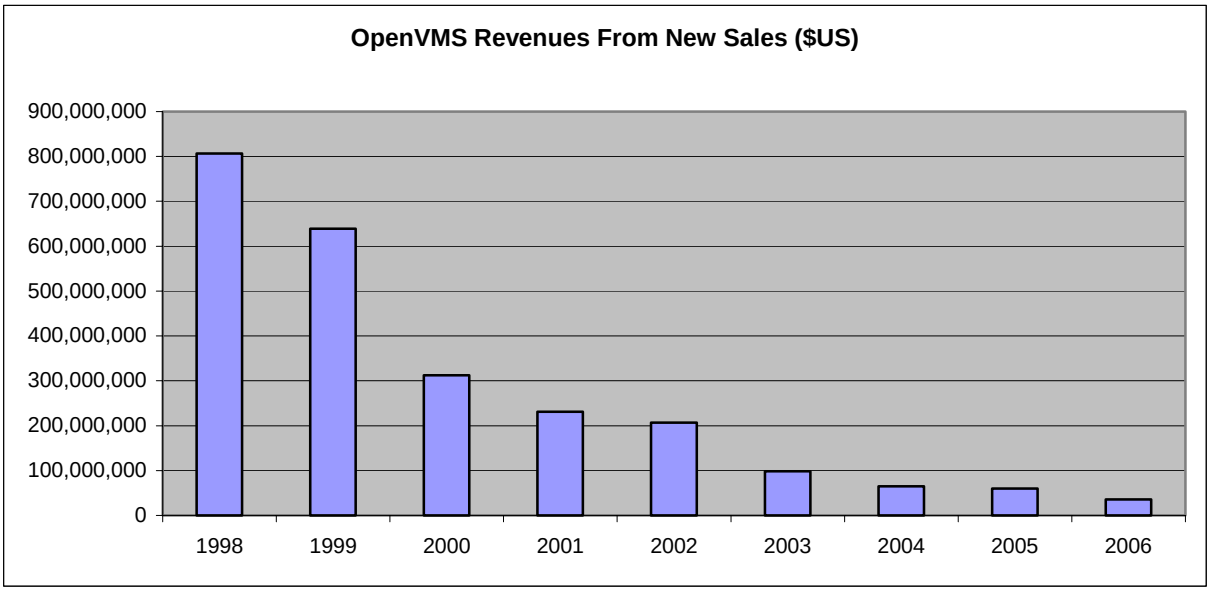
Courtesy of Gartner/SunMicrosystems

Table 9 – Worldwide Sales of Operating Systems from 1998 - 2006

Windows 2000 (and its successors) and Linux will become the primary operating systems sold. Revenues from sales of new OpenVMS operating systems sold will also decline from 1998 to 2006. The values for the table above are presented below.

Worldwide Units Sold									
	1998	1999	2000	2001	2002	2003	2004	2005	2006
HP-UX	60901	59903	71688	60368	70412	71473	79101	87827	102120
Solaris	142101	185278	302669	269362	314297	360446	400152	433564	469765
Windows NT	1349998	1967625	2103545	706758	56618	0	0	0	0
Windows 2000	0	0	440040	2326538	2933265	3180907	3259185	3261783	3363964
AIX	62866	92547	126619	96636	149386	173465	196967	213413	228956
Linux	0	1738	56855	284718	827499	1346337	1766165	2221630	2470505
OpenVMS	19103	13370	6245	6013	4864	2365	1718	1581	1135

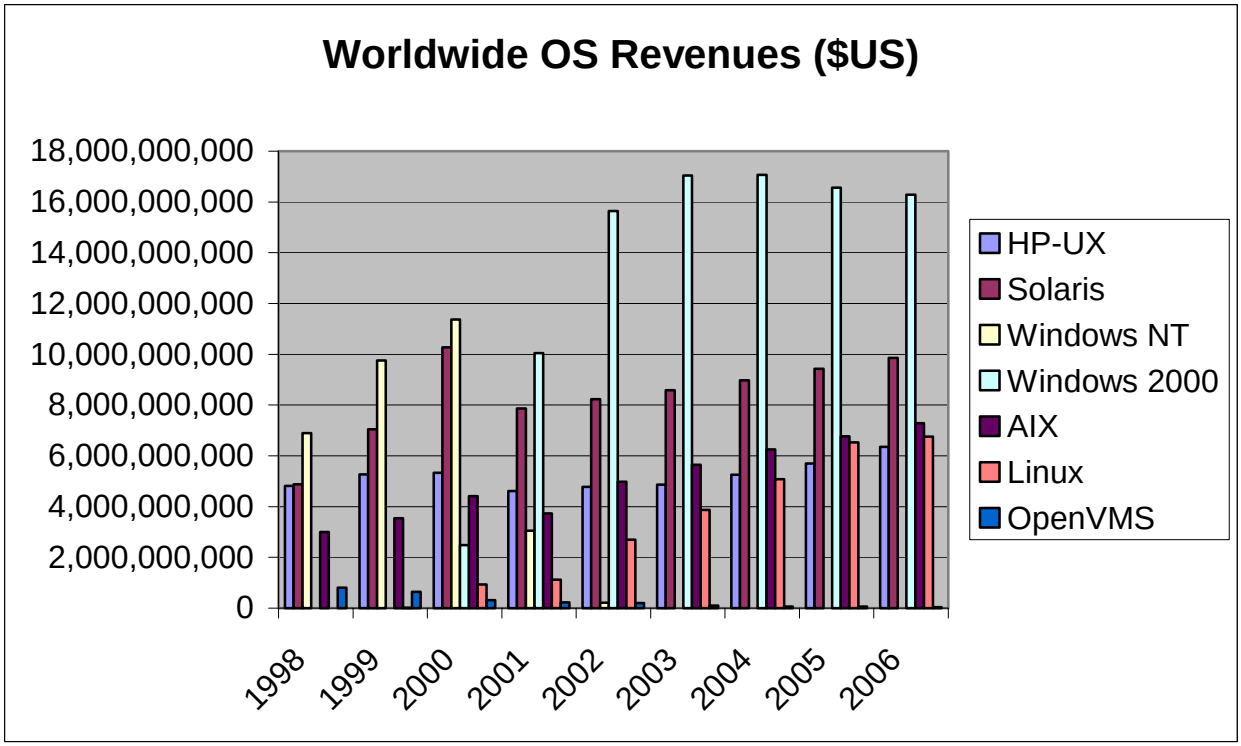
Courtesy of Gartner/SunMicrosystems



Courtesy of Gartner/Sun Microsystems

Table 10 – OpenVMS Revenues on New Sales from 1998 - 2006

In terms of revenues from the sale of operating systems, Windows 2000 (and its successors) and Linux will again lead the industry.



Courtesy of Gartner/Sun Microsystems

Table 11 – Worldwide Operating System Revenues on New Sales from 1998 - 2006

The values for the table above are presented below.

Worldwide OS Revenues ($US Billion)									
	1998	1999	2000	2001	2002	2003	2004	2005	2006
HP-UX	4.81	5.26	5.33	4.61	4.78	4.86	5.26	5.70	6.36
Solaris	4.88	7.05	10.27	7.87	8.24	8.59	8.98	9.43	9.86
Windows NT	6.89	9.76	11.38	3.05	0.22	0.00	0.00	0.00	0.00
Windows 2000	0.00	0.00	2.48	10.04	15.64	17.04	17.06	16.57	16.29
AIX	3.00	3.54	4.41	3.73	4.98	5.64	6.25	6.77	7.29
Linux	0.00	0.01	0.93	1.12	2.70	3.88	5.08	6.54	6.75
OpenVMS	0.81	0.64	0.31	0.23	0.21	0.10	0.06	0.06	0.04

Courtesy of Gartner/SunMicrosystems

4.5 INDUSTRY CONSULTANTS

Industry consultants offer an important opinion on the trends in the IT industry, strategic directions that companies are taking with respect to their infrastructure, and vendor plans for their product lines.

Opinions expressed by consultants on the future of OpenVMS range from negative to cautiously optimistic. There is a consensus that Hewlett Packard will honour the original roadmap for OpenVMS and continue with the plans to port the operating system to the Itanium processor. However, there is some uncertainty as to whether the independent software vendors (ISVs) and customers in general will follow suit.

4.5.1 Gartner Group (http://www.gartner.com/)

Founded in 1979, Gartner provides combines more than 20 years experience identifying and analyzing the trends and technologies that have shaped the course of business. With more than 650 analysts around the world, Gartner has one of the most comprehensive bodies of global research that reports on and analyzes the technologies that drive business and organizational success.

In March 2002, prior to the Hewlett Packard/Compaq merger, Gartner Group allocated a “strong negative” rating to the OpenVMS operating system. A number of reasons were behind this rating.

1. At the time, details around which Itanium platforms would support OpenVMS were not clear.

2. HP-UX was seen as the dominant midrange operating system for the two companies.

3. Gartner believed that one result of the merger would be an exercise in cost cutting.

4. OpenVMS was seen as having a loyal but diminishing install base.

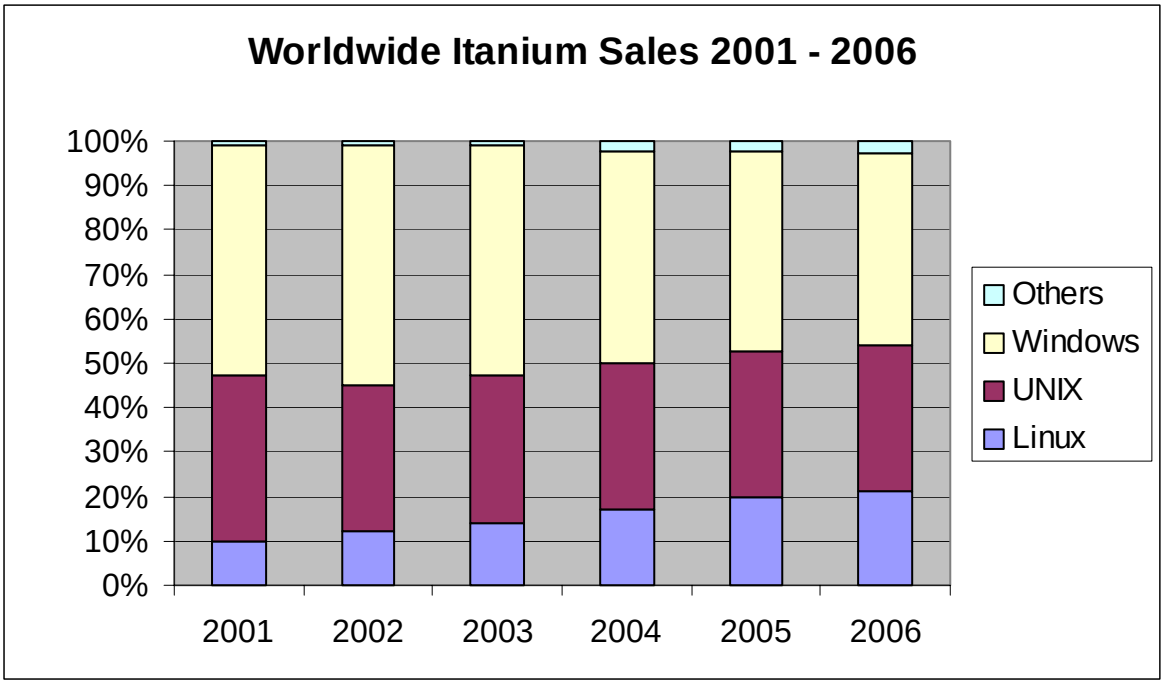
The merger affirmed Compaq’s commitment to porting OpenVMS to Itanium by 2004. As a result, Gartner revised its overall rating to “caution”. The “negative” rating still applied to any new business solutions. However, since OpenVMS has a wide base of in-house developed applications among its customers, the erosion of the ISV support was seen as not having as significant an impact as it would have if organizations were looking to buy packaged applications from ISVs.

One announcement from the merger was that components of Compaq’s UNIX version, Tru64, will be integrated into HP-UX on Itanium. Sales of Tru64 will continue until 2006. This action reiterates the view that HP-UX will become the dominant midrange operating system for Hewlett Packard.

Gartner predicts that even though Itanium will extend the life of OpenVMS, sales can expect to drop off after the Alpha processor is removed from marketing around the middle of the decade. After 2005, few new OpenVMS enhancements can be expected on either Alpha or Itanium.

Gartner also predicts that instead of porting their applications to Itanium, many existing OpenVMS customers will migrate to other platforms such as Windows or UNIX.

The table below details the projected sales of Itanium based systems from 2001 – 2006.



Courtesy of Gartner Group

Table 12 – Worldwide Itanium Sales from 2001 - 2006

In the chart above, OpenVMS sales fall into the "Others" category along with operating systems such as Netware. As shown, OpenVMS is not expected to make any appreciative impact to Itanium sales up to and including 2006. In 2006, OpenVMS will account for less that 2.5% of Itanium sales.

4.5.2 Giga (http://www.gigaweb.com)

Giga Information Group, Inc. is a global advisory firm that helps companies and institutions maximize their technology investment to deliver business results through a combination of objective research, advice and continuous technology coaching. Giga relies on experienced technology analysts who provide practical, action-oriented advice and recommendations that are based on professional experience and industry analysis.

Giga presents a more optimistic view of the future of OpenVMS. Their view is that potential immense backlash from existing OpenVMS customers may be enough for Hewlett Packard not to discontinue marketing and supporting the operating system.

Giga anticipates some customer uncertainty with many customers waiting until OpenVMS on Itanium is firmly entrenched before they consider migrating to the new processor. With an OpenVMS/Itanium general availability date around 2004-2005, migrations may not occur for up to 12 months after.

Although an early release version of OpenVMS will be created on Itanium in 2003 and made available to selected customers, Giga anticipates that a general release version will not be available for 2 years (2005).

With the merger announcements for Hewlett Packard and Compaq, customers can expect feature enhancements for at least the next three years and at a minimum a 10-plus year usable life for OpenVMS.

Despite customer uncertainty around OpenVMS, Giga categorizes those who have stated that they intend to remain on OpenVMS for the next 12 months as either:

1. OpenVMS customers who have no immediate plan to migrate but rather intend to modernize their existing legacy applications.

2. Companies who are content with the high availability and reliability of the OpenVMS environment but are not planning to deploy new OpenVMS/AlphaServer applications.

3. Companies that support the newest versions of OpenVMS and AlphaServers but in the future may migrate to either a Windows or UNIX alternative.

4.5.3 Other IT Industry Consultants

Other IT Industry consultants are not concentrating research on OpenVMS. Reference to OpenVMS is usually found in research on the Hewlett Packard/Compaq merger.

META Group

There has been little coverage of OpenVMS within the META Group research documentation in the last 12 months. The last reference to OpenVMS was in November 2001 and was part of an article on the Hewlett Packard/Compaq merger.

Forrester Research

The last reference to OpenVMS was made in an article about the Hewlett Packard/Compaq merger. The research was conducted in September 2001 and stated that with the additional service professionals, the new company may be in a better position to retain, satisfy, and upsell existing OpenVMS customers.

Aberdeen Group

The Aberdeen Group anticipates that Itanium will be successful as a technology. However, Aberdeen warns that Hewlett Packard should not attempt to port OpenVMS to Itanium. Aberdeen expects that migrating the traditionally loyal Digital and Compaq customers from OpenVMS to Itanium will be a “hard sell”. The consulting firm also feels that OpenVMS has been in a “maintenance mode” for several years with new functionality being developed simply to maintain its existing customer base.

4.5.4 Trade Journals

While conducting research, IT trade journals were investigated to determine frequency of articles concerning OpenVMS. It was found that recent references to OpenVMS tended to be made indirectly. Most articles that referenced to OpenVMS could be categorized as one of the following:

1. Articles on the Hewlett Packard/Compaq merger and the impact on each company’s line of products.

2. Articles focused other hardware or software technology in which OpenVMS is referenced as being compatible or incompatible with the technology.

There were few articles that focused on OpenVMS except in OpenVMS journals. Unlike Windows and UNIX, there is a lack of coverage and hype/excitement about OpenVMS.

4.6 INDEPENDENT SOFTWARE VENDORS

The announcement of the porting of OpenVMS to the Itanium processor has resulted in many of the existing Independent Software Vendors (ISVs) for OpenVMS proclaiming their ongoing support for OpenVMS. Two of these ISVs have particular significance to the OpenVMS environment at Newfoundland Power. These are Oracle Corporation and Cognos.

4.6.1 Oracle (http://www.oracle.com/)

Oracle has stated that it intends to continue support for the OpenVMS environment.

"Oracle and Compaq have a long and successful history of delivering enterprise solutions to our OpenVMS customers. In July 2001, Oracle released Rdb 7.1 for OpenVMS. In September 2001, Oracle9i for OpenVMS was released. Compaq has announced plans to consolidate its 64-bit servers on Itanium™ based systems. Oracle is committed to working with Compaq on its enterprise platform offerings, which includes working to deliver Oracle DBMS and Oracle Rdb DBMS on OpenVMS for Itanium™ based platforms."

Doug Kennedy, Vice President, Global Platform Partnerships, Oracle Corporation
September 2001

Despite the commitment from Oracle to continue deploying its products on OpenVMS, Oracle has relegated the OpenVMS operating system to a Tier 2 status platform for its database (Vendor Tiering is used as a designation to differentiate the best manufacturers from their competitors. Tier 1 vendors have the highest quality products, proven track records, solid support models, industry certifications like ISO-9000, and large strategic business relationships with their vendors and customers. Tier 2 vendors are often more-limited in product or technology, may be more limited in breadth of third-party service and support capabilities and typically represent a higher risk to customers than Tier 1. (Source, Gartner). The latest version of Oracle database product, Oracle 9.2 Enterprise Edition, has been released and certified on a number of operating system platforms. The table below shows the release dates for various midrange and Windows environments.

Oracle 9.2 Enterprise Edition Release and Certification				
Operating System	Availability	Certification	Release Date	Patch Release Schedule
Solaris	Y	Y	June 2002	Tier 1 release
AIX	Y	Y	June 2002	Tier 1 release
OpenVMS	N	Y	October 2002	Tier 1 release + 6 weeks
HP-UX	Y	Y	June 2002	Tier 1 release
Linux (Red Hat)	Y	Y	June 2002	Tier 1 release
Windows 2000	Y	Y	June 2002	Tier 1 release
Windows NT	Y	Y	June 2002	Tier 1 release

Table 13 - Oracle 9.2 Enterprise Edition Release and Certification

As shown in the table above, Oracle 9.2 Enterprise Edition is available on the major midrange and Windows operating systems. However, it is not scheduled to be released on OpenVMS until at least October 2002.

The table also indicates the scheduling for the release of software patches and program fixes. Once a patch has been released for the Tier 1 platforms, it will be another 6 weeks before it becomes generally available for OpenVMS customers. As a result, OpenVMS customers can expect to have to wait longer than other customers to receive software fixes. A Oracle Technical Assistance Report (TAR) confirming the Tier-2 status of OpenVMS can be found in Appendix B.

4.6.2 Cognos (http://www.cognos.com/)

Cognos is one of the largest vendors of business intelligence software. Its product line assists users in extracting data, analyzing it, and then creating reports. The company's product PowerHouse is in use on the OpenVMS servers at Newfoundland Power.

In an interview with **xwave**, Marianne Stagg from Cognos stated that Cognos supports the migration of OpenVMS to Itanium. She also said that while some Cognos clients have migrated from OpenVMS to a Windows environment, the highest number of Cognos Powerhouse customers are on HP-UX, followed by OpenVMS.

Currently, Powerhouse version 8.4 is in beta on HP-UX. An OpenVMS beta version will be tested in August with a general release date to follow in October. Cognos has declared that OpenVMS is a Tier 1 operating system for Powerhouse.

4.6.3 ISV Enthusiasm

According to the Gartner Group, ISV enthusiasm for OpenVMS is at best, not growing, and at worst, eroding. In March 2002, prior to the Hewlett Packard/Compaq merger, Gartner Group allocated a “strong negative” rating to the OpenVMS operating system. After the merger, Gartner revised its overall rating to “caution”. The “negative” rating still applied to any new business solutions. Despite the 100 ISVs proclaiming support for OpenVMS on Itanium, ISVs may not follow Hewlett Packard’s lead and instead opt to concentrate on developing their applications on more Open-Standards based operating systems or on OS’s with a higher percentage of market share. The charts below show the level of ISV enthusiasm for the various operating systems in the midrange marketplace in 1999 and again in 2001.

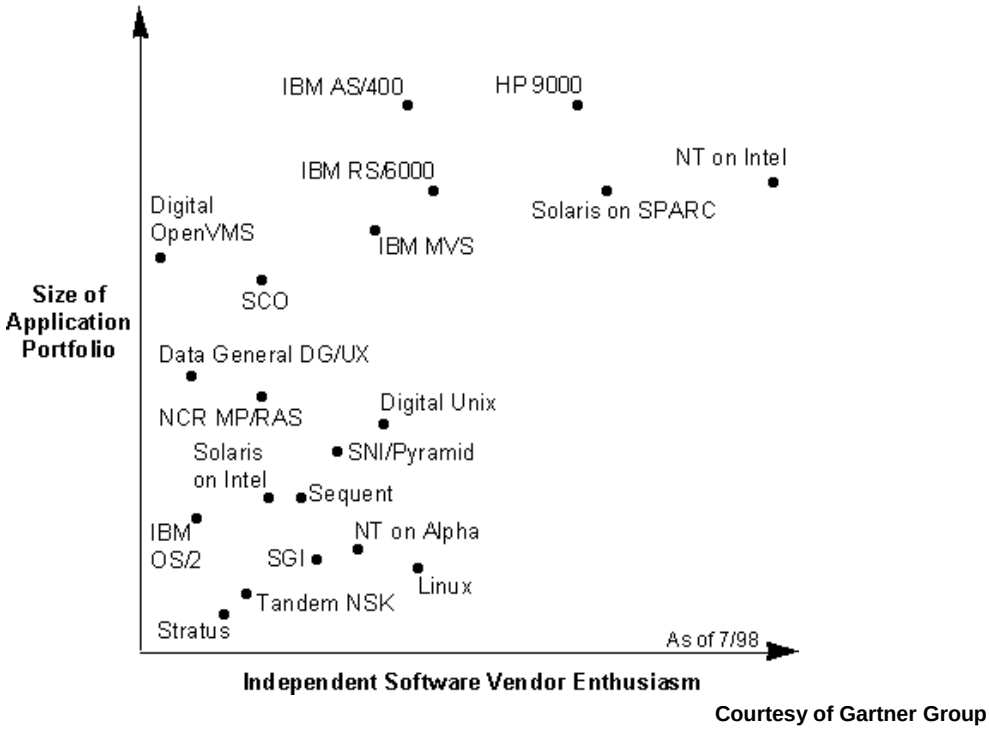


Table 14 - ISV Enthusiasm for Midrange Operating Systems 1999

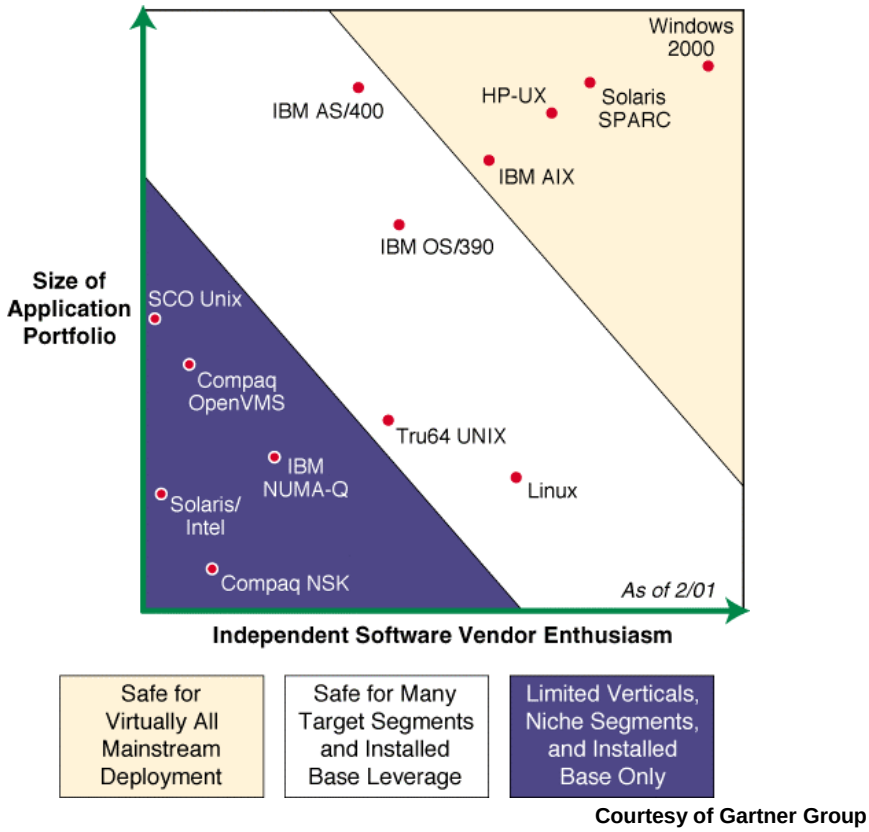


Table 15 - ISV Enthusiasm for Midrange Operating Systems 2001

The two charts indicate that the ISV enthusiasm for the UNIX and Windows operating systems is much higher than that for OpenVMS. These operating systems are viewed as more mainstream than niche OSs such as OpenVMS and IBM's NUMA-Q. As well, there has been no growth in the ISV enthusiasm for OpenVMS from 1999 to 2001. The lack of increase in ISV enthusiasm indicates that OpenVMS has stalled in its growth in numbers of new applications being developed for the operating system.

4.6.4 Application Providers

The prime mission critical application currently located on the OpenVMS servers at Newfoundland Power is the Customer Support Service (CSS) application. While there is no definite timeline for the replacement of the CSS application, eventual replacement of the custom-built application will be necessary. In keeping with the IS Department's guiding principles to "Buy instead of build" and "Buy from leading vendors", **xwave** conducted research into the leading application providers of CSS and Customer Information Service (CIS) systems.

Through interviews and documentation, **xwave** found that major CSS and CIS providers were supporting Windows NT/2000 and UNIX platforms as application servers.

The table below details some of the leading application providers and the platforms on which their products are supported.

CSS / CIS Application Providers			
Vendor	Application	Supported Application Platform	Supported Database
Great Plains		Windows NT Windows 2000	SQL Server
PeopleSoft	CIS	Windows 2000 Windows NT4 AIX 4.3 HP-UX 11 Solaris 7 Solaris 8 Tru64 UNIX 5.0A Tru64 UNIX 5.1	SQL Server DB2 Oracle Sybase Informix
SAP	SAP	Tru64 UNIX AIX HP-UX Linux Reliant UNIX Solaris Windows 2000 Windows NT OS/400 OS/390	DB2/UDB/400/390 Informix SQL Server Oracle SAP DB
Advanced Utility Systems	CIS Infinity	Windows NT	Oracle SQL Server
Peace Systems	Energy Suite	UNIX	Oracle Informix
Oracle	11i Applications	Macintosh OS (client only) Tru64 UNIX Fujitsu PRIMEPOWER HP-UX AIX Intel Based Server LINUX Windows 2000 Windows NT for Intel Solaris	Oracle
JD Edwards	One World	AIX Solaris HP-UX OS/400 Windows NT Windows 2000	DB2 Oracle SQL Server

Table 16 - CSS / CIS Application Providers

Vendors who are supporting OpenVMS tend to support the platform for the database component only. One example of a CIS application vendor whose support for OpenVMS is diminishing is PeopleSoft.

PeopleSoft

PeopleSoft's CIS application is supported on the platforms in the above table. Like other vendors, the current version of the PeopleSoft, product line, PeopleSoft 8, supports OpenVMS for the database component only.

Earlier versions of the PeopleSoft products were supported on OpenVMS for the batch and database server components, depending upon customer demand. For example, PeopleSoft versions 5, 6 provided batch server support for OpenVMS. Versions 7.0 to 7.55, however, did not support OpenVMS because of the lack of customer demand for OpenVMS based versions of the batch server software. Support for batch services was reinstated in version 7.59 but discontinued in version 8. In contrast, the Solaris operating system has been supported for all components of the PeopleSoft product line since version 1.0.

4.7 XWAVE INTERNAL RESEARCH

As part of the research into the prevalence and direction of OpenVMS, **xwave** was able to tap into a number of internal resources that could offer insight into the OpenVMS industry. These resources included:

- Sales teams
- Resource coordinators
- Technology consultants
- Server support resources
- Trainers
- Recruiters

4.7.1 Sales Teams

An investigation of **xwave** sales activity within Atlantic Canada has shown that in August 2002, xwave received a request to provide four OpenVMS workstations/servers for a local customer. These computers will be deployed in South America as part of a niche, offshore oil application. Prior to this order, the last new OpenVMS server sales occurred in January 2001. AlphaServer sales were limited to the sale of replacement parts.

In contrast, the Sales teams within Atlantic Canada alone have sold hundreds of Intel and UNIX based solutions in the last 18 months.

An important component to the Sales teams is the responding to Requests For Proposals (RFPs) put out by customers requiring IT solutions to their business requirements. **xwave**'s Sales teams in Atlantic Canada have not identified any OpenVMS opportunities or RFPs in the last year.

4.7.2 Resource Coordinators

xwave's clients often require the services of our IT professionals in order to build or support IT solutions, and to provide consulting services. As a result, there are many requests for **xwave**'s technology consultants and server support resources. These requirements are funnelled through the **xwave** Account Management who in turn direct the request to a centralized Resource Coordination group. This group tracks the requests and matches resources to the requirements.

The table below details the number of requests received by the **xwave** Resource Coordinators in 2001 – 2002.

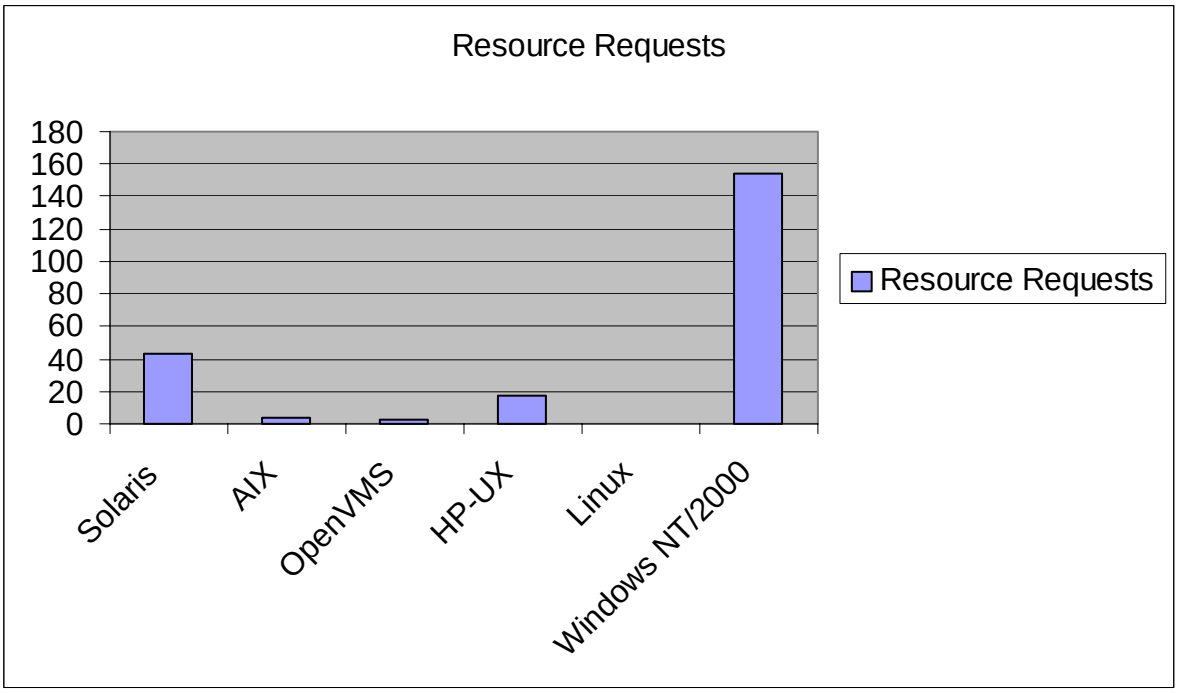


Table 17 - Resource Requests for 2001 – 2002

Throughout 2001 and up to the first half of 2002 there were 154 Windows NT/2000 resource requests issued to the Resource Coordination group. This number contrasts sharply with the two requests issued for OpenVMS resources. One of the latter requests was issued on behalf of Newfoundland Power and was for a DBA resource with OpenVMS experience. The other request was for a client in Ontario and was issued in 2001.

4.7.3 Recruiters

Every year **xwave** receives thousands of resumes from IT professionals. Since **xwave** is located throughout Canada, the United States, and Europe, the resumes represent a cross section of the IT community.

An investigation of this repository of resumes has produced information on the types of skills that are present in the IT industry. The table below details the numbers of resumes with various OpenVMS, UNIX, or Windows based skills.

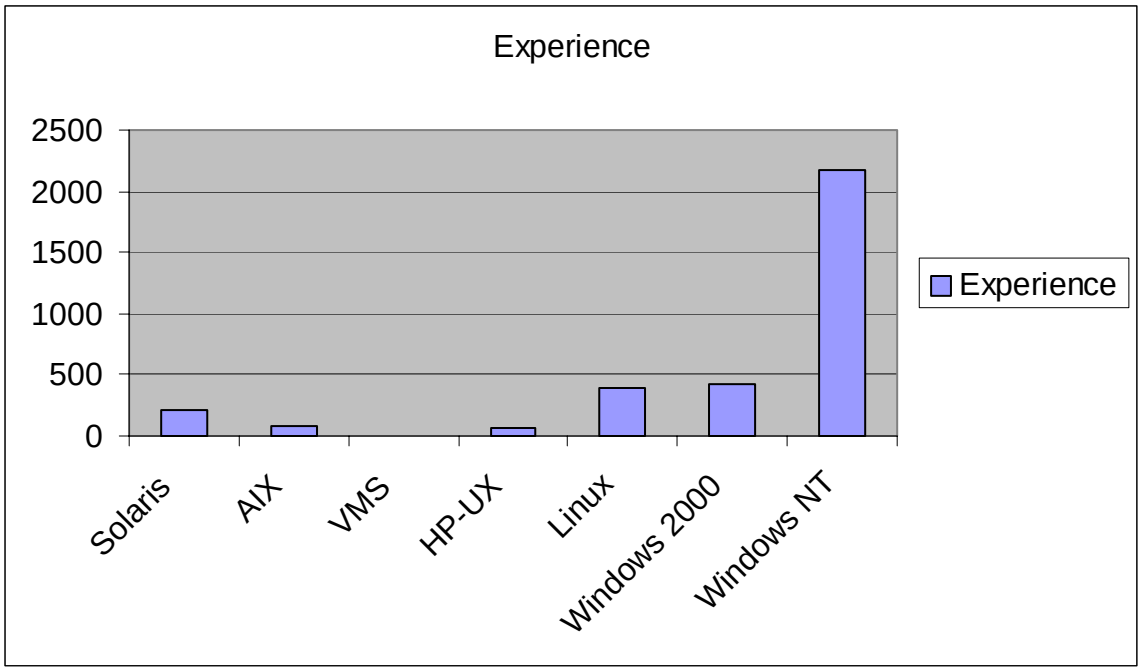


Table 18 – Operating System Experience on Resumes

Of the 3000 resumes online, only seven indicated that they had any OpenVMS (or VMS) experience. This is in sharp contrast to the nearly 2200 claiming to have some Windows NT experience.

It is estimated that approximately 60% of the resumes online at **xwave** are from people who have recently graduated from post secondary institutions. This indicates that very few graduates are entering the workforce with any OpenVMS experience. The research also shows that there are very few OpenVMS skills available for hire in the IT industry.

4.8 INDUSTRY

Through a series of customer and account manager interviews, **xwave** was able to develop some insight into our clients' views on OpenVMS.

xwave's customer base spans a large number of industries, and research information was gathered from a cross section of these industries. The customers that were specifically referenced in this report were chosen because:

The customers were based in Atlantic Canada and therefore could reflect the Atlantic Canada Information Technology landscape.

- The sizes of the server environments were comparable to Newfoundland Power's computing environment.
- The customers were relevant to Newfoundland Power because they were utility companies or public institutions.

Most of the customers who had OpenVMS applications have had them in place for at least 5 – 10 years. Many of these systems were upgrades from older VAX/VMS applications. Many of the OpenVMS servers were "tucked away in the back of the computer room".

Customers who were looking to replace the applications on the OpenVMS based servers were considering migrating to other operating systems such Windows 2000, HP-UX, or Solaris if the newer applications were available on these platforms.

While most customers were pleased with the level of availability and reliability of their OpenVMS systems, OpenVMS was not seen as a strategic operating system for deploying new mission critical applications.

4.8.1 The Fortis Group of Companies (http://www.fortisinc.com/)

Members of the Fortis Group of Companies include Newfoundland Power, Maritime Electric, Canadian Niagara Power, and Fortis Properties. The Corporation also holds a 67% interest in Belize Electricity and a 22% interest in Caribbean Utilities. Newfoundland Power is the only company in the Group that currently has production OpenVMS systems in place.

OpenVMS is not considered a strategic operating system within the Group. Microsoft Windows 2000 and the various UNIX versions are the preferred platforms for new applications.

4.8.2 College of the North Atlantic (CONA - http://www.northatlantic.nf.ca)

The college currently has only two OpenVMS systems in place. The AlphaServer 4100s run the College's business systems. The first AlphaServer was purchased in 1997 and served CONA for 4 years before capacity problems arose. To facilitate a solution, the College had to purchase a second AlphaServer. With the 4100 series not longer available through Compaq marketing, the College was forced to acquire a refurbished server from the United States. Once installed, the second server was used to alleviate some of the capacity problems encountered in the original server.

CONA considers its OpenVMS servers to be a solid and reliable environment. However, the College feels that the OpenVMS operating system has no future. The College is actively looking to replace its legacy business systems with newer ERP packaged solutions.

"The new Business solutions at the College will not be OpenVMS based."
Wayne Hann, Manager of Information Services, CONA

July 2002

While CONA has never offered OpenVMS courses, students were exposed to VMS utilities such as editors and compilers as a means of compiling programs and learning about software development in that environment. This approach ended in 1997. Since then, students were exposed to software development tools/environments mostly on Windows or UNIX platforms.

4.8.3 Newfoundland and Labrador Hydro (http://www.nlh.nf.ca/)

Newfoundland and Labrador Hydro has no OpenVMS systems in production. The company's administrative systems operate primarily on Windows NT and Windows 2000 platforms. Its SCADA data is managed through the Harris Energy Management System, which operates on a proprietary Harris operating system and server.

4.8.4 Memorial University of Newfoundland (http://www.mun.ca/index.php)

While the Department of Computing and Communications (C&C) at the University had VMS systems in production in the 1980s and 1990s, most were replaced by 1998. The only remaining production application that resides on OpenVMS today is on a server that does not have a maintenance contract in place. C&C has made the decision to use UNIX for their deployment and subsequently has moved all other applications off OpenVMS, cancelled the software and hardware maintenance on OpenVMS, and removed the AlphaServers. Sun Microsystems' Solaris is the preferred UNIX operating system for enterprise applications such as the University Portal, the Web Course Tool (WebCT), and the Banner Financial and Student Administration systems. A combination of Solaris and Linux is chosen for other applications.

"I have no plans to use OpenVMS in the future."
Randy Dodge, Manger of Technical Support, MUN
July 2002

4.8.5 New Brunswick Power (http://www.nbpower.com/)

New Brunswick has production OpenVMS 5.5-2 applications. Version 5.5-2 is seven releases behind the current OpenVMS 7.3-1. Newfoundland Power receives no formal support from Hewlett Packard for this version. However, Hewlett Packard provides the Utility "Best Efforts" support at a charge of $250 per hour. Old VAX systems have been purchased in an effort to have replacement parts on site.

While seven "important" systems at the Utility are OpenVMS based, OpenVMS is not viewed as a strategic operating system. As older applications are retired, the new replacements are being deployed on Windows NT and 2000 servers.

4.8.6 Atlantic Lotto (http://www.alc.ca/)

During the 1990s, Atlantic Lotto developed its mission critical gaming engine on OpenVMS servers. The gaming engine must be available at all times, because an outage interrupts the Lotto's revenue stream. However, the Corporation is now in the process of porting its application to Windows NT and Linux. A successful business case for the porting was developed and was based upon the future of OpenVMS.

Atlantic Lotto still has production OpenVMS systems but intends to eventually migrate its applications off OpenVMS.

The table below details some of **xwave**'s customers who were polled to see if they deployed OpenVMS as production systems.

Customer	Production OpenVMS Systems	Predominant Operating Systems in Production
Fortis	Yes	Windows 2000 UNIX
College of the North Atlantic	Yes	Windows NT/2000 Linux
Newfoundland and Labrador Hydro	No	Windows NT/2000
Memorial University	Yes	Windows NT/2000 UNIX
New Brunswick Power	Yes (VMS)	Windows NT/2000
Atlantic Lotto	Yes	Windows NT/2000
Nova Scotia Power	No	Solaris Windows NT/2000
Maritime Life	No	Windows NT/2000 AIX HP-UX
Blue Cross	No	HP-UX

Table 19 - Operating Systems at xwave Customer Sites

4.9 EDUCATION CENTRES AND THE JOB MARKET

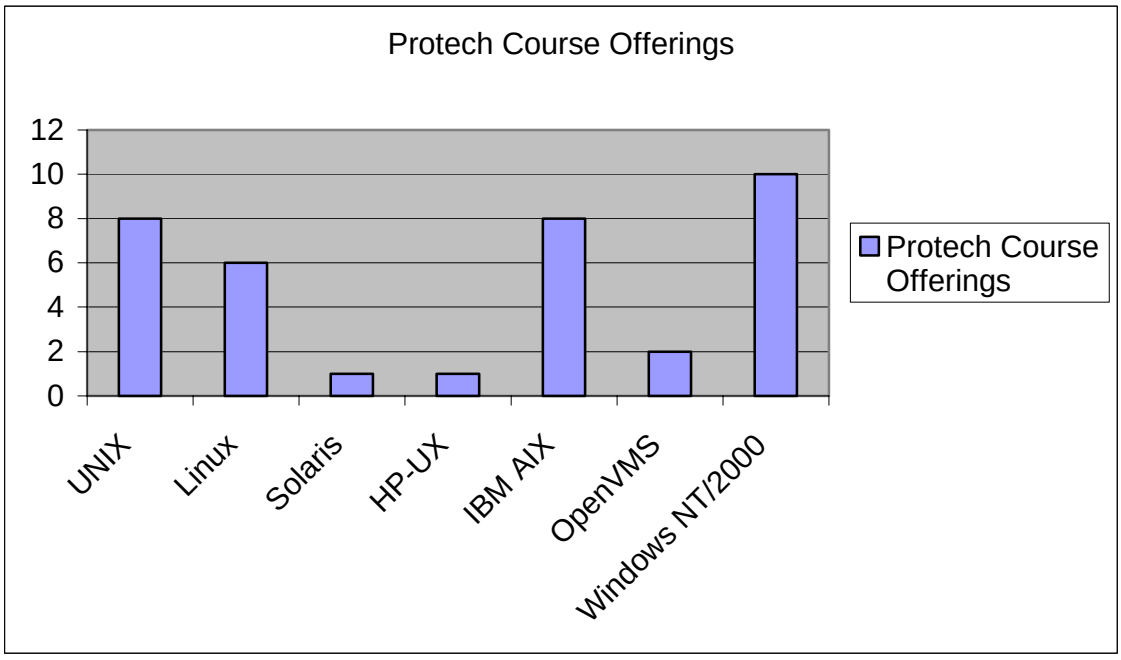
4.9.1 Education centres

Education centres and training companies offer a wide array of training courses for companies. The most popular, or "hot", courses reflect what skills are in demand in the IT industry. Currently, the hottest courses are in the Windows, Database, and UNIX categories. Many learning centres are not offering OpenVMS curriculum.

Polar Bear Corporate Education Services, (http://www.polarbear.com/) formally Broadleaf, does not offer any OpenVMS training in Newfoundland. In contrast, they offer Windows NT/2000 courses approximately every 1.5 months.

Learning Tree International (http://www.learningtree.ca/), has never offered OpenVMS training to its customers. It has 13 Windows NT/2000 courses in its catalogue with courses starting in Ottawa or Toronto every week.

ProTech (http://www.protechpts.com/), a Pennsylvania-based IT training company that offers over 300 courses in the United States and Canada, has a curriculum that includes OpenVMS, Windows, and UNIX courses. The table below details the number of courses in each area. At this point, ProTech has no OpenVMS courses scheduled for the remainder of 2002.



Courtesy of ProTech

Table 20 – ProTech Course Offerings

The College of the North Atlantic (http://www.northatlantic.nf.ca/) has never offered OpenVMS courses. The students, however, were exposed to VMS utilities such as editors and compilers as a means of compiling

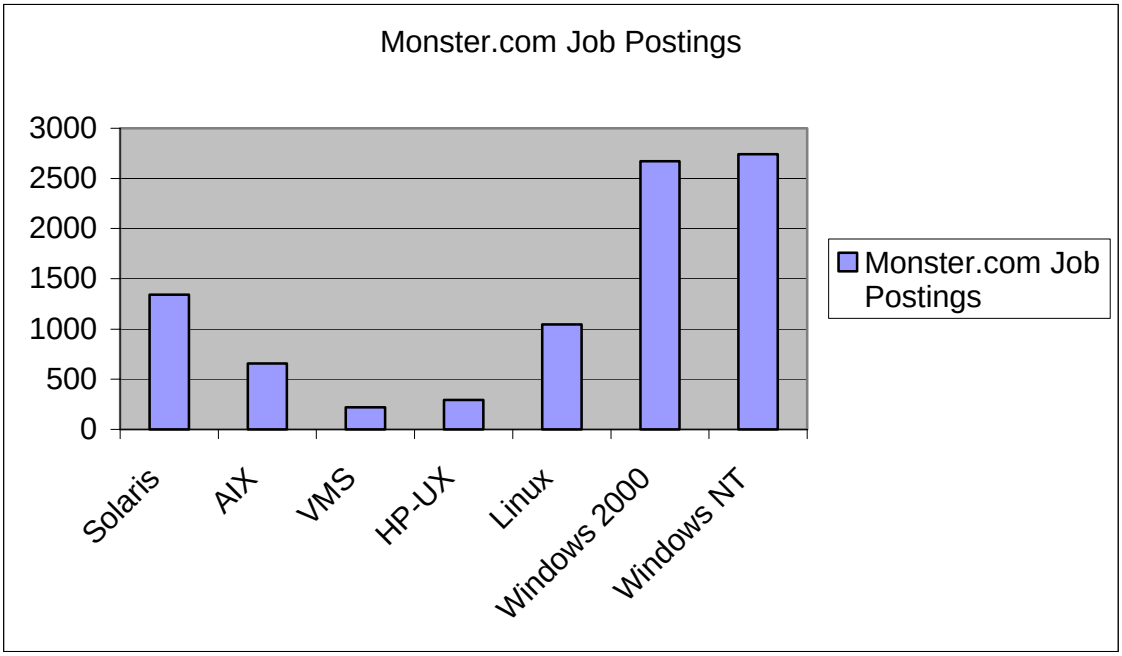
programs and learning about software development in that environment. This approach ended in 1997. Since then, students were exposed to software development tools/environments mostly on Windows or UNIX platforms.

Hewlett Packard (http://www.hp.com/) currently has OpenVMS courses available but at this point there are no classroom training scheduled to be held in Canada.

4.9.2 Job Market

An important indicator of the prevalence of OpenVMS can be found in the job market. Online companies that host IT professionals' resumes provide insight into the IT skills that employers can expect to gain when hiring new employees as well as the job available in various IT areas.

One of the leading Job Market services is Monster.com (http://www.monster.com). The table below shows the number of jobs listed on Monster.com that require some experience with various operating systems.



Courtesy of Monster.com

Table 21 – Job Postings on Monster.com

The table indicates that there is a much higher demand for IT professionals with Windows or UNIX skills. As well, the number of job postings indicates the prevalence of the various operating systems in the North American job market.

5.0 ALTERNATIVES

Newfoundland Power has three alternatives to choose from in deciding the direction of the OpenVMS computing environment:

1. Remain on the existing OpenVMS AlphaServer 4100 platforms until OpenVMS on Itanium is generally available. Then, migrate the existing applications over to the new technology.
2. Purchase new AlphaServers and migrate the in-house applications over from the 4100 servers.
3. Migrate away from the OpenVMS environment and towards the Windows or UNIX environments.

5.1 REMAIN ON THE EXISTING OPENVMS ALPHASERVER 4100 PLATFORMS

Newfoundland Power could decide to remain on the existing AlphaServers until at least 2005 and then port the OpenVMS operating system and the applications to a new set of Itanium servers. However, the age of the servers and the timeframe between the 2002 and 2005 presents a high level of risk to Newfoundland Power for a number of reasons.

5.1.1 AlphaServer 4100 End-of-Life on Marketing

The AlphaServers 4100 at Newfoundland Power have been removed from marketing by Compaq. As a result, it is becoming increasingly difficult to obtain quality replacement parts for the servers. Recent AlphaServer purchases have been for refurbished components.

5.1.2 Performance Issues and Availability of Parts

In 2001, DRACO encountered performance problems. To alleviate the issue, memory was removed from the disaster recovery server CORVUS, reducing its total memory to 4GB. This action had two consequences:

1. In the event of a disaster recovery scenario for DRACO, its DR server would not be able to provide the same level of performance that was earlier anticipated. Removing memory from CORVUS leaves it two GB less that DRACO.
2. The addition of 1GB of memory to DRACO filled the system board for the server. Therefore, no more memory can be added to DRACO unless another system board is added or original memory is replaced by higher density memory.

A midrange server has a useful life of approximately 4-5 years, provided the original configuration allows for additional capacity growth. The newest AlphaServers at Newfoundland Power was purchased in 1998. The oldest, CYGNUS was acquired in 1995. Newfoundland Power can no longer rely on the disaster recovery servers for reliable replacement parts because, with the exception of VOLANS, they are as old or older than the primary production and development servers.

Newfoundland Power may decide to remain on the existing servers. By doing so, it will have to assume the risk associated with leaving its mission critical CSS application on servers that will be at least 7 years old before OpenVMS on Itanium is available. Maintaining these existing systems until 2005 would jeopardize the mission critical environment.

5.1.3 Itanium Uncertainty and Niche Market

Hardware vendors have begun to market Itanium servers. Intel has just released the second generation of Itanium, the Itanium 2 processor. However, there is still customer uncertainty around the success and cost effectiveness of Itanium. Itanium has yet to gain wide mainstream status. Many customers will be content with the less expensive processors. As well, there could be performance degradation when customers run 32-bit applications on Itanium's 64-bit architecture

Giga states that Itanium will be seen as a solution for software development and high performance technical computing. Gartner anticipates that most of the Itanium 2 customers will be focused on software development, testing, proof of concept, and some technical computing.

Newfoundland Power may find that it can deliver its applications to its clients on less expensive technology than the Itanium family of processors.

5.1.4 Oracle Server Support and New Version Requirements

The current version of Oracle Server on the OpenVMS platforms at Newfoundland Power is Oracle Enterprise Edition 8.1.6 (8i). This version is currently in Extended Assistance Support (EAS) status. EAS includes the follow types of support:

- Telephone and Electronic support, consisting of:
  - Answers to customers' questions
    - Assistance with migration plans to a supported platform and/or product
    - Workarounds, where possible

However, EAS does not provide:

- Error Correction Support (ECS) - No new bug fixes
- Backporting of fixes
- Certification with supported products, newer operating system versions or new compilers
- Escalation support, response time adherence and skill availability

This means that Oracle will only provide existing fixes to Newfoundland Power. As well, fixes found in newer versions of Oracle will not be applied to Oracle 8.1.6. Perhaps most important is that Oracle will not escalate any support requests from Newfoundland Power while 8.1.6 is installed.

EAS will no longer be available after October 2004. The Oracle Desupport Notice is in Appendix C.

Newfoundland Power should migrate to the newer versions of Oracle Server. Version 8.1.6 is three releases behind the latest version. However, Oracle upgrades at **xwave** have shown that version 9i of the database product can consume up to 20% more system resources than previous 8i versions. As a result, Newfoundland Power may have to obtain additional systems resources such as CPUs, memory, and disk to accommodate the new requirements. This will be difficult with the existing AlphaServers.

Oracle Enterprise Edition Licensing at Newfoundland Power

It was not obvious why Enterprise Edition was purchased instead of Standard Edition. Standard Edition is less expensive than Enterprise. Standard Edition is sufficient for servers with a capacity for four CPUs, unless some of the features in the Enterprise Edition but not in Standard are required. A listing of the features in both editions is contained in the Appendix D.

5.2 PURCHASE NEW ALPHASERVERS

Newfoundland Power could purchase the latest Alpha technology from HP. Since the company has not budgeted for replacement of these servers in the 2002 fiscal year, purchases would not occur until at least April 2003. The servers would most likely come from the EV7 product family of servers. Once received, plans to configure the servers and the operating system would begin. The software toolsets such as COBOL, BASIC, and FORTRAN, and the Oracle database software would have to be installed. Applications would have to be ported over to the new servers, tested and then put into production.

5.2.1 AlphaServer Technology End-of-Life

In June 2001, Compaq announced the AlphaServer Roadmap that included information on the commitment to sell AlphaServers up to 2006 only. After the HP/Compaq merger in April 2002, HP reaffirmed the Roadmap. The two main operating systems that are on the AlphaServers is Tru64 and OpenVMS. Tru64 would be phased out in favour of HP-UX. OpenVMS will be ported to the new Itanium processor by 2004-2005.

If Newfoundland Power purchases the EV7 servers in 2003 and then goes through the process of bringing them online for the user community, then the company will be obtaining servers whose technology will most likely be obsolete in less than 3 years. The result of this action would be that the OpenVMS server environment would be in the same position as it is today – upgrades and replacement parts would become increasingly difficult to obtain.

HP will most likely focus its resources on the Itanium processor rather than the Alpha. This is evident in the fact that OpenVMS is being ported to Itanium and that unlike the Alpha processor, there has been no discussion about the retirement or end-of-life plans for Itanium.

5.3 MIGRATE AWAY FROM OPENVMS

The other alternative is to migrate Newfoundland Power's OpenVMS based applications towards Windows or UNIX environments. As shown in the research presented, the combination of a number of significant factors would limit the potential for OpenVMS to become a mainstream operating system in the midrange market.

5.3.1 Migration Alternatives

Migration away from OpenVMS can be accomplished either by attrition or by actively porting the legacy applications.

MIGRATION THROUGH ATTRITION

Attrition involves maintaining the existing OpenVMS environment for as long as the applications are in use. As replacement systems are purchased for the older legacy systems, they would be implemented in the Windows environment.

Following the "Buy not build" philosophy, the older code and toolsets would be abandoned and newer tools such as Visual Studio, C++, ASP, XML, and SQL Plus would be utilized. The tools would not be used to build in-house applications but rather to customize purchased solutions.

Because the new applications have not been identified, it is impossible to provide a technical architecture. Different vendor applications have different technical architecture requirements.

This alternative will be successful if the existing applications will be scheduled for replacement within the next 12 – 18 months. A longer timeline for replacement places the OpenVMS applications at the same risk level as simply remaining on the AlphaServers until Itanium has gained mainstream status.

Newfoundland Power's current plan is to replace all the applications on the OpenVMS servers except CSS by the end of 2003. Therefore, CSS is the only application that would have to be actively migrated from the existing servers.

ACTIVE MIGRATION

This alternative would involve the development of a migration plan to port the existing CSS software, application code and database to either the Windows or the UNIX environments. Such a solution would have to provide similar availability, reliability, and stability as currently provided under the AlphaServer platforms.

xwave has extensive experience in deploying applications on Windows and UNIX platforms. A discussion on the benefits and risks with each operating system can be found in the Appendix E.

5.3.1.1 MIGRATION TO MICROSOFT WINDOWS 2000

Newfoundland Power has standardized upon Windows 2000 operating system and Compaq Proliant servers for the deployment of Intel solutions. Therefore, Newfoundland Power should follow these standards when migrating systems from OpenVMS to Intel.

The migration to a Windows environment would result in a change in how the CSS application and the database are structured. The application and database services would be separated onto their own servers. One Compaq DL380 would host the production application while a larger Compaq DL580 would contain the Oracle database.

The creation of a second environment would host the development effort and at the same time act as a disaster recovery server infrastructure. This configuration maximizes the utilization of the disaster recovery servers while at the same time reduces the number of servers required to support.

The production servers would be housed at Duffy place. This places the CSS application close to the majority of users of the production system. The servers would connect to the Storage Area Network (SAN) solution proposed recently by **xwave**. As a result, 437 GB of external disk storage would be installed in the SAN for use by the production servers.

The table below details the server configurations for the production Windows environment. Costs include acquisition / product cost only.

Server Configurations for the Production CSS Windows Environment			
Component	Function	Configuration	Cost
Production Database Server	Database server for production application	Compaq DL580 2 X1600-1MB MHz CPUs 4 GB RAM 2 X 18.2 GB Disks Oracle licensing	$75,600
Production Application Server	Application server for production application	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 18.2 GB Disks Runtime software	$31,000
External Storage	External storage for production servers	437 GB disk storage (to be located in proposed SAN solution)	$9,200
Server Rack	Rack for production servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for production servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$132,800.00

Table 22 - Server Configurations for the Production CSS Windows Environment

The development servers would be housed at the Kenmount Road office. The servers have the same hardware and software configurations as the production servers in order to provide the same performance for users in the event of a production server failure.

The servers would connect to the Storage Area Network solution proposed recently by **xwave**. As a result, 437 GB of external disk storage would be installed in the SAN for use by the development servers.

Server Configurations for the Development / Disaster Recovery CSS Windows Environment			
Component	Function	Configuration	Cost
Development Database Server	Database server for development application	Compaq DL580 2 X1600-1MB MHz CPUs 4 GB RAM 4 X 72.8 GB Disks Oracle licensing	$42,800
Development Application Server	Application server for development application	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Compiler and Runtime software	$51,500
External Storage	External storage for development servers	437 GB disk storage (to be located in proposed SAN solution)	$9,200
Server Rack	Rack for development servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for development servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$120,500.00

Table 23 - Server Configurations for the Development / DR CSS Windows Environment

The tables above represent the requirements for migrating the CSS application. The existing OpenVMS environment hosts 10 other applications that are scheduled to be replaced before the end of 2003. Appendix F contains high-level server configurations to replace all existing OpenVMS applications at Newfoundland Power.

5.3.1.2 MIGRATION TO UNIX

UNIX can provide a level of availability, reliability, and stability that is comparable to OpenVMS.

As in the case of a migration to Windows, the UNIX production servers would be housed at Duffy place. This places the CSS application close to the majority of users of the production system.

The table below details the server configurations for the production UNIX environment. Costs include acquisition / product cost only.

Server Configurations for the Production CSS UNIX Environment			
Component	Function	Configuration	Cost
Production Database Server	Database server for production application	Sun SunFire V480 2 X 900 MHz CPUs 4 GB RAM 2 X 36GB Disks Oracle licensing	$88,200
Production Application Server	Application server for production application	Sun SunFire V480 2 X 900 MHz CPUs 4 GB RAM 2 X 36GB Disks Runtime software	$50,700
Storage Array	Storage array for production servers	Sun StorEdge D2	$19,400
Server Rack	Rack for production servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for production servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$175,300.00

Table 24 - Server Configurations for the Production CSS UNIX Environment

The UNIX development servers would be housed at the Kenmount Road office. Like the Windows alternative, the servers have the same hardware and software configurations as the production servers in order to provide the same performance for users in the event of a production server failure.

Server Configurations for the Development / Disaster Recovery CSS UNIX Environment			
Component	Function	Configuration	Cost
Development Database Server	Database server for development application	Sun SunFire V480 2 X 900 MHz CPUs 4 GB RAM 2 X 36GB Disks Oracle licensing	$55,500
Development Application Server	Application server for development application	Sun SunFire V480 2 X 900 MHz CPUs 4 GB RAM 2 X 36GB Disks Compiler and Runtime software	$50,700
Storage Array	Storage array for development servers	Sun StorEdge D2	$19,400
Server Rack	Rack for development servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for development servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$142,600.00

Table 25 - Server Configurations for the Development / DR CSS UNIX Environment

The tables above represent the requirements for migrating the CSS application. Appendix F contains high-level server configurations to replace all existing OpenVMS applications at Newfoundland Power.

6.0 RECOMMENDATIONS

The current OpenVMS servers at Newfoundland Power house mission critical applications. As a result, Newfoundland Power's ability to be a leader in electrical transmission and distribution services in North America is impacted if the applications become unavailable.

Analysis of the information presented in the preceding sections indicates that the future for OpenVMS as an operating system for critical business applications is limited. Despite assurances from Hewlett Packard, continuing to use OpenVMS contains an unacceptable level of uncertainty and risk. As well, the combination of a number of significant factors limits the potential for OpenVMS to become a mainstream operating system in the midrange market. **As a result of the analysis of the Project's research, xwave recommends that Newfoundland Power migrate away from the OpenVMS operating system environment and begin deploying its current OpenVMS based applications onto other operating systems.**

A migration of the OpenVMS based applications to a Windows or UNIX environment will place Newfoundland Power in a better position to provide an available, reliable, and stable computing environment for its applications in the future. These operating systems were chosen as alternatives because Newfoundland Power has experience with both - Windows through the deployment of applications such as the Great Plains application and UNIX through the Tru64 SCADA implementation. It is important to note that the configurations and prices reflect current technology as of August 2002.

By the end of 2003, all the applications on the OpenVMS servers except CSS will already have been replaced. Therefore, the configurations below represent a high-level infrastructure architecture to replace the current CSS infrastructure. Appendix F contains high-level server configurations to replace all existing OpenVMS applications at Newfoundland Power.

A Microsoft Windows 2000 alternative would involve the deployment of two production servers, as well as two additional servers that would accommodate application development and disaster recovery. The following table summarizes the server infrastructure and provides a high-level estimate of hardware and software required to implement this solution. Costs include acquisition / product cost only.

CSS Windows 2000 Environment		
Environment	Requirements	Cost
• Production	One Compaq DL580 database server One Compaq DL380 application server 437 GB external storage One server rack One communications switch	$132,800
Development / Disaster Recovery	One Compaq DL580 database server One Compaq DL380 application server 437 GB external storage One server rack One communications switch	$120,500
	Total (excluding tax)	$253,300.00

The servers would connect to the Storage Area Network solution proposed recently by **xwave**. As a result, 874 GB of external disk storage would be installed in the SAN for use by the servers.

A UNIX alternative would involve the deployment of two production servers, as well as two additional servers that would accommodate application development and disaster recovery. Costs include acquisition / product cost only.

CSS UNIX Environment		
Environment	Requirements	Cost
• Production	One Sun Microsystems Sun Fire V480 database server One Sun Microsystems Sun Fire V480 application server One Sun StorEdge D2 Array One server rack One communications switch	$175,300
Development / Disaster Recovery	One Sun Microsystems Sun Fire V480 database server One Sun Microsystems Sun Fire V480 application server One Sun StorEdge D2 Array One server rack One communications switch	$142,600
	Total (excluding tax)	$317,900.00

Both alternatives would include locating the production servers at Duffy Place. This places the CSS application close to the majority of users of the production system.

At this time, **xwave** does not make a recommendation between Windows 2000 and UNIX as the preferred alternative. The final decision on which platform to deploy depends upon the future direction of applications such as the Customer Support System (CSS). Specifically, future replacements for these applications will determine which operating systems should be used.

APPENDIX A – OPENVMS INFRASTRUCTURE TECHNICAL QUESTIONNAIRE

The following questions form a guideline of the type of information **xwave** is seeking during the information-gathering phase with the IT resources at Newfoundland Power. While additional questions may arise from the interview(s), the questions below will drive the discussions.

1. **How many OpenVMS servers are currently in operation?**

   Response:
   There are 3 Production and 3 Disaster Recovery/test servers.

2. **What is the function of each?**

   Response:
   One is the Customer Service System, another is the Financial Systems (being phased out), and the third is the Customer Service Development System and their Disaster Recovery backups.

   When are the Financial systems being phased out? What is the plan for the server? What will be the new platform (Is this the Great Plains project)?

   Response:
   Great Plains is the chosen solution. There is an implementation planned for Compaq servers for Great Plains. FASBE is the old financial system. CSS will be replaced in 3-5 years – development will NOT be done in house on the new CSS system.

3. **What corporate applications reside on each server?**

   Response:
   In-house developed and supported CSS, PCLS/Interruptions, JUS, SLMS, FASBE, SWITCH, SRS

   What is the function of each application? Are they all in-house developed? What are they developed in? Are these server centric, Client server, or web applications?

   Response:
   FASBE, SWITCH and SRS are located on the Financial Server. HRIS system (provided by StarGarden) interfaces with Great Plains. Acronyms are as follows:

   CSS – Customer Support System
   PCLS – Problem Call Logging System
   JUS – Joint Use System
   SLMS – Street Light Management System
   SRS – Spill Reporting System (a replacement of SRS is coming.)

4. What software packages (and versions) reside on each server?

Response:
OpenVMS Alpha 7.2-1, Cobol 2.6, Basic, Fortran, DECForms 3.1, DECnet 7.2-1, DECWindows Motif 1.2-5, CA AdviseIT agent and Manger 2.4, Process Software TCPWare 5.3-2, Cognos Powerhouse 820D3, WordPerfect/VMS 5.3+.

Is this software on each server? What software is used for a database engine?

Response:
Cobol 2.6 is used on the Development server only
PVCS runs on the Development Server
DECNet is a file transfer protocol for OpenVMS
Power have developed their own backup script for OpenVMS
Use their network to backup during off-peak times (100MBit over 1GBit backbone)
- *For NT Backup they use ARCServIT*
- *Backups are done at each site for the other location Duffy-Kenmount and vice versa*
- *Backups run nightly, full backup on the weekend*
- *6 tapes for monthly, 6 for weekly, 6 for daily*
- *DLT drives for each server*

Running Oracle 8.1.6 Enterprise – not sure why Enterprise instead of Standard
200 licenses in total, multiplatform and split amojngst systems

Database for CSS is ~ 20GB
- *CSS developed in Cobol and Powerhouse, online component in Axiant*

Planning on a network upgrade next year between buildings

5. How many FTEs (Full Time Equivalents) are required to support the OpenVMS servers?

Response:
1

Is this a single individual or is the support spread across multiple individuals?

Response:
½ Keith Le Feuvre, ½ Sean Kearley

6. How many FTEs are required to support the non-OpenVMS servers?

Response:
2

Are these two individuals?

Response:
Upgrade of SCADA units (364's ?) soon – moving to NT platform

Topsail Road office has 2 Intel-based servers, 4 364's
8 regional offices have servers for File/Print/User Directory
Using BDC, SMS and TrendMicro (for viruses through Enterprise agreement via Fortis)

7. **What are the skillsets / certifications for the resources supporting the OpenVMS servers?**

Response:
Computer Science diploma. Additional training provided by DEC/ Compaq.

Are the resources trained/experienced in the Wintel environment as well?

Response: OpenVMS courses taken, as well as couses such as Cisco Administration

8. **Are there Change Management windows established for the servers?**

Response:
Yes.

What is the schedule for CM (ex: one Sunday a month.)

Response:
Change Management procedures are rigorous for Production
Schedule on a by-Request basis
Developed CM application in VB and Access
Most changes are implemented on Friday nights, allowing for weekend stabilization
From 8pm-8am Friday night, batch processing, purge, archive and backup

9. **Are the servers currently under hardware and software Support Agreements with vendors? What levels of Support exist?**

Response:
Yes. Production Servers have 24 X 7 hardware and software maintenance. Disaster Recovery servers have 9 X 5 hardware maintenance.

Same day or next business day on parts? How quickly the response call (4 hour?)

Response:
2 hour callback on support, 4 hour on parts

10. Who applies hardware/software patches or repairs to the servers?

Response:
Newfoundland Power performs software patches and upgrades in-house. Hardware repairs are performed by the Vendors and supervised by Newfoundland Power.

Hardware vendors allpy patches Oracle 8.1.7 on NT box, 8.1.6 on all servers
Plus SQL 2000

11. What is the hardware configuration of each server (Model/CPUs/RAM/Disk storage/network connectivity, etc)?

Response:
Draco: AlphaServer 4100 5/533, 2 CPU, 6 GB RAM, 226 GB 100 Mb/s
Prod1: AlphaServer 4100 5/466, 2 CPU, 2 GB RAM, 110 GB 100 Mb/s
Orion: AlphaServer 4100 5/300, 2 CPU, 1.5GB RAM, 125 GB 100 Mb/s
Corvus: AlphaServer 4100 5/533, 2 CPU, 4 GB RAM, 226 GB 100 Mb/s
Volans: AlphaServer 4100 5/466, 2 CPU, 2 GB RAM, 110 GB 100 Mb/s
Cygnus: AlphaServer 2100 5/250, 2 CPU, 1.28 GB RAM, 130 GB 100 Mb/s

Which are the production, development, and disaster recovery servers?

Response:
Draco = CSS
Prod1 = Financial
Orion = Development

Corvus, Volans and Cygnus are DR servers for respective Production servers

Years put into service: *Draco – 1998* *Prod1 – 1998*
Orion – 1997 *Corvus – 1998*
Volans – 1999 *Cygnus – 1995*

Everything on the server is backed up and if a restore is necessary, everything is restored (Full Volume)

Corvus, Colans and Cygnus are mirrors of the production servers respectively and are warm. In the event of a major upgrade or application migration, the event takes place on the DR servers Corvus, Volans and Cygnus which are then mirrored to the production servers.

12. What type of disk storage is connected to the servers (internal/external subsystem/SAN)?

Response:
Internal and external disk storage, Non SAN.

Compaq RAID Controller with 200GB on OpenStorage

Replacing soon with Compaq SAN

13. **When were the servers purchased?**

Response:
Earliest 1995, and the latest in 1998.

When were the last upgrades applied to the hardware? Have the servers started to be limited in their capacity for performance? Is there an evergreen plan for servers at Newfoundland Power?

Response:
See above notes …

An upgrade to the CSS server was done, adding Memory and Disk space

14. **Do you have any enterprise-wide hardware or software agreements with vendors that allow the installation of hardware/software at no additional charge?**

Response:
No.

15. **What are the expected level (%) and hours of availability for the servers?**

Response:
CSS system is 24X7. Financial System is 12X5. 100% during prime working hours of Monday to Friday 8am to 8 pm.

What is built into the servers to maintain the level of availability (mirroring, redundant PS and fans, clustering, etc?)
What is the expectation with the development server?

Response:
As noted above, 3 servers are warm "mirrors" of the production units. Worst case scenario is a 24hr restore. It takes approximately 8 hours to backup the Databases.

16. How long can the servers be unavailable during any given outage?

Response:
Maximum of one-half hour during prime time 8am to 8pm Monday to Friday except in rare emergencies. Scheduled outages can be longer on the weekends. Environmental consideration ie weather and or problems with the electrical grid will impact planned outages.

17. What Disaster Recovery plans exist for the servers?

Response:
All three production servers have disaster recovery plans and warm backup servers.

Is there any clustering software on the servers? How are the backup servers maintained as "warm"?

Response:
All DR servers are Power On and drives are spinning. Backups are done Monday – Saturday 8pm-8am – 50-Step backup procedure completed to ensure no problems.

18. Are the servers considered Production or Development servers?

Response:
Two are production servers, and one is a Development/test server. Three are Disaster recovery and test servers.

19. Is there any development activity currently being conducted on the servers or are they strictly in an operational mode?

Response:
Yes see above.

20. What interfaces exist between the OpenVMS servers and other systems at Newfoundland Power or external entities?

Response:
TCP/IP interfaces primarily Cognos Axiant Client/Server connections, Telnet, NFS, SMTP, SNMP, and FTP.

Are there any system Interfaces such as payroll?

Response:
CSS interfaces with FASBE / BOSS – most interactions are FTP flat file

CSS interfaces with the webserver (Oracle/NT) as an export form CSS

21. Where are the OpenVMS servers physically located?

Response:
4 are at Kenmount Road and 2 are at Duffy Place.

4 at Kenmount are Draco, Orion, Prod1 and Cygnus
2 at Duffy are Volans and Corvus

There is a plan to place Draco @ Duffy and bring Corvus back to Kenmount

22. Are there diagrams available that show the network location of the OpenVMS servers?

Response:
Yes.

23. What network protocols are used on the servers?

Response:
DECnet and TCP/IP.

What is DECnet used for that cannot be done by TCP/IP?

Response:
DECNet is used as an File Transfer Protocol for CSS to Great Plains

24. How are the servers backed up? What is the frequency of the backups and approximately how much data is backed up?

Response:
The servers are backed up using DLT tape drive and the tapes are taken off site to its Disaster Recovery site. Full backups are performed once per week and incremental backup on the other four days. Backups are coordinated and initiated by the Computer Room operators.

25. Does Newfoundland Power have existing server and OS standards developed?

Response:
Yes

Describe how OpenVMS fits into these standards.
Are these standards for choosing servers and OSs or in maintaining them?

Response:
Newfoundland Power only buys Compaq and Compaq Servers
Tier 1 Servers and PC's

26. **Are the OpenVMS servers monitored for availability? How is this done (scripts, HP OpenView, etc)?**

Response:
Yes with HP OpenView and in-house developed scripts.

How is notification of a problem made (automated pager, message to a console, etc)? Is there afterhours support for the servers (anyone on call)?

Response:
Newfoundland Power uses custom developed Scripts which eMail notification to pagers on support staff. MS Exchange server is equipped with a paging module. SMTP or VMS for paging of other processes, HPOpenView Monitor pages to eMail or pager.

27. **Are the servers located in racks?**

Response:
Yes.

Do you use standard 19" Compaq racks?

Response:
Non-standard racks as the AlphaServer 4100 is a wide-body server (much wider than Proliant series servers)

28. **Are there any contract implications to consider if the OpenVMS servers are no longer in use (e.g., any existing multi-year contracts)?**

Response:
No we have one-year contracts.

29. **What is the annual maintenance costs for the hardware and software on the OpenVMS platforms?**

Response:

$145,000 Hardware, $283,000 Software.

30. How many users/developers are on each server?

Response:
85 users of CSS, 35 of Financial

Where are they located (in Kenmount/Duffy, around the province)?

Response:
Users have Citrix MetaFrame – desktop client is 100MB
Great Plains is Citrix based, not web-based

31. Will the user community for each server expand within the next 2 years?

Response:
No.

32. Are there any plans to increase the hardware capacity or upgrade the software on the servers in the next 2 years?

Response:
Yes. Purchase SAN for CSS, Memory for DR server, Upgrade OpenVMS, Oracle, Powerhouse.

33. What are the reasons for wanting to migrate from OpenVMS?

Response:
Part of the 3-5 year plan to migrate to NT servers

34. Is there any documentation on the reasons (ROI / COS studies, Strategic planning reports, etc)?

Response:
A report was written in August 2001 concerning OpenVMS as an operating system at Newfoundland Power.

APPENDIX B – OPENVMS TIER-2 RELATIONSHIP WITH ORACLE

The following Technical Assistance Request (TAR) confirms the Tier-2 relationship that OpenVMS has with Oracle. The TAR program allows customers to formally request assistance in solving product related problems, obtain software fixes, and get answers to questions concerning Oracle's line of products.

Midrange Technical Forum

Select Forum | Post New Message | Post Reply | Forum Index | Collapse Thread

Displayed below are the messages of the selected thread.

Thread Status: Active

From: Todd Mowbray 28-Nov-01 18:19
Subject: OpenVMS tier 1 again ?

OpenVMS tier 1 again ?

Can someone at Oracle please clear up some confusion surrounding the current status of the OpenVMS platform with respect to the Tiering system?....there have been some rumors that OpenVMS is again a Tier 1 platform.

Todd

From: Oracle, Regina ROHR 29-Nov-01 18:22
Subject: Re : OpenVMS tier 1 again ?

I know we are almost Tier 1, but not quite. I'll contact
the Product Line to see if there was a change.

Regina Rohr
Oracle Support Services Midrange

From: Oracle, Regina ROHR 04-Dec-01 00:01
Subject: Re : Re : OpenVMS tier 1 again ?

We are not tier 1, but we are one of the 9 strategic platforms.

Means we are not having everything. Like for instance iAS is not available on OpenVMS.

So, no tier 1 but close.

Hope this helps,

Regina Rohr
Oracle Support Services Midrange

From: Todd Mowbray 07-Dec-01 21:12
Subject: Re : OpenVMS tier 1 again ?

I was hoping that this would mean increased focus on providing timely corrections to bugs that have affected other platforms, but seem to take a long time to get resolved on port 89 (OpenVMS).

From: Oracle, Regina ROHR 12-Dec-01 16:21
Subject: Re : Re : OpenVMS tier 1 again ?

What are the Tar numbers and bug numbers? If no customer reports the error we do not get an automatic backport to OpenVMS (nor any other platform, unless it is a security patch), it is per request only.

Thanks

Regina Rohr
Oracle Support Services Midrange

From: Todd Mowbray 18-Dec-01 15:56
Subject: Re : OpenVMS tier 1 again ?

Nothing specific, just a commentary on resolution time for say mts and connection performance problems, that seem to get resolved quicker on other ports.

Todd

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APPENDIX C – ORACLE 8.1.6 DESUPPORT NOTICE

Oracle Corporation
Product Obsolescence Desupport Notice

Product Details:

Product:	Oracle Server - Client, Enterprise Edition, Parallel Server, Personal Edition, RAC & Standard Edition
Product Version(s):	8.1.6 (8i)

Platform(s) Details:

Platform(s):	Platform Version(s):
ALL Platforms	ALL

Desupport End Dates:

Error Correction Support (ECS): 31-OCT-2001

Extended Assistance Support (EAS): 31-OCT-2004

Product Obsolescence / Desupport Information:

Oracle Corporation announces the end of Error Correction Support for **Oracle Server - Client, Enterprise Edition, Parallel Server, Personal Edition, RAC & Standard Edition version(s) 8.1.6 (8i)** on the following platform(s): **ALL Platforms,** effective **31-OCT-2001**.

Oracle Corporation recommends customers upgrade/migrate to the following as soon as possible to maintain the highest level of support: Oracle Server - Client, Enterprise Edition, Personal Edition & Standard Edition/Workgroup Server 8.1.7 (8i) on any Oracle certified platform.

EAS will be provided until **31-OCT-2004**, if the customer has a current support contract in place.

EAS **includes** the following:

Telephone and Electronic support, consisting of:

EAS does **NOT include** the following:

- Error Correction Support (ECS) - No new bug fixes
- Backporting of fixes

- Answers to customers' questions
- Assistance with migration plans to a supported platform and/or product
- Workarounds, where possible
- Certification with supported products, newer operating system versions or new compilers
- Escalation support, response time adherence and skill availability

Customer Action:

To upgrade/migrate, U.S. customers must contact Client Relations at the following: (NOTE: Non-U.S. customers must contact their Oracle Local Support Center (LSC).)

West: (719) 785-7600	Central & Mountain: (719) 635-8900	East: (407) 240-8900	Toll-Free: 1-800-223-1711

Exceptions and/or Miscellaneous Information:

- **Compaq Tru64 UNIX AlphaServers Customers:** Compaq Tru64 UNIX AlphaServers containing Alpha CPUs prior to version EV56 will be desupported in conjunction with Oracle8i 8.1.6. Customers should migrate to Compaq Tru64 UNIX AlphaServers containing Alpha CPUs version EV56 or higher.
- **E-Business Suite Customers:** E-Business Suite customers (including EMEA E-Business Suite customers) running 11.5.5 and lower will remain supported until **01-JUN-2002**. Please see Certify via MetaLink for certification details.
- For both Oracle8i 8.1.6 customers and all E-Business Suite customers, **the end of EAS will be 31-OCT-2004**.
- EMS will **NOT** be offered for 8.1.6.
- **Novell NetWare Customers:**
  - The 8.1.6 end of ECS date for Novell NetWare customers will be **31- DEC-2001**. This is due to Oracle8i 8.1.7's certification on Novell NetWare.
  - The 8.1.6 end of EAS date for Novell NetWare customers will remain the same as all other platforms.

- *This desupport notice is addressed to the customer's contact currently on file with Oracle Corporation. (NOTE: If the contact information is not current, please email the current contact information and CSI# to OBSSUPP_US@oracle.com.)*
- *This document is for informational purposes only, and is intended to outline Oracle Corporation's current migration path. The information in this document is subject to change without notice at Oracle Corporation's discretion. In accordance with Oracle Corporation's current transfer policy, future*

releases of Oracle programs (migration paths) are provided to customers who have a valid support contract only.

- *Customers with a current support contract may also view the current desupport notice via Oracle MetaLink at http://metalink.oracle.com, under "Product LifeCycle" --> "Certifications" by each product group or under Doc ID: 123178.1.*

For further assistance, please email OBSSUPP_US@oracle.com. Last modified: 22-May-2002 10:11:41 (U.S. Pacific Time)

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Courtesy of Oracle Corp.

APPENDIX D – ORACLE SERVER EDITIONS COMPARISON CHART

Product Editions

Evaluating Databases? Start Here

Oracle9*i* Database is available in both Standard [More Info || Add to Cart] & Enterprise Editions [More Info || Add to Cart]. The following options extend the power of the Oracle database in secure data management, transaction processing and data warehousing.

Feature Summary	Standard	Enterprise	Option
High Availability			
Oracle Data Guard		✓	
Standby Database	✓	✓	
Oracle Fail Safe	✓	✓	
Transparent application failover		✓	
Oracle Real Application Clusters [More Info || Add to Cart]		✓	✓
Oracle Partitioning [More Info || Add to Cart]		✓	✓
Security			
Advanced Security Option [More Info || Add to Cart]		✓	✓
Oracle Label Security [More Info || Add to Cart]		✓	✓
Virtual Private Database		✓	
Fine grained auditing		✓	
Password management and proxy authentication	✓	✓	
Manageability			
Java, XML and Globalization support	✓	✓	
Oracle Enterprise Manager	✓	✓	
Oracle Change Management Pack		✓	✓
Oracle Diagnostics Pack		✓	✓

Oracle Tuning Pack		✓	✓
Oracle Management Pack for Oracle Applications		✓	✓
Oracle Management Pack for SAP R/3		✓	✓
Analytics and Data Warehousing			
Oracle OLAP [More Info || Add to Cart]		✓	✓
Oracle Data Mining [More Info || Add to Cart]		✓	✓
Optimizer statistics management	✓	✓	
Analytic functions	✓	✓	
Content Management			
Oracle Workflow	✓	✓	
Oracle Spatial [More Info || Add to Cart]		✓	✓
Dynamic Services	✓	✓	
Oracle Internet File System	✓	✓	
Ultra Search	✓	✓	
*inter*Media	✓	✓	
Oracle Text	✓	✓	

Courtesy of Oracle Corp.

APPENDIX E – WINDOWS AND UNIX OPERATING SYSTEMS DISCUSSION PAPER

SOURCE, XWAVE ISBU ENTERPRISE SERVER TEAM

Comparison of WinTel and UNIX Operating Systems for Enterprise Environments

Many companies are at a critical juncture in their IT infrastructure evolution. Existing applications have been supported successfully based on sound investments in Windows NT, Intel-based platforms. However, as the infrastructure continues to evolve and becomes more integrated with daily operations, environments will have to move from an 8/5, five days a week reliability, to a 24 hour, five days a week reliability, and eventually to a complete 7/24 environment. This has significant implications in the areas of availability, redundancy, and capacity planning to name a few. Companies must understand the benefits and risks associated with using a single environment (Windows NT/2000) versus a heterogeneous environment (Windows / UNIX) to accomplish its business goals. The benefits and risks associated with each platform are discussed below. To a great extent many of the benefits / risks of a UNIX-based infrastructure are inverse to those of a WinTel architecture.

WinTel

Benefits

Fundamentally, the primary driver for companies using a WinTel environment is cost. Intel-based hardware is less expensive than UNIX hardware due to the mass-market production capabilities of the industry. In addition, there is more flexibility in choice of hardware platforms as many vendors compete to provide similar equipment, resulting in a reduction in overall cost. From a straight cost perspective it is very difficult to justify moving away from an WinTel infrastructure. This does not, however take into consideration the Total Cost of Ownership (TCO) associated with running a complete WinTel environment.

A second benefit of using a WinTel environment comes from the size of the development market for software. WinTel is by far the most common platform available in the marketplace, and as such, software vendors are more likely to develop software first or only for the WinTel server type. As with hardware, this diversity and volume of software providers creates a stronger market for potential applications, resulting in a broader array of products and lower purchase price points.

Due to the nature of the WinTel architecture, which typically assigns a single application to a single server, there is less chance of creating single points of failure. That is, due to the “horizontal growth” architecture for a WinTel environment there is rarely a single server in the system that will cause a catastrophic failure of multiple systems. This is not true in the UNIX realm where, due to the power of the server, it is not uncommon to have a single server performing multiple functions.

Another benefit of the WinTel architecture comes from the implementation of Active Directory under a Windows 2000 network. While many corporations have not yet availed of this feature (but are in the planning stage), the move to Active Directory helps to consolidate administration of the network environment as it treats all network elements, such as printers, servers and users, as elements in a directory database. This significantly reduces the amount of administration time required in a larger network environment.

The WinTel environment comes from the integration of Web Services with operating system, which is another benefit of this platform. As Microsoft has continued to evolve the operating system, they have continually integrated more functionality and interoperability with web services. On a go forward basis, as more core

operational applications become exposed to web interface requirements, this becomes easier to both implement and manage.

Finally, many companies have already created a significant internal skill set within the company to design, build and operate a WinTel environment. This level of investment cannot be overlooked in considering how future applications are deployed. Any deviation from this path must justify the increased cost associated with training or hiring new resources, along with the fragmentation of existing resource cycles currently focused on maintaining the internal environment.

Risks

At the core of the risks surrounding the WinTel environment is stability. Despite significant gains in this area, the WinTel architecture still has not reached the level of stability that UNIX has been at for a number of years. Despite the advances in High Availability (HA) Clustering technologies and automatic fail-over capabilities, a WinTel environment is still not designed, fundamentally, with stability in mind. This comes from the very nature of the market environment which takes any number of “mix and match” parts from various vendors (Intel chips, Seagate drives, etc.) and tries to create a single computing environment. No matter how critically this is reviewed, the performance and operation of one vendor’s version of a WinTel server will vary from another vendors, which indeed is why vendors try to differentiate themselves on various performance metrics. While hardware failures have declined significantly in the past few years, the majority of failures are caused by the way in which the Application interacts with the Operating System and the Hardware. This “three-legged stool” only requires one small deviation or failure to cause an interruption in service. The longer an application is run without being shut down and started up again on a server, the more likely it is that something will start to go wrong. While rebooting a server may be acceptable in an 8/5 environment, it wreaks havoc in a 7/24 environment.

A second risk associated with a WinTel environment is a cost/management risk. Due to the architecture of a WinTel infrastructure, horizontal expansion (adding more servers with each application) means more servers to manage. This is compounded when you try to bring this to a fully redundant, HA clustered infrastructure where you are buying multiples of servers for each application. This “server sprawl” characteristic is often the trigger point for companies starting to investigate alternative platforms and / or Total Cost of Ownership for their IT infrastructure.

Another risk associated with WinTel architecture comes from the application development cycle itself. As applications are moved into the core of operation functionality for companies there needs to be a certain level of comfort and stability in the operating system environment. The Windows environment is constantly changing with new release versions and complete overhauls of the operating system coming every year or two. Many companies are now just starting to figure out how to move to Windows 2000, and Microsoft is preparing to release Windows 2002. As such applications become tied to future Windows capability and functionality, which has implications for both go-forward implementation, and retroactive support.

Finally, but certainly not least important, is the issue of security. Overall, a WinTel environment tends to be less secure than UNIX for a number of reasons. First, because it is more prevalent (more desktops have Windows than UNIX as operating system), it is simply a larger target for subversive activities. Second, because the WinTel system is configured to “work out of the box” it is often over-provisioned from an

application perspective. That is, it comes with additional drivers, options etc. that are never used and can pose unknown security risks. It is common for WinTel server to become increasingly stable and secure as more unnecessary software and drivers are removed from them.

Summary

The WinTel architecture is a low entry cost method to provision computing power to the enterprise. However as applications increase, both the size of the application and the number of applications, issues arise with the manageability, total cost of ownership and security of the environment. With these characteristics WinTel servers are generally used for e-mail / messaging services, web services, file services, print services, small to medium application services and small to medium database services.

UNIX

Benefits

The first and most cited benefit, of a UNIX infrastructure is stability. Overall, UNIX systems have been created to manage mission-critical application, and as such, the OS kernel has been minimized in order to create a more stable operating system. In addition, although all UNIX versions come from the same original source code (created by Bell Labs), each vendor has modified it to custom-fit its own hardware. As such SUN has created Solaris, IBM has created AIX, Compaq has created Tru64 UNIX, etc. Once again, while they are fundamentally from the same original UNIX kernel, each one has been tuned to the specific hardware. This results in an overall reduction in issues as compared to a WinTel environment as the “three-legged stool” has two of the legs combined (hardware and OS) to reduce potential conflicts. This is further reduced in complexity as most application vendors test and performance-tune their application with specific flavours of UNIX, such as SAP on Solaris or JDE on AIX. The result is a much more stable and robust environment, which is of key consideration for staging production applications.

The second benefit of a UNIX-based platform is vertical expansion. Unlike a WinTel environment that tends to expand horizontally (adding servers), a UNIX environment scales well vertically by allowing multiple applications, and even multiple virtual servers, to reside on a single infrastructure. This provides for reduction in space and power consumption, as well as creating fewer servers to manage. Moving from a WinTel environment to a UNIX environment is often associated with addressing server sprawl issues. The ability to multi-thread activities is core to the way UNIX was originally developed, and as such, it is performed natively on most UNIX platforms. Another result of this history is that workload management and management tools for UNIX platforms tend to be much more developed and tested in the UNIX world than are their counterparts in the WinTel space. The latest iterations of operating system software allow for advanced features such as dynamic reconfiguration and Domaining / LPARing to enable logical and physical separation of applications on the same server, much akin to the way in which a mainframe environment treats its various partitions.

Another benefit of a UNIX-based platform is its close integration with Internet applications. Historically UNIX has been closely integrated with the Internet, and even in a Microsoft dominated work most large web servers are still UNIX and/or Linux based. UNIX was founded on the concept of a networked environment (all UNIX machines come pre-configured with a native IP address) and as such is designed to work best in that

configuration. On a go-forward basis as the Internet becomes more integrated into the daily operation of companies, this will become increasingly important.

Risks

As with the WinTel environment, there are also significant risks associated with a company moving into a UNIX-based environment. The primary risk lies in higher entry-level costs for hardware. On a cost-per-unit basis a UNIX environment costs significantly more than a WinTel environment due to fewer competitors, a smaller market and less demand. This price-point differential is a major barrier to many small and medium sized businesses deploying a UNIX-based infrastructure.

A second drawback associated with UNIX is the proprietary nature of hardware and operating systems. As noted in the benefits section, each OS is tuned to specific hardware, which results in a much more stable environment. The downside, however, is that once a company has committed to a platform, it becomes much more difficult to deviate and hence, the company tends to be tied to a single vendor.

It is important to pause at this point to briefly mention Linux. Linux is a non-hardware specific version of UNIX that has gained much popularity and press in the past several years. It is a true UNIX operating system whose kernel can be recompiled on almost any machine. However, despite the hype, Linux is not ready for deploying large-scale vendor applications like ERP, or Financials at this time.

The final risks associated with a UNIX-based environment are skill sets. UNIX is not an “out of the box” type of operating system. Unlike a WinTel server, a UNIX server comes with nothing loaded on it, and it works only as you add specific drivers, applications, etc. While it is completely configurable, it requires a significant amount of experience and/or training to operate effectively. This is another significant barrier to using UNIX within many company environments since, to adopt a UNIX platform, would require hiring and/or retraining resources.

Summary

UNIX is a very robust, scaleable and flexible environment that is commonly used in medium to large organizations that require continuous availability of mission-critical applications and data. UNIX environments are most commonly used for e-mail / messaging services, web services, proxy services, DNS services, firewall services, small to large application services and small to large database services.

APPENDIX F – MIGRATION OF ALL EXISTING OPENVMS APPLICATIONS

This appendix contains high-level server configurations to replace all existing OpenVMS applications at Newfoundland Power.

The migration to a Windows environment would result in a change in how the existing applications and the databases are structured. The application and database services would be separated onto their own servers. Four Compaq DL380s would host the production applications while a larger Compaq DL580 would contain the Oracle databases. The creation of a second environment would host the development effort and at the same time act as a disaster recovery server infrastructure. This configuration maximizes the utilization of the disaster recovery servers while at the same time reduces the number of servers required to support.

The production servers would be housed at Duffy place. This places the CSS application close to the majority of users of the production system.

The table below details the server configurations for the production Windows environment. Costs include acquisition / product cost only.

Server Configurations for the Production Windows Environment			
Component	Function	Configuration	Cost
Production Database Server	Database server for production applications	Compaq DL580 2 X1600-1MB MHz CPUs 6 GB RAM 4 X 72.8 GB Disks Oracle licensing	$80,600
Production Application Server 1	Application server for • CSS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Runtime software	$34,000
Production Application Server 2	Application server for • PCLS • JUS • SLMS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Runtime software	$34,000
Production Application Server 3	Application server for • MES • SRS • PES • TLIS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Runtime software	$34,000
Production Application Server 4	Application server for • SWITCH • FASBE • HRIS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Runtime software	$34,000
Storage Area Network	SAN for production servers	HP (Compaq) SAN	$130,000

Server Configurations for the Production Windows Environment			
Component	Function	Configuration	Cost
Server Rack	Rack for production servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for production servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$363,600.00

Table 26 - Production Windows Environment for all existing OpenVMS applications

The development servers would be housed at the Kenmount Road office. The servers have the same hardware and software configurations as the production servers in order to provide the same performance for users in the event of a production server failure.

Server Configurations for the Development Windows Environment			
Component	Function	Configuration	Cost
Development Database Server	Database server for development applications	Compaq DL580 2 X1600-1MB MHz CPUs 6 GB RAM 4 X 72.8 GB Disks Oracle licensing	$47,900
Development Application Server 1	Application server for • CSS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Compiler and Runtime software	$54,500
Development Application Server 2	Application server for • PCLS • JUS • SLMS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Compiler and Runtime software	$54,500
Development Application Server 3	Application server for • MES • SRS • PES • TLIS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Compiler and Runtime software	$54,500
Development Application Server 4	Application server for • SWITCH • FASBE • HRIS	Compaq DL380 2 X1400-1MB MHz CPUs 2 GB RAM 2 X 36.4 GB Disks Compiler and Runtime software	$54,500

Server Configurations for the Development Windows Environment			
Component	Function	Configuration	Cost
Storage Area Network	SAN for development servers	HP (Compaq) SAN	$130,000
Server Rack	Rack for development servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for development servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$412,900.00

Table 27 - Development Windows Environment for all existing OpenVMS applications

As in the case of a migration to Windows, the UNIX production servers would be housed at Duffy place. This places the CSS application close to the majority of users of the production system.

The table below details the server configurations for the production UNIX environment. Costs include acquisition / product cost only.

Server Configurations for the Production UNIX Environment			
Component	Function	Configuration	Cost
Production Database Server	Database server for production applications	Sun SunFire V480 2 X 900 MHz CPUs 6 GB RAM 2 X 36GB Disks	$114,000
Production Application Server	Application server for • CSS • PCLS • JUS • SLMS • MES • SRS • SWITCH • FASBE • HRIS • PES • TLIS	Sun SunFire V480 2 X 900 MHz CPUs 6 GB RAM 2 X 36GB Disks	$56,600
Storage Area Network	SAN for production servers	HP (Compaq) SAN	$130,000
Server Rack	Rack for production servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for production servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$317,600.00

Table 28 - Production UNIX Environment for all existing OpenVMS applications

The UNIX development servers would be housed at the Kenmount Road office. Like the Windows alternative, the servers have the same hardware and software configurations as the production servers in order to provide the same performance for users in the event of a production server failure.

Server Configurations for the Development UNIX Environment			
Component	Function	Configuration	Cost
Development Database Server	Database server for development applications	Sun SunFire V480 2 X 900 MHz CPUs 6 GB RAM 2 X 36GB Disks	$61,400
Development Application Server	Application server for • CSS • PCLS • JUS • SLMS • MES • SRS • SWITCH • FASBE • HRIS • PES • TLIS	Sun SunFire V480 2 X 900 MHz CPUs 6 GB RAM 2 X 36GB Disks	$56,600
Storage Area Network	SAN for development servers	HP (Compaq) SAN	$130,000
Server Rack	Rack for development servers	Compaq 245161-B21 Rack 10642	$13,000
Communications Switch	Switch for development servers	Cisco Catalyst 3524	$4,000
		Total (excluding tax)	$265,000.00

Table 29 - Development UNIX Environment for all existing OpenVMS applications

Appendix H - Gartner Research Note: The Case for OpenVMS: Should You Migrate?
External

Decision Framework, DF-18-0559
G. Weiss

Research Note
15 October 2002

The Case for OpenVMS: Should You Migrate?

OpenVMS users must consider the options and planning criteria for staying with, or leaving, OpenVMS.

Core Topic
Hardware Platforms: Server Platforms

Key Issue
How will centralized and distributed servers evolve during the next five years?

Strategic Planning Assumptions
Fewer than 10 percent of OpenVMS users will migrate from Alpha to Itanium by 2006 (0.7 probability).

Fifty-five percent of users will migrate from Alpha OpenVMS to a competitive vendor platform (Unix or Windows Server) by 2006 (0.7 probability); 20 percent will migrate to an HP merged Unix or Windows Server environment by 2006 (0.7 probability); 25 percent of OpenVMS users will remain with OpenVMS beyond 2006 (0.7 probability).

We apply our framework for evaluating the planning process of a server migration (see "How to Plan a Server Migration Strategy") to the issues of how and when users should consider a migration from OpenVMS.

Is the application support by third parties shrinking?

OpenVMS is definitely a shrinking market opportunity for independent software vendors (ISVs). Many of the original third-party ISVs are out of the OpenVMS market or have proclaimed their last releases supported on OpenVMS, and we expect continued attrition. Thus, users with strong third-party dependency must monitor their ISVs and be prepared with an alternative platform strategy in advance of ISV departures. With Hewlett-Packard's (HP's) stated intention to move the OpenVMS environment to Itanium, users should request clear indications that ISVs will also move and support their applications on Itanium. If the preponderance of ISVs fail to support Itanium, the intended move of OpenVMS will encounter the chief obstacle to its viability in application support.

How much custom code has been developed?

For the 50 percent or so remaining OpenVMS users running custom code, these IS organizations have the flexibility to await the outcome of HP's migration to Itanium. However, the IS organization should also be ready to assess the costs of migrating the existing code under OpenVMS or selecting another platform and operating system (OS) with third-party applications or conversion of code. If the code remains under OpenVMS and is portable enough to recompile and link, the IS organization should ensure that the code is well-documented in case the original developers depart before Itanium production systems are deployed. Even with such flexibility, the IS organization should restrain further development. Loss of the people who developed the code and poor documentation may mean starting from

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scratch or switching to third-party packages that may not be available for OpenVMS. At worst, HP intends to provide a binary translation tool at a likely trade-off in performance.

What is the level of in-house administration and technical skills?

If OpenVMS skills become increasingly difficult to find or keep, then it's very likely that the IS organization will pay increasingly higher costs for the maintenance of OpenVMS over time. We believe that users will inevitably face this difficulty and that HP will not be able to assure the OpenVMS community of the size and distribution of technical and administrative skills. Most of the "new IT skills" emerging in the market will be focused on Linux, Microsoft .NET, deployment and provisioning, and advanced database administration, while proprietary environments will continue to suffer skill attrition. Users can help soften the impact if OpenVMS programs move to Java and C++ as the common development and program environment.

What is the degree of interoperability and systems integration with other enterprise systems?

The remaining loyalists have mostly used OpenVMS clustering and high-availability solutions as a testament to its high reliability and scaling. These IS organizations' reluctance to move from OpenVMS is partly from the fear that an alternative OS, such as Windows or Unix, will not provide comparable reliability and ease of use. These OpenVMS systems are operationally viable, but organically (growth in applications) static. Therefore, they should be positioned as high value to operations, low value to application expansion. Despite some of the protocols offered for interoperability (TCP/IP, COM for OpenVMS, Pathworks), we remain skeptical of OpenVMS playing roles as peer nodes in Windows and Unix networks.

What is the vendor's road map for the platform?

HP has decided to continue an OpenVMS road map entailing the movement of a good deal of the system code to Itanium. According to HP, the reason is that the Itanium migration is considerably simpler and easier to manage than the VAX-to-Alpha migration, its estimated internal costs will be reasonable (estimated in the $40 million range), and the current OpenVMS/Alpha revenue stream is profitable. However, the real issue is whether the program will translate into user benefits. HP must prove that the costs of migration to users will provide longer-term returns than a migration to an alternative platform. IS organizations therefore must assess the following:

1. How much of the code can move intact with compatibility maintained on Itanium 2?
2. What parts of the system code and layered software will continue to be supported vs. that designated "end of life"?
3. How well will the code perform on the designated new Itanium platforms?

These questions will remain indecisive until completion of the OpenVMS port and the delivery of production platforms on which users can run test profiles. Users will probably not have definitive answers before 2005, but HP intends to report on milestones of its posted road maps on its Web site.

What are the vendor's technical support resources?

Although HP may have the OpenVMS installed base's interest at heart, it will be exceedingly difficult to maintain a core of well-trained specialists worldwide that can service all of the OpenVMS accounts with mission-critical responsiveness. Simply put, IT careers are made on growth platforms as opposed to legacies considered remnants of a bygone era, regardless of the technology's superiority.

What is the rate of advancement and functional improvements for the platform?

As a leading indicator, users must trust HP and its partners to provide a continual stream of enhancements. If it cannot, or is not willing to provide the investment and marketing effort, OpenVMS will lack traction and strategic value. Although HP claims 400,000 systems and a continuing profitable revenue stream of $2 billion as justification for continued support, HP must nevertheless prove that the OS fits well into the evolving commodity nature of the hardware market. Systems supporting OpenVMS must be modular, be flexible and support a variety of software solutions to compete effectively. OpenVMS users should not expect priority responsiveness with the other merger details, road maps and costs vying for attention, with the exception perhaps of Galaxy, a partitioning scheme for AlphaServers that must be moved to Itanium.

What are the suggested targets for an upgrade?

Currently, HP's strategy consists of upgrades of HP-UX platforms such as Superdome to Itanium and the introduction of two-way and four-way Itanium 2 systems (announced 8 July 2002). Users must be apprised of the complete system road map encompassing the replacement of the Alpha GS series, including performance data and test suites. AlphaServer systems are an alternate choice, with a chip upgrade due in 2004, but with a high

probability of no further shipments after 2006 and cessation of support by 2011.

What other vendor systems directly or indirectly compete for market attention?

HP intends to continue to support NonStop systems, ship AlphaServers to about 2006 (with continued support of Tru64 but without further enhancements), ship PA-RISC systems with HP-UX, oversee user migrations from PA-RISC to Itanium and continue server marketing programs for Windows (ProLiant family), blades and Linux. Thus, OpenVMS must be evaluated in the context of a broad product portfolio and its effectiveness to contribute to HP's bottom line. So far, HP is suggesting that OpenVMS is a strategic installed base. However, we believe that the true test will be speed of execution in moving users to Itanium. Inordinate delays would have an atrophying effect and could divert resources and marketing attention to the winning platforms.

How profitable, under scrutiny, is the revenue stream for the platform?

HP maintains that OpenVMS business is profitable and maintenance revenue is good enough to sustain a business of continuing support for OpenVMS. Users should evaluate their own support expenses. If the platform is operationally self-sustaining at minimum cost, there should be no urgency to migrate to other platforms or operating environments. HP has indicated that it intends to create a Unix-like OpenVMS environment and attract Unix developers and applications to the platform. We would advise users not to be lulled by this. Such programs have had minimal success in the past (for example, IBM's attempt on the mainframe with Unix Systems Services) and represent a contrarian view of building more Unix variants than the market seeks in this era of consolidation.

Has vendor management made a firm commitment to the platform's viability?

We have been pleasantly surprised by HP and Compaq's serious endeavor to enhance the viability of OpenVMS with a detailed road map. Had there been a muted response after the merger, we would have declared an earlier end of life. Such an effort is worth recognition but not a passport to sustained long-term viability. OpenVMS users may feel more breathing room, but they must still remain alert to the road map's progress.

What will be the maximum period the user/organization can remain on the platform before organizational ineffectiveness sets in?

Eventually, because of limited development, infrequent refreshment of the technology, and a lack of human resources or application choices, an organizational IT program on OpenVMS will atrophy on the platform. As an outside target, OpenVMS could continue to survive through 2010, but the relevant issue is IT effectiveness: will it meld with the strategic directions and applications of the enterprise, or will it remain an island of computing, doing its limited jobs well but outside the organic growth of IT. HP is hoping that enabling Java development, Web services and selected ISVs such as BEA Systems and Oracle will make OpenVMS as vital as other operating environments. However, such endorsements and tools are only as effective as the speed with which enhancements are delivered to the platform. In an era of consolidation, Oracle and SAP are bent on a course of consolidating to a few Unix variants with hopes that Linux becomes the standard environment. Then, fewer ports will need to be maintained, reducing the ISV's internal resources and costs.

How much will a migration cost?

Third-party systems integrators and specialists in converting code and system software should help users assess the costs in migrating to HP's Itanium on OpenVMS vs. targeting another OS and platform. Costs could range from a low end of $100,000 (three-month project) to a high end of $3 million (eight months), based on the type and amount of code (for example, assembly code, 3GL, 4GL), retraining and redeployment. Among third parties in this market are Sector7 and TKM Digital (formerly Digital India). HP offers free assessments and workshops to minimize upfront costs, but the actual migration costs must still be borne by the user.

Bottom Line: The issue for most users is not whether to migrate, but when. We believe OpenVMS is not a sustainable strategy other than for specific and short-term tactical needs or budget constraints. If users intend to see the OpenVMS transition through to Itanium, then we recommend that they negotiate for service credits and loaners to minimize cost burdens during the transition. Such credits can come in the form of preliminary migration assessments, performance analysis, compatibility certification and loaners for pilots. If HP cannot provide specific timetables and products for the transition by mid-2003, users should have, and resort to, a contingency plan to an alternative platform. For the small, but statistically significant, number of governmental and defense users of OpenVMS with much longer

Acronym Key

HP	Hewlett-Packard
ISV	Independent software vendor
OS	Operating system

support expectations and less dependence on ISVs, these users should remain with OpenVMS and demand support from HP even beyond HP's stated end of support around 2011.

Appendix I - HP OpenVMS Rolling Roadmaps External

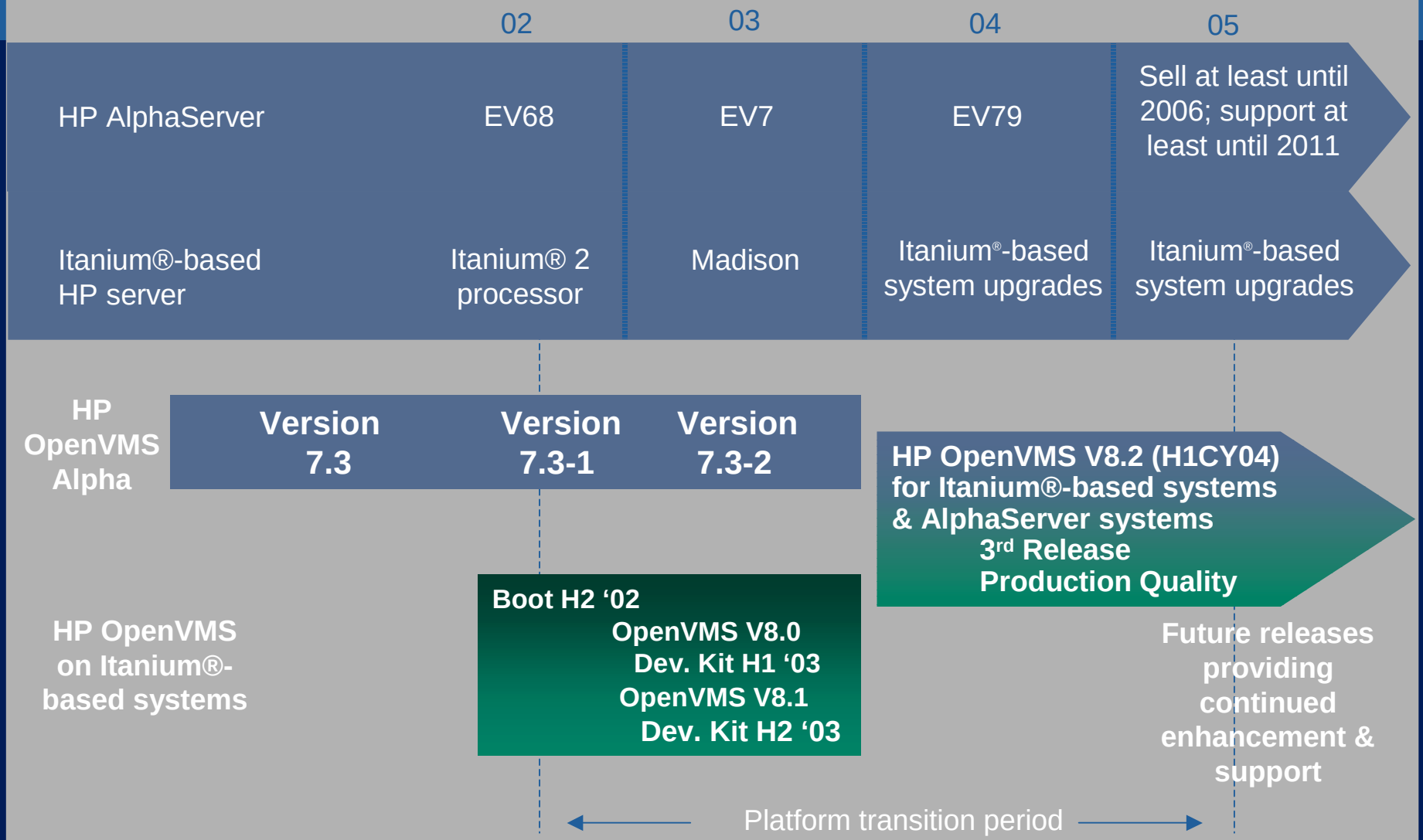
hp OpenVMS Rolling Roadmaps

HP makes no warranties regarding the accuracy of any information disclosed. *This time sensitive information is provided to facilitate customer planning processes.* HP does not warrant or represent that it will introduce any product or feature to which this information may relate.

These roadmaps are updated every two to three months.

hp OpenVMS Itanium®-based Architecture Porting Roadmaps

hp OpenVMS roadmap



hp OpenVMS Itanium®-based Systems Roadmap

H1 03	H2 03	H1 04	H2 04

1st Boot occurs/Internal Kit

First Ship

H1 03: OpenVMS V8.0 "Mako"
Audience: Key ISVs, Partners, Early Adopters
OpenVMS Itanium Operating System, Monitor Utility
Networks: DECnet Phase IV, TCP/IP
Development Tools: Cross Linker, Librarian
Cross Compilers: C, C++, BLISS, FORTRAN, IMACRO

H2 03: OpenVMS V8.1 "Jaws"
Audience: Key ISVs, Partners, Early Adopters
Limited cluster functionality (4 nodes)

Native Compilers: C, C++, BLISS, FORTRAN, IMACRO, Pascal, BASIC, COBOL

Additional Language Support: JAVA

Additional Layered Products…Networks, Data Serving, Security, eBusiness Integration, Application Development

Internal releases

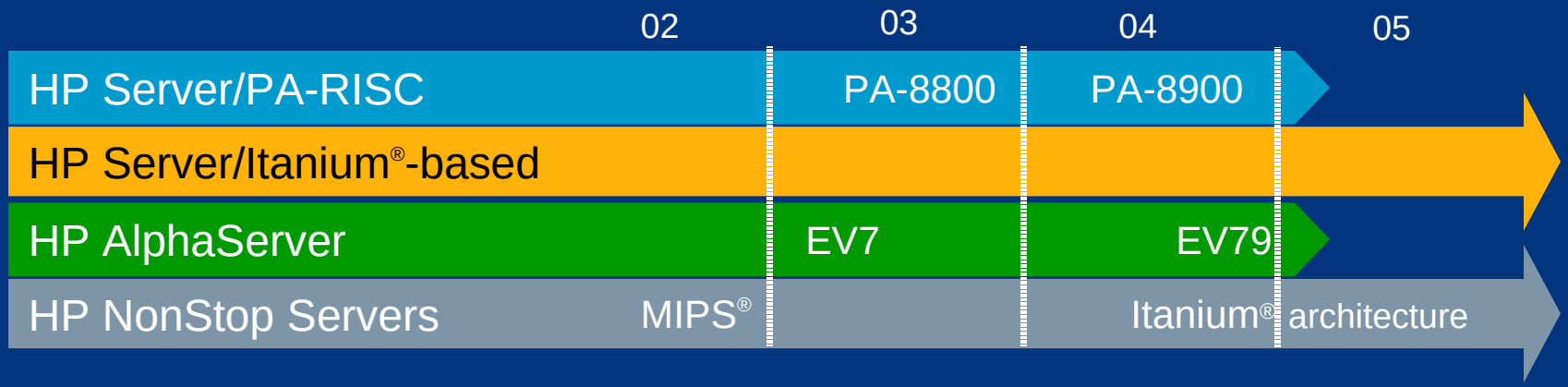
External releases

Production Quality

→ **OpenVMS V8.2**

hp Systems Roadmaps

BCS leadership system roadmaps



HP Server/PA-RISC	deliver leading PA-RISC servers based on existing roadmaps
HP Server/Itanium®-based	provide compatibility with PA-RISC servers and support HP-UX, Linux®, Windows®/64, and OpenVMS
HP AlphaServer	deliver on published roadmap, planned sales at least till 2006, with support at least until 2011
HP NonStop Servers	published roadmaps remain unchanged

no change to existing server roadmap commitments

hp AlphaServer roadmap

- deliver HP AlphaServer systems according to published roadmap, including EV7 and EV79-based systems
- Sales at least until 2006, with support at least until 2011
- protect customer investment through “best-in-class” migration program
- flexible upgrade paths, allowing customers to move when ready

hp AlphaServer evolution

GS80
GS160
GS320

GS1280
8p, 16p

GS1280
32p

GS1280
64p

CPU: EV7 1.15GHz
Type: new-box
OS: HP Tru64 UNIX®, HP OpenVMS

CPU: EV79
Type: in-box
OS: HP Tru64 UNIX, HP OpenVMS

Superdome

CPU: Itanium® next gen
Type: new box
OS: OpenVMS
HP-UX 11i v3
Linux
.NET

rx86xx

CPU: Itanium next gen
Type: new box
OS: OpenVMS
HP-UX 11i v3
Linux
.NET

ES45

ES80

CPU: EV7 1GHz
Type: new-box
OS: Tru64 UNIX, OpenVMS

ES47

CPU: EV7 1GHz
Type: new-box
OS: Tru64 UNIX, OpenVMS

CPU: EV79
Type: in-box
OS: Tru64 UNIX, OpenVMS

rx76xx

CPU: Itanium next gen
Type: new box
OS: OpenVMS
HP-UX 11i v3
Linux
.NET

rx56xx

DS10, DS10L
DS20E
DS20L
DS25

DS15

CPU: EV68 1GHz
Type: new-box
OS: Tru64 UNIX, OpenVMS

rx2600

CPU: Itanium next gen
Type: new box
OS: OpenVMS, Linux
HP-UX 11i v2, .NET

CPU: Itanium next gen
Type: in-box
OS: OpenVMS
HP-UX 11i v3
Linux
.NET

2003 2004 2005

subject to change without notice – current as of October 1, 2002

hp OpenVMS Alpha, VAX and Itanium®-based operating system

- Releases, COE
- UNIX Portability
- Clusters
- Storage
- LAN
- Security

hp OpenVMS Operating System Roadmap

OpenVMS Alpha V7.3-2 (Opal)
Minor Release
FRS: Q4CY2003

- Ongoing EV7 platform support
- Performance Enhancements
- Unix® Portability Standards
- Availability enhancements
- DECwindows XllR6 support

OpenVMS V8 on Itanium®-based architecture
Initial Release (V8.0): H1CY03
Update Release (V8.1): H2CY03

HW Update to V7.3-1
V7.3-1 plus HW remedial kit
FRS: January 2003

- EV7 New System Support

OpenVMS V8.2 (Topaz)
Major Feature Release
Platforms: Itanium®-based , Alpha & VAX
FRS: H12004

- Performance
- Security
- Storage
- Standards
- Alpha Compatibility with OpenVMS Itanium®
- Clusters

OpenVMS V8.x
New Feature Release
Platforms: Alpha and Itanium®-based
FRS: H12005

- Performance
- Security
- Storage
- Standards

OpenVMS releases

OpenVMS Cluster Roadmap

Shadowing Enhancements
- MiniMerge Support (Write History Logging) for HSG80/FC Environments

Version 7.3-2
- Dynamic Volume Expansion
- Shadowing Dissimilar Device support
- Cluster Performance Enhancements
  - PE Driver Fastpath

Mixed-Architecture Alpha/Itanium® Clusters
- Add-in new systems to existing clusters!
- Tap into existing FC storage fabrics

New Cluster Interconnect
- LAN over FC Adapter (DT Capabilities)

New Cluster Interconnect
- Infiniband (Itanium®-based Platform Only)

Unix Portability Roadmap

OpenVMS Alpha V7.3-2 (Opal)

- CRTL
  - •User database functions
  - •UNIX style signal functions
  - •UID/GID
  - •poll()
  - •File I/O
- •GNV 4.1
  - •Bbzip2
  - •Gawk
  - •Man
  - •Improved complier interfaces (cc,gcc)

OpenVMS V8.2 (Topaz)

- •CRTL
  - •Binary Tree
  - •Asynch I/O interfaces
  - •Symbolic links
  - •Byte range locking
  - • glob()
  - •semaphores
- •GNV
  - • VI (and other tools)
  - • Configure and make improvements

OpenVMS futures

- • Full function select()
- •fork ()
- •forkable IO
- •Shared memory APIs
- •UNIX 98 compliance

OpenVMS V8.1 (Itanium ports of)

- • CRTL
- • GNV

OpenVMS Storage HW Roadmap

Lower cost FC - MSA1000 (Q1 2003)
- 2-node support Arbitrated Loop at FRS
- Switched Support (using existing external Switch)
- Imbedded Switch early Q2 2003

Virtualization Support
- SV3000 Investigation
- VersaStor HBA H1 2004

Continued EVA and Device Support
- Support of new Storage EVA solutions
- Support new storage Tape and Disk solutions (SDLT, Ultrium 2, NSR, etc)

OpenVMS Itanium® Storage Support (H1 2004)
- FC support to connect into existing SANs
  - EVA, MSA, EMA Solutions
- SmartArray support identical to existing
- Direct-Attached SCSI support of Itanium® Infrastructure

Backplane RAID Support (SCSI)
- U160 (SmartArray) Q4 2002
- U320 (SmartArray) H2 2003

Hardware Mirroring Support
- EVA/DRM Support (H1 2003)

Hardware Mirroring Support
- EVA/DRM Enhanced Support (H1 2004)
  - Active/Active, Multi-Site
  - Viable Alternative to HBVS

OpenVMS Enterprise Backup Solutions Roadmap

HP OpenView Data Protector
- Initial Release V5.1 (Q3 2003)
  - -First version with OpenVMS support
  - -Media Agent , Disk Agent, ODS5

HP OpenView Data Protector
- Enhancements – Oracle, Oracle Rdb

Legato NetWorker
- Initial Release (Q4 2002)
  - Client, Storage Node

Legato NetWorker
- Enhancements – Oracle, Oracle Rdb, ODS5 Support

Archive/Backup System V4.1:
- Support for new OS Versions
- More scheduling options
- GUI enhancements
- NSR support (M2402)
- Remote cataloging

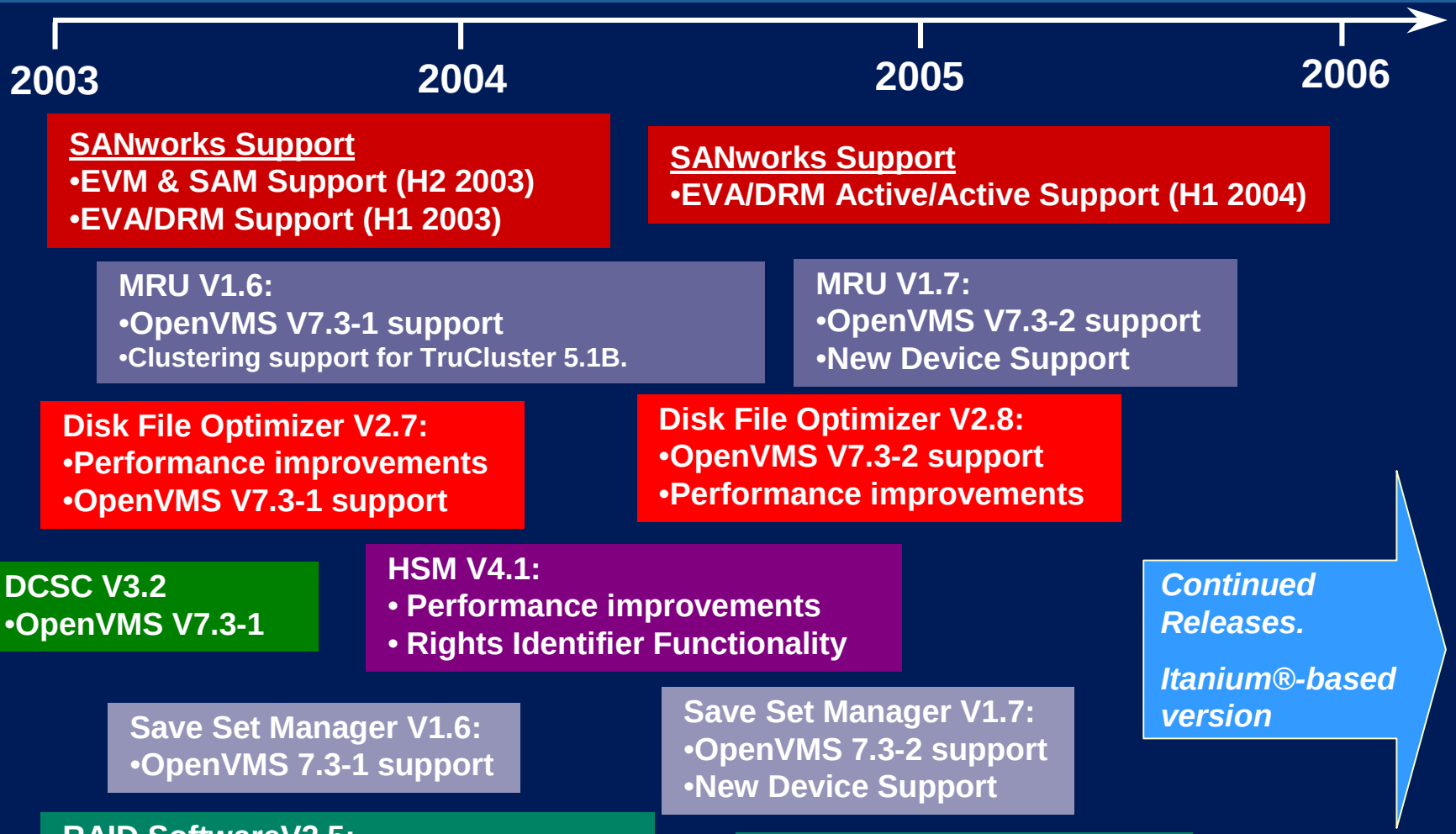
Archive/Backup System V4.2 & HSM V4.2
- Support for new OS versions
- New device support
- Bug fixes

Continued Releases.

Itanium®-based version

Storage Library System V2.9H:
- New device support

OpenVMS Storage SW Roadmap



OpenVMS LAN HW Roadmap

OpenVMS Alpha V7.3-2 (Opal)

- DEGXA Gigabit Ethernet boot driver with Boot support
- LAN FastPath support
- LAN Device Fail over (NetRAIN)

OpenVMS Alpha V8.2 (Opal)

Dual Gigabit NIC support

NetRAIN improvements

10 Gigabit NIC (Investigation)

***OpenVMS Itanium®-based* Ethernet support**

- DE600 support (Fast Ethernet)
- DEGXA support (Gigabit)

OpenVMS Security Roadmap

ITSEC C2 Security Evaluation on V7.2-2

TCP/IP

SSH V2 SDK

OpenVMS Alpha V7.3-2 (Opal)

- Updated versions of:
  - OpenSSL
  - Kerberos
  - CDSA
- Unix® Portability features:
  - UID/GUID support
  - Case Sensitive Passwords
  - CDE deadman
  - CDE screenlock
- ACME Login (SDK)
  - LDAP ACME Agent

OpenVMS V8.2 (Topaz)

- ACME Login
- Kerberos (incl VAX support)
- OpenSSL (incl VAX support)
- Buffer Overflow Protection

Open Source Security Tools

- Stunnel (secure tunnel)
- GnuPG V1.2

OpenVMS V8.1 on Itanium®-based platforms

Full Security support

OpenVMS eBusiness Integration Technologies

- Data Serving
- Integration
- Collaborative Computing

OpenVMS eBusiness Integration Technologies

Secure Web Server V1.4 (Apache 1.3.xx based)

Secure Web Server V2.0 (Apache 2.0 based)

Secure Web Server on Itanium® -based architecture

Attunity Connect V4.0 (formerly ISG Navigator)

Attunity Connect on Itanium®-based architecture

DECforms V3.3

DECforms V3.4

DECforms V4.0 on Itanium®-based architecture (H1 2005)

Secure Web Browser V1.2.1

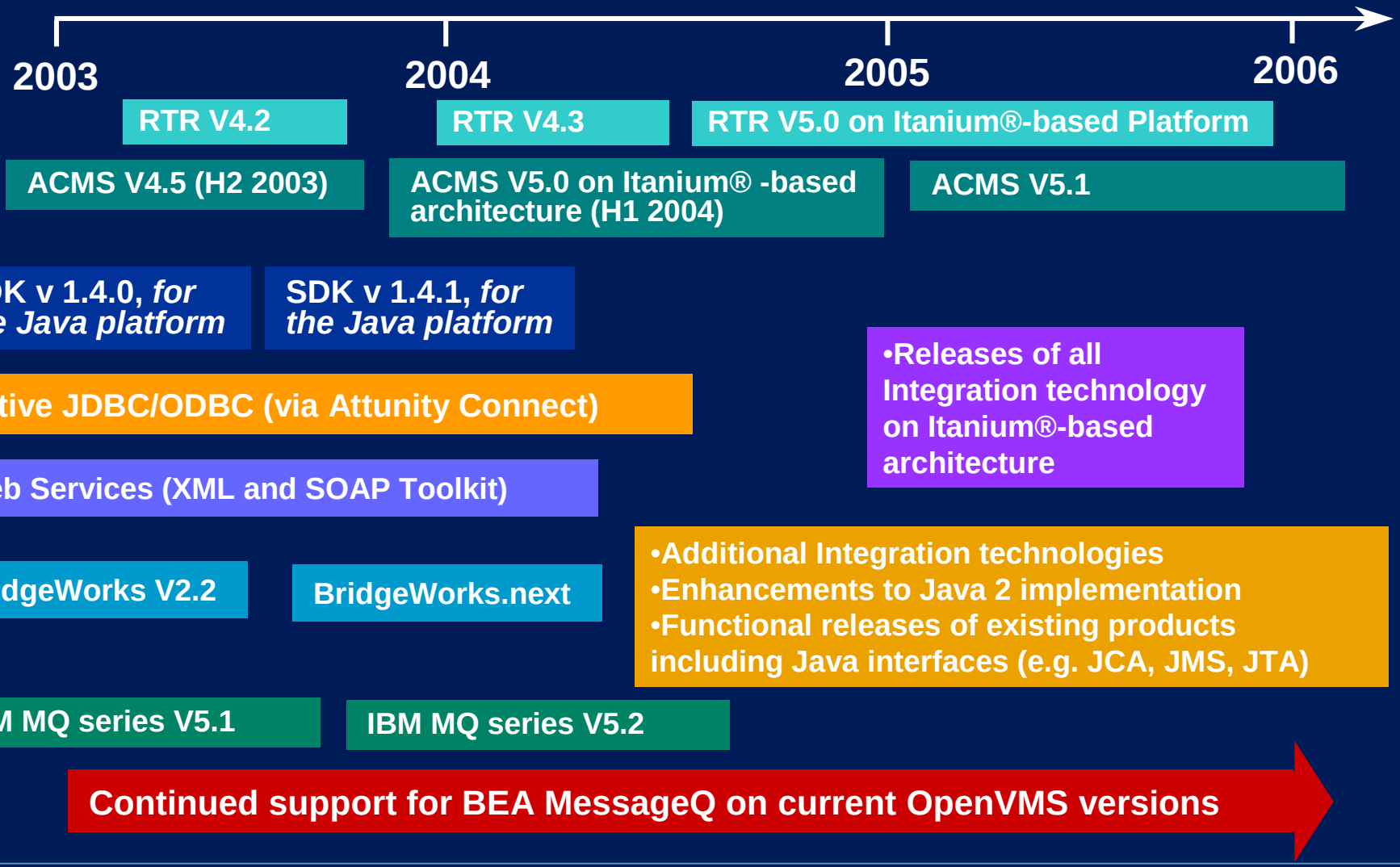
Secure Web Browser (based upon Mozilla) on Itanium® -based Platform

TP Web Connector V1.4 on Itanium® -based architecture

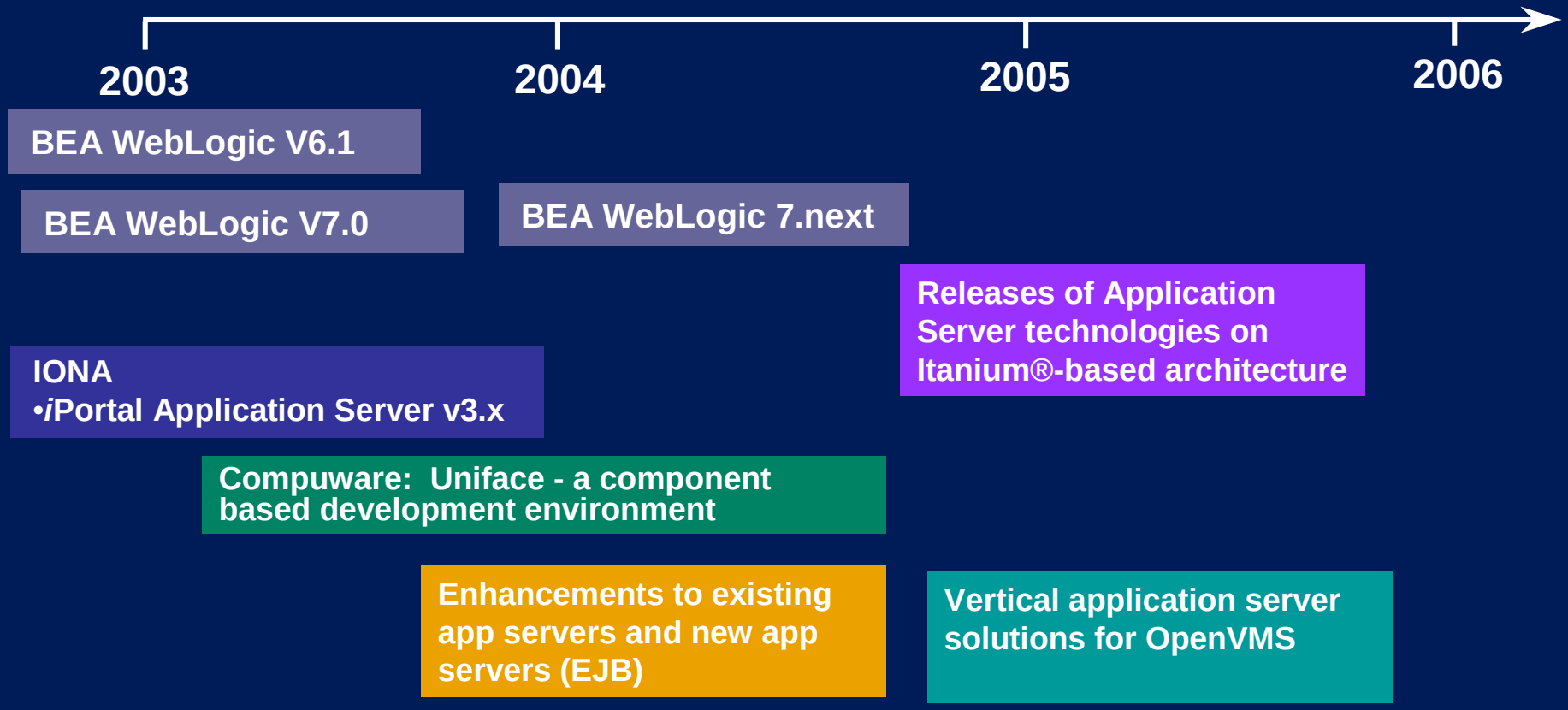
TP Desktop Connector V3.3 on Itanium® -based architecture

- Functional releases of existing data serving products
- Additional Data Serving technologies

OpenVMS *e*Business Integration Technologies

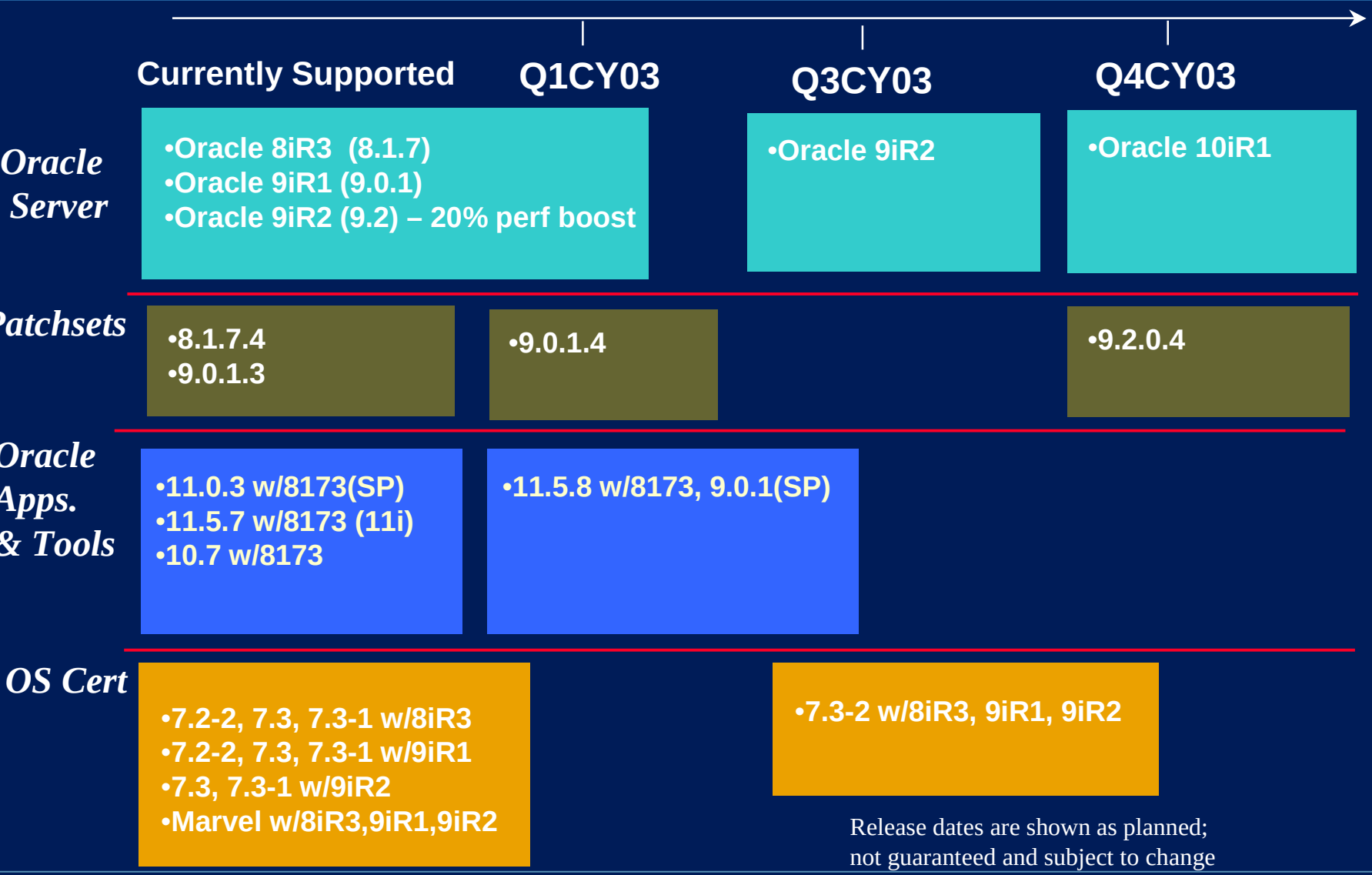


OpenVMS *e*Business Integration Technologies



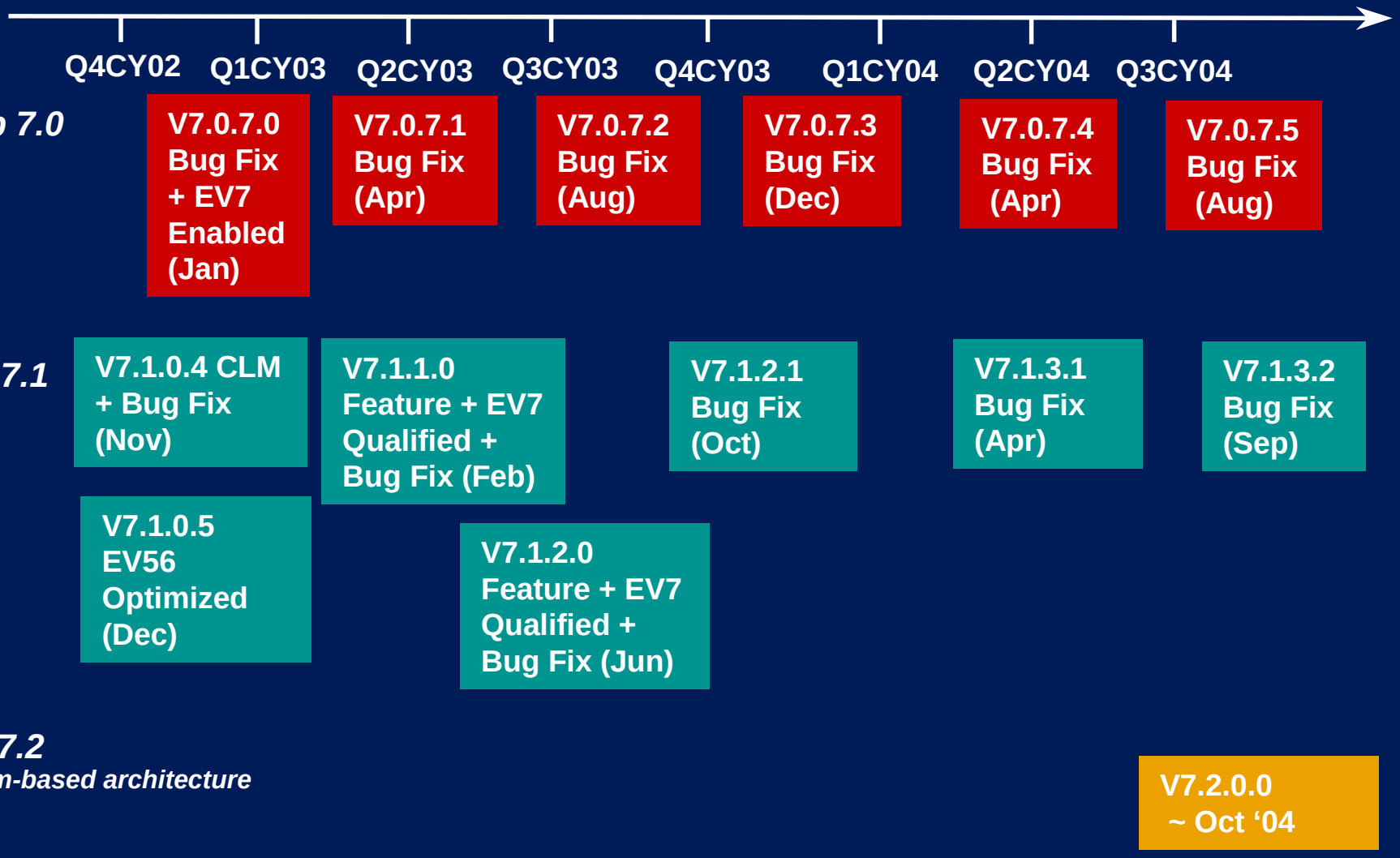
Database Solutions

Oracle® 8i/9i OpenVMS Roadmap



Release dates are shown as planned; not guaranteed and subject to change

Oracle® Rdb Roadmap



System Management

- hp OpenView Integration Planning
- Partner OpenVMS Solutions
- hp Web Management Agents
- hp OpenVMS Solutions

hp OpenView Integration Planning

Available Today

Network Node Manager:

- OpenVMS systems run the Insight Management Agents

OpenView Operations:

- Manage OpenVMS systems from HP OpenView Operations
- Available from AppMind

Coming Soon

OpenView Storage Data Protector (OmniBack):

- Disk Manager & Media Manager for OpenVMS available Q2CY2003

Future Planning

Storage Area Management Client:

- Storage device management, performance analysis for storage systems, and storage resource management capabilities

OpenView Operations:

- Native HP agent investigation

System Management Roadmap
Web Management Agents

HP Insight Manager

SP1.2 Insight Manager 7
•Available now

Continued releases

OpenVMS Web Agents

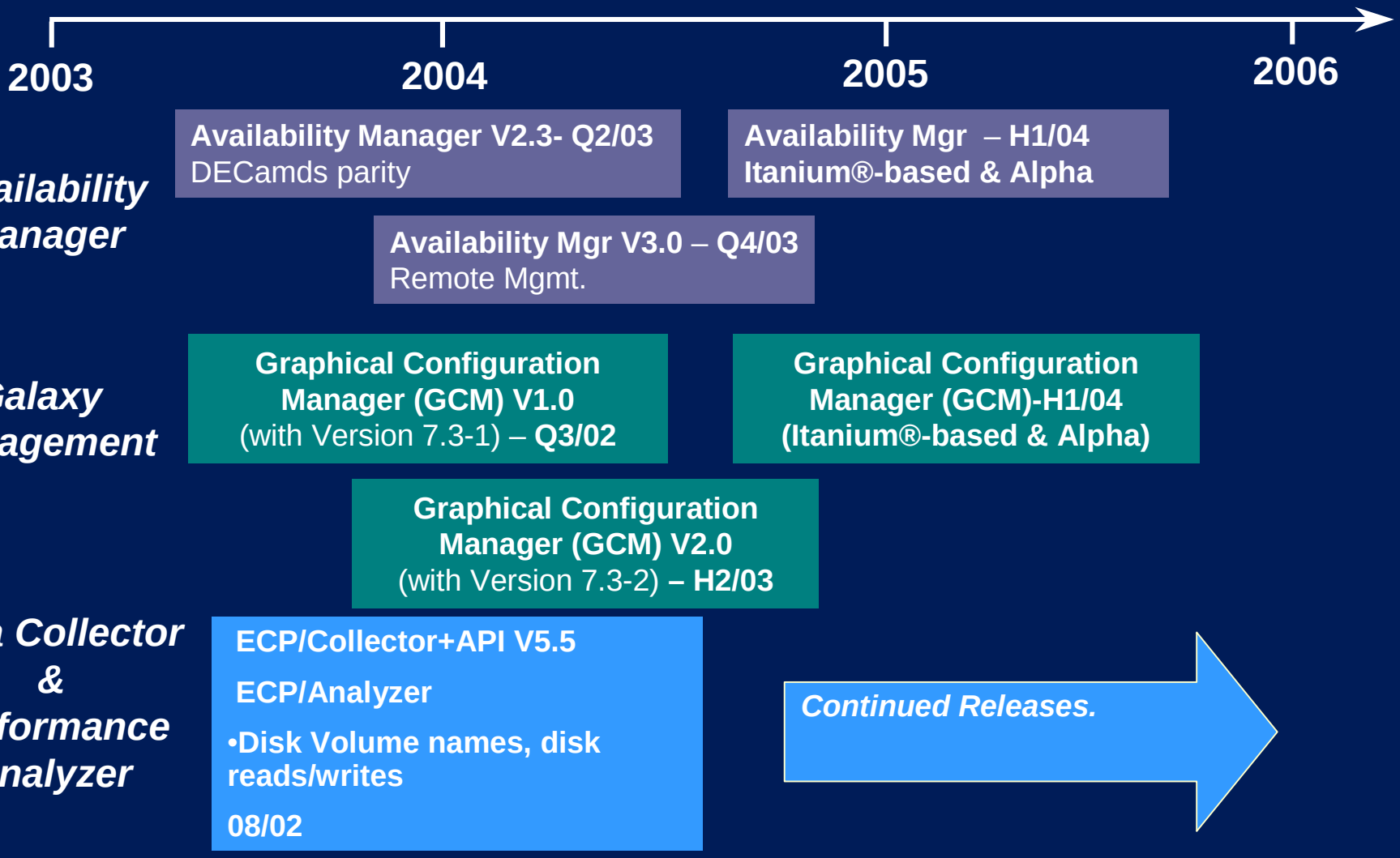
V2.4 Web Agents
SmartArray, Environmentals, Mozilla
Q2 2002

V3.0 Web Agents
SSL & Authentication
Q1 2003

Continued Releases

Itanium®-based version

System Management Roadmap
Integrated O/S Solutions



Networking Products

- **TCP/IP Services**
- **DECnet and WAN**
- **File & Print**

TCP/IP Services for OpenVMS

TCP/IP V5.4 (Oct 2003)
Featuring IP security and performance enhancements
- SSHv2 client functionality
- FailSAFE IP (IP fail over)
- Scaleable kernel
- TCP/IP kernel updated
- Perf enhancements to Telnet server locking
- NFS Server Performance enhancement
- 10k+ BG device support
- Bind 9.2.1 upgrade
- SSL POP Security
- INETDRIVER perf update
- TCPDUMP Support

TCP/IP V5.5 on Itanium® (H1 2004)
- Support for OVMS V8.2

TCP/IP (H2 2005)
Continued focus on performance & security
- BIND V9 Resolver
- DHCPv6
- IPv6 Routing
- Standards
- Improved cluster support
- Multi media support
- SCTP Support

FailSAFE IP PCSI EAK (Feb 2003)

SSHv2 PCSI EAK (Feb 2003)

DECnet & X.25 Product Roadmap

DECnet

Continued support for DECnet-Plus and DECnet Phase IV on current OpenVMS versions

Support for DECnet Phase IV on Itanium® (H1CY03)

Support for DECnet-Plus on Itanium® (H2CY03)

X.25

Continued support for new OpenVMS hardware releases and device drivers

Support for X.25 on Itanium® (CY2004)

Enterprise File and Print

Adv Server V7.3a (Q4'02) (Alpha only)
- Opportunistic Locking support
- Performance Enhancements
- Support VMS V7.3-1, V7.3, V7.2-2

Cobra (CY04) (Alpha & Itanium®)
- VAX support
- Enhanced Windows 2000 Interoperability including Active Directory
- Kerberos support
- Scalability
- Robustness

Adv Server Itanium® (H203) (Alpha and Itanium®)

PATHWORKS for OpenVMS V6.1
- Support OVMS releases on VAX and Alpha as needed

PATHWORKS 32 – V7.3 shipped in H2CY02 with support for WinXP. Continued Support for Microsoft Service Pack releases for Win95, 98, NT4.0 Win 2000 and Windows XP

DECprint Supervisor (DCPS) Roadmap

DCPS V2.1: (Q3CY02)
- New printers supported: HP LaserJet 2200, 4100, & 9000, Genicom, Xerox, Lexmark
- IBM InfoPrint support for Bell Helicopter
- OpenVMS V7.3-1 support

DCPS V2.2: (Q1CY03)
- HP LaserJet 2300, 4100 mfp, 4200, 4300, 5100 and 9000 mfp support
- HP Color LaserJet 2500, 5500 and 9500 support
- Autostart support
- Bug fixes
- Support for New EV7 Update Release

DCPS V2.1 added feature:
- HP Color LaserJet 4600 support

DCPS V2.3: (Q3 CY03)
- IPV6 protocol support

DCPS Future Functionality:
- Uni-directional Printer support
  - Multi-functional printer support
- Port to Itanium
- PPD: PostScript Printer Description

Transaction Processing and Middleware Software

Reliable Transaction Router (RTR)

RTR V4.2

- Quality enhancement release
- Java RTR Toolkit
- Platform support:
  - OpenVMS Alpha
  - OpenVMS VAX
  - Tru64 UNIX
  - Sun Solaris
  - Windows®

RTR V4.3

- Quality enhancement release
- RTR configuration fault detection web browser interface.
- Platform support:
  - OpenVMS Alpha
  - OpenVMS Itanium®-based
  - Tru64 UNIX
  - Sun Solaris
  - Windows®

RTR V5.0 features being considered include:

- TCP/IP V6 support
- Specific customer requests
- Integrate RTR J2EE toolkit
- Platform support:
  - OpenVMS Alpha
  - OpenVMS Itanium®-based
  - Tru64 UNIX
  - Sun Solaris
  - Windows®

ACMS and DECforms Roadmaps

ACMS V4.5

Repackage TP Web Connector and TP Desktop components with ACMS

Enhanced management interface and instrumentation

ACMS V5.0

ACMS Itanium®-based product release, including TP Web Connector and TP Desktop Connector

ACMS V5.1

Enhanced management interface and instrumentation

DECforms V3.4

- Maintenance release

DECforms V4.0
Itanium®-based product release

DECforms V3.3

- Maintenance release

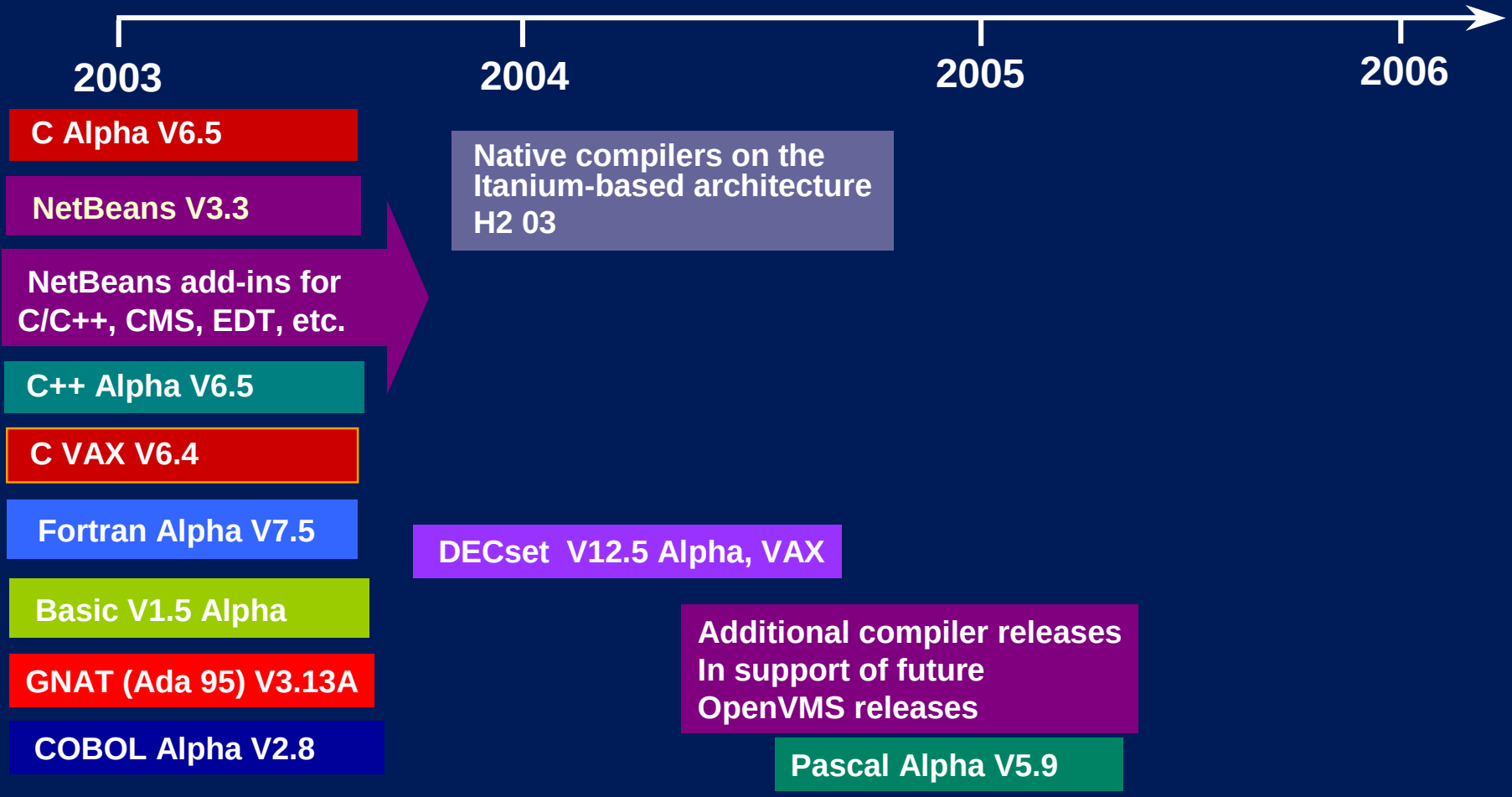
ACMS/BEA WebLogic Server Campaign – NOW !

BEA and HP Partnership

Deliver integrated solutions

Application Development Into The Future

Application Development and Deployment on OpenVMS



Mail and Messaging Roadmap

- TeamLinks Windows V5.0
  Nested Folder Support
  More Explorer-like look & feel
- TeamLinks V5.0 ECO1 – Sep 02
- MAPI Driver V7.1
- Office Server V6.1
- IMAP4 client/server access to VMSmail in TCP/IP Servs V5.3
- LDAP API with OpenSSL support in OpenVMS V7.3-1

Directory and Mail Backbone Roadmap

MB400 V3.2 - Jul ’03
Enhanced Cluster support

•Smtp Gateway V2.4 – Oct ‘03
S/MIME support

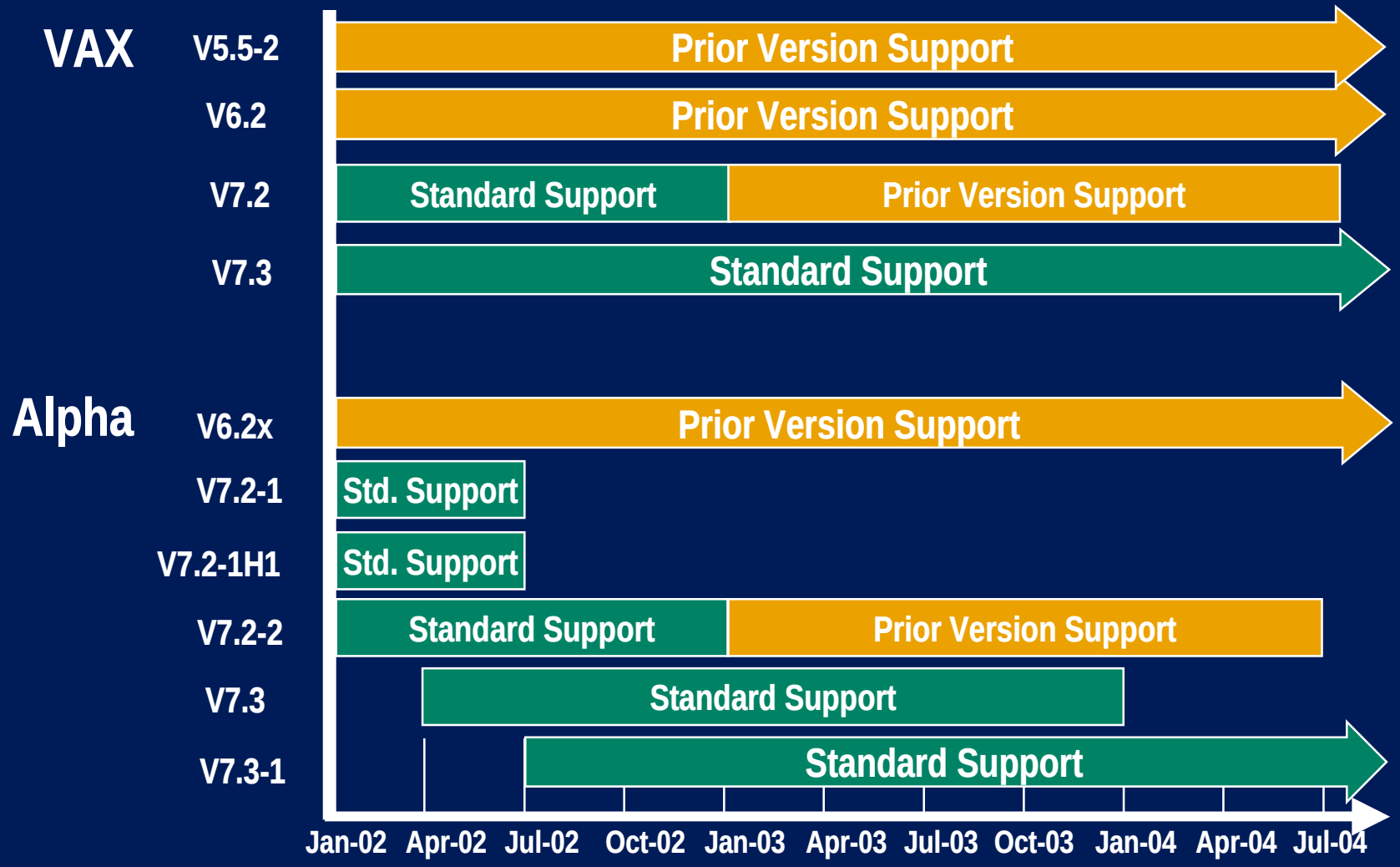
• Enterprise Directory V5.3 – OpenVMS 7.3-2
More Security; More RAS; Elimination of DECnet (optional); Mgmt GUI V2.1

• Enterprise Directory V5.4 – OpenVMS 8.2
Strong Authentication; 64-bit Addressing; Mgmt GUI V2.2

•Enterprise Directory V6.0
Dec ’04; Itanium®-based architecture port

OpenVMS
Service Support

OpenVMS Service Support Roadmap



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Appendix J – HP OpenVMS Commitment Letter
External

Hewlett-Packard Company

May 14, 2003

Mr. Bob Blackmore
Mr. Dale Batston
Mr. Ed Okeefe

Newfoundland Power Inc.
P.O. Box 8910
55 Kenmount Road
St. John's NL
Canada, A1B 3P6

Dear Mr. Blackmore,

With the merger of Compaq Computer Corporation and Hewlett-Packard Company behind us, I would like to summarize the positive outcome of the merger for OpenVMS. I am pleased to inform you that HP will continue with the previously committed AlphaServer and OpenVMS roadmaps. We delivered HP OpenVMS V7.3-1 in August 2002, delivered the Alpha EV7 technology in January 2003 and performed the first boot of OpenVMS on an Itanium®-based system January 31, 2003. Clearly, OpenVMS continues to withstand the test of time as we celebrate its 25th anniversary.

HP will deliver the AlphaServer roadmap announced in June 2001 along with the associated feature enhancements of OpenVMS on AlphaServer systems. This includes the EV79 version of the Alpha processor, which will be the follow-on to the newest generation, EV7-based HP AlphaServer systems supporting OpenVMS, Tru64 UNIX®, and Linux. HP will sell AlphaServer systems at least until 2006, with support through at least 2011.

OpenVMS remains a strategic product. We are committed to continuing the port of OpenVMS to Itanium architecture-based HP servers, and transitioning our HP OpenVMS application portfolio to the Itanium architecture as previously committed. We expect initial availability of OpenVMS on Itanium architecture-based HP servers in the first half of 2003 with an evaluation release for ISVs and early adopter customers, and a full production release in the second half of 2004.

ISVs have been a very strategic part of our success with OpenVMS in target markets such as Healthcare, Public Sector, and Finance. These ISVs are very excited about the opportunity that the Itanium architecture-based HP servers will provide to the long-term success of OpenVMS.

We are committed to enabling our customers to deploy Itanium-based HP systems on their own schedules and to making the transition to the Itanium architecture-based HP servers as smooth as possible. Existing OpenVMS applications will run on the new servers with little or no modification. To help facilitate this, we will provide source compatibility for OpenVMS applications, and where sources are not available, binary compatibility as well.

I want to personally assure you that the capabilities for which you have come to depend upon in OpenVMS – leadership clustering, high availability and "bullet-proof" operations – will continue to be delivered by HP. There is no more important asset to HP than you, our users.

In closing, be assured HP is committed to the published roadmaps for the OpenVMS operating system and the AlphaServer system family, ensuring product leadership now and in the future.

Should you have any questions or issues, please do not hesitate to contact me.

Mark Gorham
Vice President
OpenVMS Group
Hewlett-Packard Company
Mark.Gorham@hp.com

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UNIX is a registered trademark of The Open Group.

Appendix K - HP CSS Applications Options Review External

Newfoundland Power

Customer Service System (CSS) Application

Options Review

Abstract: The purpose of this document is to provide a review of the options available for Newfoundland Powers mission critical Customer Service System (CSS) application.

Prepared for: Dale Batstone
Application Manager
Information Technology Services
Newfoundland Power
dbatston@newfoundlandpower.com

Prepared by: Kerry Main
Solutions Architect
Consulting and Integration Services
Hewlett-Packard (Canada) Co.
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Version V1.0 – April 7, 2003

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Preface

Distribution Control	
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HP Services Sales	Scott Smith
Customer Project Manager	
Customer Operations	
HP Customer Services	
Technical Review List	
Change History	
Version	**Date**
Initial Version	

Table of Contents

1. Executive Summary

Newfoundland Power is an investor owned utility whose business is the generation, transmission and distribution of electricity in a regulated environment.

Newfoundland Power and its predecessor companies have been engaged in the production and sale of electricity since 1885. Newfoundland Power, a regulated investor owned electric utility, serves approximately 220,000 customers throughout the island portion of the province of Newfoundland and Labrador.

At the heart of its Customer Services operation is a mission critical application called Customer Service System (CSS). This is an application that has been customized over the years to better address the unique requirements of its Customer base. Among other things, it allows its call center representatives to address all of its service orders, billing and customer calls.

CSS is a COBOL based application that runs on the HP OpenVMS Alpha operating system platform. In recent years the front end client portion has been enhanced with the Axiant 4GL product from Cognos Corporation.

In determining their future strategy and architectures, Newfoundland Power is currently investigating the following options with respect to the CSS application:

1. Port CSS to a new platform (preference *if* this option is chosen is Windows 2000)
2. Keep current environment, but adopt industry standard development and integration architectures and technologies.
3. Replace CSS with a new application

Making a decision to switch platforms for a mission critical application like CSS is never an easy one. Since every OS platform from every vendor has strengths and weaknesses, it is important to weigh the costs and business risks against the benefits that would be achieved in the new environment.

Regardless of the platform chosen, HP can assist Newfoundland Power in developing a future application architecture that will allow them to achieve the following business benefits:

1) Increased business agility e.g. respond to new requirements in shorter timeframes.
2) Protect current investments and minimize both costs and potential future business risks to Newfoundland Power.
3) Drive new business models and direction e.g. provide the capacity to provide partners, customers and employees with secure, real time access to information that they have been previously authorized to access anytime, anywhere – including the internet.
4) Reduce overall costs by simplifying the overall application infrastructure design.
5) Continue to build a highly motivated IT Development and Operations environment by providing them with the latest software development and management technologies

Should Newfoundland Power decide on Option 2 (Section 3), HP would like to recommend an Application Consolidation and Integration workshop be considered as its next step. It would be a way to not only protect its current investments, but also enhance its current environment with new application development, management and integration technologies.

Section 5 "Future Vision" is also provided as part of this report so that Newfoundland Power can better understand where the industry is heading with respect to IT Strategies and Architectures.

2. Current Environment

This section will provide a summary[1] of Newfoundland Powers current environment for the CSS application.

2.1 Application Configuration - Online Environment

CSS is a thin client environment where almost all business logic is executed on the server. It is comprised primarily of Cognos Axiant on the PCs and Powerhouse with calls to Cobol "back-end programs" on the server for primary business logic execution.

CSS has a graphical user interface with a windows like environment. It is a modular application with like functions grouped under series of screens called "Conversations"

It is integrated with Call Center Software from Aspect Telecommunications. There is Screen Pop capabilities and automatic call routing to Customer Account Representatives

The application contains direct access to a database of a separate outage management application from within CSS. The outage management application is PCLS - *Problem Call Logging System.*

2.1.1 Custom Software

The following is a description of some of the customized software associated with the CSS application online environment.

Desktop:	▪ Cognos Axiant 3.0. Utilizes some proprietary windows objects. ▪ Visual Basic module for specific screen handling technique
Server:	▪ Powerhouse for VMS Version 820.d3. ▪ Cobol

2.1.2 Embedded Software

The following is a description of some of the embedded software associated with the CSS application:

[1] Material supplied by the IT Staff at Newfoundland Power.

- PC Lookup Correction v1.10 from COMDATA Services Ltd. Software to ensure mailing addresses comply with Canada Post standards to obtain postal incentive rates.
- Communication with a number of windows software programs is enabled via DDE (Dynamic Data Exchange). This includes Microsoft Excel, Visual Basic program and integration with Aspect system (Screen Pop). No OLE, ActiveX, custom DLL's

2.1.3 Response Time and Availability

Response Time: The majority of on-line forms have a sub second response time. Specific "heavy" functioning forms could have a response time up to 4-6 seconds at times.

Availability: The on-line availability is approximately 99 %. And runs in update mode from 8:00 am to 8:00 pm Monday to Friday with extended read-only capabilities available outside this window.

2.2 Batch Environment

The batch processing is performed to complete high volume transactions and larger reporting requests. (e.g. post readings, post cash payments, edit accounts, calculate late payment charges, calculate forfeited discount charges, calculate bills, print bills, perform audit checks, populate collection queues, issue form letters, produce daily, weekly and monthly reports etc.)

There is a regular nightly batch "window" (8pm - 8am daily) during which full online system availability is limited. As well there are weekly, monthly, quarterly, yearly and numerous specialized processes. Nightly and most other batch processes are computer operator attended.

2.2.1 Custom Software

The following is a description of some of the software associated with the CSS application batch environment.

- OpenVMS Cobol 2.4
- ProCOBOL
- Powerhouse QUIZ, QTP
- DCL - used for job submission, execution control, printing and error handling

2.2.2 Embedded Software

The following is a description of some of the embedded software associated with the CSS application.

- PC Lookup Presort v1.04 from COMDATA Services Ltd. Software to sort mail to obtain postal incentive rates.

2.2.3 Batch and Printing

The following provides an overview of the batch and printing availability times.

Full batch window length: 10hrs and 20min.

This is from the start of the first job to the last read-only report each day. The online system is made available much sooner however the system response time is often too degraded for general call center use till full batch is completed. If the full batch window goes beyond the 8:00am start time for call center opening some read only jobs are sacrificed to ensure performance is maintained.

The following provides an indication of the amount of printing done:

Bills Printed:

- 192,000 bills are printed per month.
- This averages to 10,100 bills printed per night assuming a 19 cycle billing period. There are on average two nights per month (non-reading days) where less than 3,000 bills are printed.

Collection Notices and Form Letters:

- 14,600 Payment Reminder Notices are printed per month. About 730/day.
- 10,500 Delinquent Account Letters are printed per month. About 525/day.
- 1,400 Various form letters are printed per month.

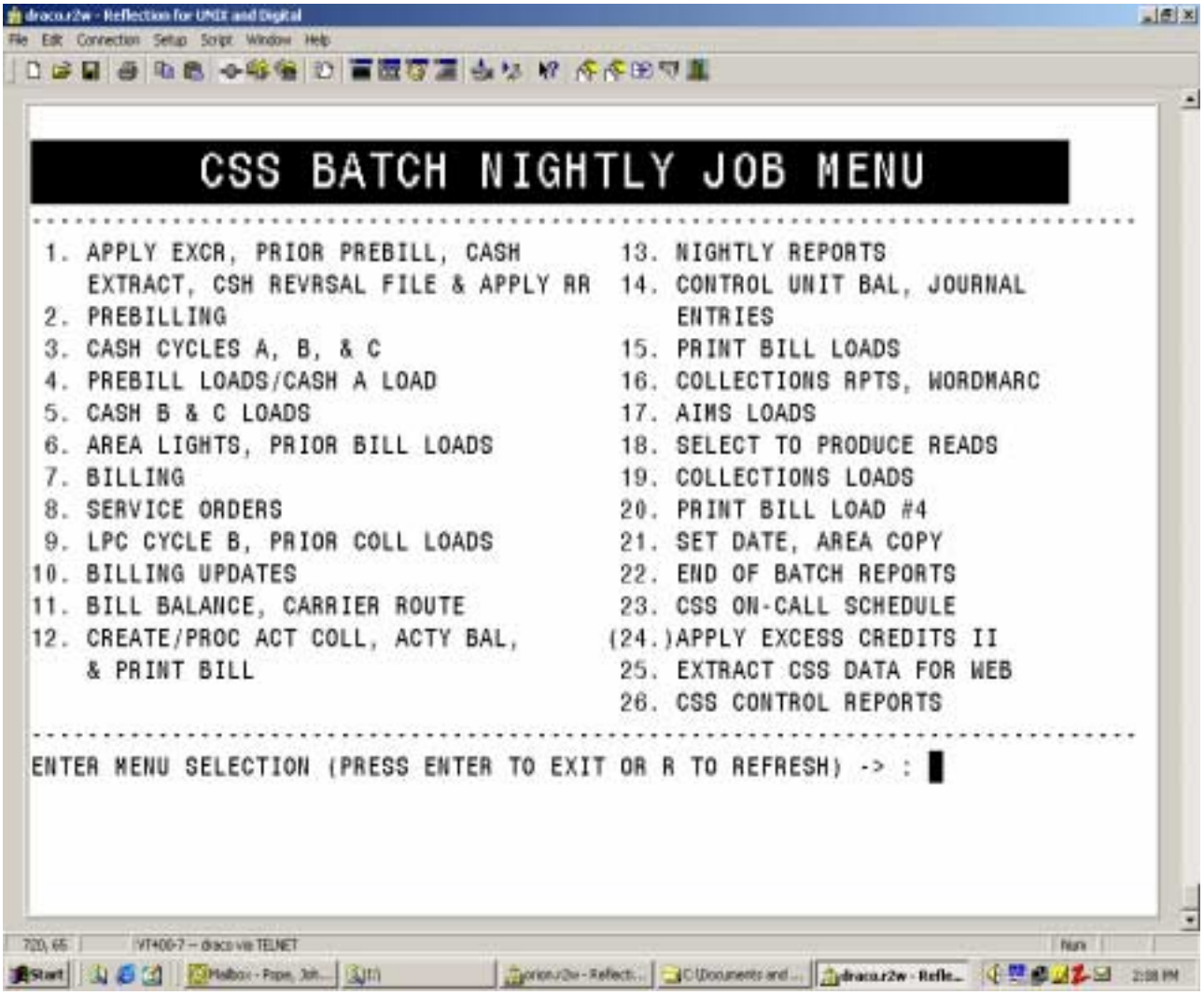
Transactions Posted:

- 121,500 cash transactions are posted per month. About 6,100 per day.
- 205, 000 readings are posted per month. About 10,800 per cycle day.

The following screen shot depicts the batch submission menu that is utilized by the operator to execute the CSS nightly batch. The batch operator interface is text based written in DCL and running on the OpenVMS operating system. The operator logs into the

DRACO server with a privileged account and executes the batch steps in a pre-determined sequence (not necessarily in numerical order). Each of the batch options can/may submit multiple jobs to be executed.

Figure 1 CSS Batch Nightly Job Menu



2.3 Data Architecture

The current data model for CSS is fully documented and is based on a Customer/1 model, which was highly customized when the system was developed. The separation of Customer, Premise and Bill Account is preserved. The data is relatively normalized and modeled accordingly.

With few exceptions all customer related data is stored in one Oracle database residing on an OpenVMS server. OpenVMS RMS files are primarily used to hold interim transactional data, control data and some reporting information and as well to load database tables during batch processing.

The following section provides additional details of the data architecture for the CSS application and associated interfaces.

2.3.1 Database Management System

The following provides an overview of the databases used at Newfoundland Power.

1. The primary customer related CSS application data is stored in an Oracle 8.1.6 database (SID: CSSPRD) residing on an OpenVMS V7.2-1 server.
2. Oracle SQLNET protocol is used for all client connections (TNSNAMES).
3. Oracle Server Standard edition 8i (8.1.6.1.2, 8.1.7.0.0) on Windows NT 4.0
    a. Corporate Reporting: Data-marts for financial and HR
    b. DataStream MP2, Avantis.PRO
    c. URM Safety Management System
    d. Customer Inquiry database for Internet, Intranet and IVR
4. Oracle Server Standard edition 8i (8.1.7.3.0) on Windows 2000
    a. ITRON Premier 4 Plus (Handheld Meter Reading)
5. SQL Server 7.0 Standard edition on Windows NT 4.0
    a. Intranet content storage
    b. Plant (Fixed Assets)
    c. Operations
    d. Forms

6. SQL Server 2000 Standard edition on Windows 2000
    a. Microsoft Great Plain's Enterprise (GL/AP/AR/Canadian Payroll/Project Accounting/Inventory/Purchasing)
    b. Microsoft Great Plain's Empower (Human Resources)
7. Workstations currently have one of several versions of the Oracle client installed including v7.3, v8.0.5, and v8.1.6.

2.3.2 Database Tuning and Monitoring Tools

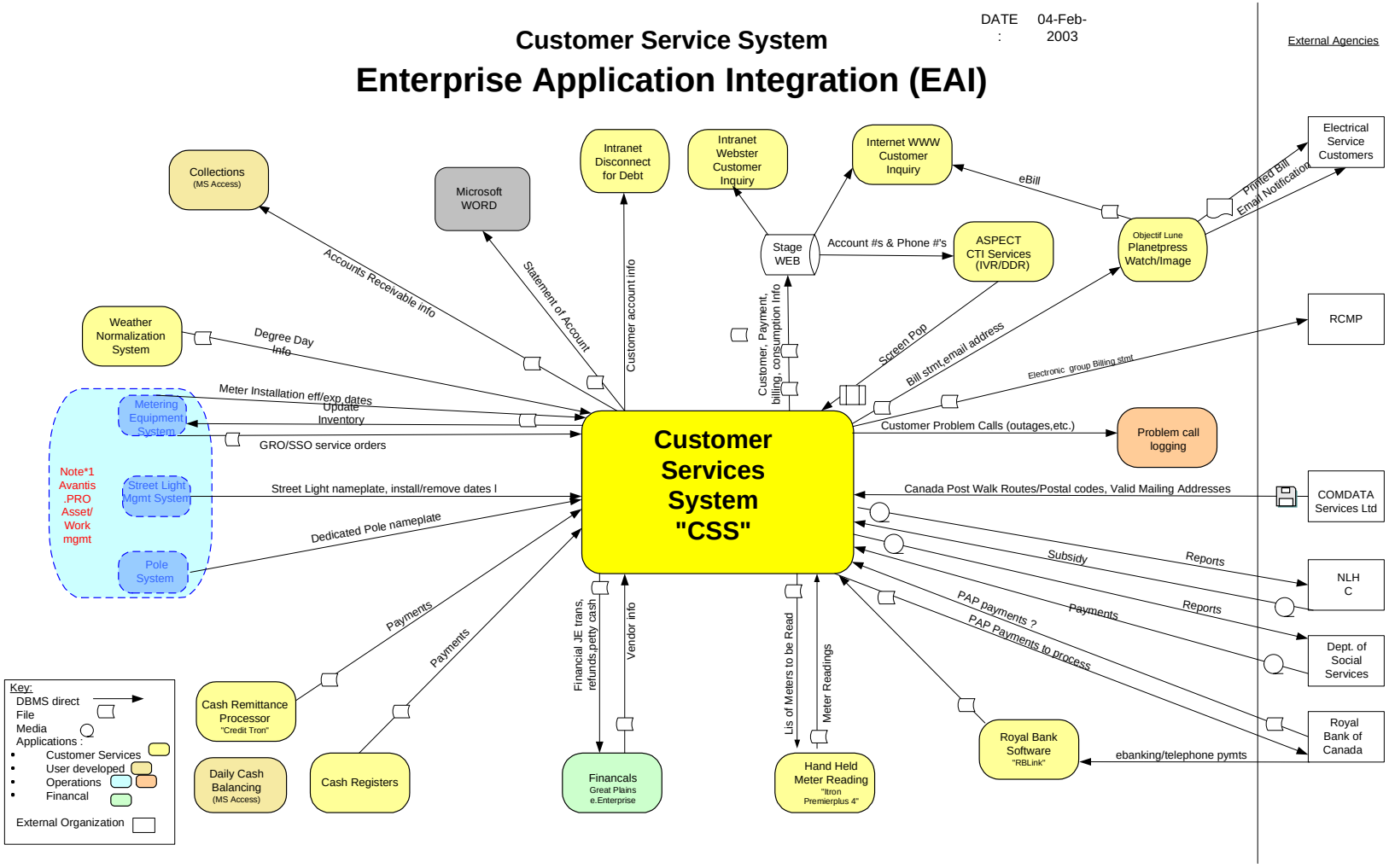
The following provides an overview of the database backups, file systems and users.

- **Database Backups**: In-house written DCL procedures utilizing OpenVMS operating system features.
- **File System**: Data of an adhoc, reporting, and batch processing nature is stored in the OpenVMS RMS file subsystem. The RMS files are formatted for sequential or indexed access.
- **Users**: 250 - 300 named users; 70-80 concurrent users daily; peaks at 100
- **Database size**: 26 gigabytes; Grows at about 2-3 gigabytes of data per year Annually purge 2.5 gigabytes of data
- **Database Reserved Memory**: 1.438 gigabytes

2.3.3 CSS Application Interfaces

Reference Figure 2 for a diagram that illustrates the CSS Application interfaces.

Figure 2 CSS Application Interfaces



2.4 Security Architecture

Multi-level security features have been developed to prevent unauthorized access at the business or database level. These include application, DBMS and Operating System level security.

2.4.1 Application Level

The CSS application has security features built in through code. It has security tables set up in the database that define functional groups and the individual screens that are accessible to the group. An administrator assigns users to a group. This is a function within the application.

Code is written to identify the user logged in and the group they belong to. This is maintained throughout the session. As the user navigates from screen to screen common code is executed to ensure the user can access the particular form. If not authorized a message is presented to the user as notification that access is denied.

2.4.2 Database Security

Application level database security is enforced thru the operating system using trusted connections.

Oracle table level security is enforced thru Oracle password protected roles.

Database views are used as a security technique to protect sensitive data.

2.4.3 File Security

Controlled with OpenVMS identifiers. The identifiers are granted during application start-up and are only available while running the application. If access is required outside the application a separate identifier is assigned to the user and this is restricted based on the users requirements.

2.4.4 Operating System Security

Usernames and passwords are required to access all systems. The user name and password is validated and based on the users specific access is given via vms identifiers. This sets the level of access allowed on the system.

2.5 Reporting Environment

This section will provide an overview of the various reporting features currently available in CSS.

2.5.1 Production Reporting

Production Reporting is basically handled through the on-line environment and through the nightly batch processing. Reports are developed through quiz and Cobol and are executed in a structured scheduled manner.

CSIS - A small reporting application written in DCL called CSIS. This basically consolidates some of the production reports, generated primarily through batch, into a central area for users. The menu has various options which print the pertinent report based on the users logon id.

2.5.2 Ad Hoc End User

CSS does not have a reporting database or warehouse available to users. All reporting is generally done from the production data source.

The DR/Test server Corvus is used for some reporting efforts as this takes pressure from the production machine and allows the users some flexibility in when and how the reports are developed and executed. Restoring the production CSS database over to the test machine as required facilitates this.

Ad Hoc reporting is available to users through 2 different avenues.

Quiz is primarily used as the ad-hoc tool of choice. Users are familiar with the tool and what is available through the dictionary.

Impromptu (Cognos report writer tool) is also utilized in a limited means. Some users are skilled in generating and executing Impromptu reports.

2.5.3 OLAP Reporting

Cognos PowerPlay is the product used for OLAP reporting.

An OLAP cube is created from daily revenue files generated from the nightly batch processing for billing/revenue analysis.

2.6 Hardware

This section provides an overview of the current hardware environment.

2.6.1 Production

Production Application/Database Server (DRACO):

- Type Compaq Digital Alpha Server 4100
- Processor: 3 5/533
- Memory: 6 Gb Ram
- Disks: Internal 7 @ 9GB 1@ 18GB 3 @ 4.3GB SAN 18@36.4GB
- Controller: 1 SE SCSI, 2 FC Controllers, 1 Raid KZPSC 1 DE500 10/100 Ethernet
- Tape Drive: TZ88, 2 DLT 7000

Disaster Recovery and Test

Disaster Recovery Server / Test Server (CORVUS)

- Type Compaq Digital Alpha Server 4100
- Processor: 3 5/ 533
- Memory: 6 Gb Ram
- Disks: Internal 8 @ 9GB 1@ 18GB 1 @ 4.3GB
- SAN 18@36.4GB
- Controller: 1 SE SCSI, 2 FC Controllers, 1 Raid KZPSC 1 DE500 10/100 Ethernet
- Tape Drive: TZ88, 2 DLT 4000

2.6.2 Development and Test

Development Server/Test (ORION)

- Type Compaq Digital Alpha Server 4100
- Processor: 2 5/ 300
- Memory: 1.5 Gb Ram
- Disks: 17 @ 9 Gb, 1 @ 4Gb total 157Gb
- Controller: 1-10/100 ETH,2 SE SCSI, 1 Raid KZPSC 1 DE500
- Tape Drive: 1 @ TZ88, 1 @ TZ87

2.6.3 Desktop Configuration

- Platform/OS: Windows NT
- Type: Dell Optiplex GX110+/L Pentium III
- CPU: 733
- Hard Drive: 12.4 gigs
- Monitor: 17 inch Dell Monitor
- Memory: 256 MB

3. Target Environment Options

In determining there future strategy, Newfoundland Power is currently investigating the following options:

1. Port CSS to a new platform (stated preference *if* this option is chosen is Windows 2000)
2. Keep current environment, but adopt industry standard development and integration architectures and technologies.
3. Replace CSS with a new application

Regardless of the decision on which platform(s) it decides is the way forward HP is a multi-platform company that can assist Newfoundland Power to fast-tack them to achieving their desired end state.

This section will provide some thoughts for consideration by Newfoundland Power as they go through the process of determining their future plans.

The goal of the following sections is to ensure Newfoundland Power takes into consideration all of the issues and technical considerations when determining their future IT Architecture.

3.1 Overview

Making a decision to switch platforms for a mission critical application like CSS is never an easy one. Since every OS platform from every vendor has strengths and weaknesses, it is important to weigh the costs and business risks against the benefits that would be achieved in the new environment.

The following sections will discuss a few of the platform options that are available to Newfoundland Power.

3.2 Option 1 - Port CSS to New Platform

HP was requested by Newfoundland Power to investigate some ball park estimates of other large application porting estimates and what it might cost to port CSS to either Microsoft Windows or one of the various UNIX environments.

The HP porting centers typically require a 1-2 day on site code analysis and workshop with the Customer in order to provide a detailed estimate, but the following “rule-of-

thumb" (application only) for a typical large mission critical application came from an experienced developer in one HP porting center:

- $1 per line of code if the code is fairly straight forward, is based on industry standards (Fortran, COBOL etc) and has minimal optimization for a specific hardware platform.
- $4-$10 per line of code if the code has a high degree of complex work flow, or is heavily customized to take advantage of the current hardware / software environment.

3.2.1 Sample Case Studies

From HP porting center experiences:

Example 1 - Customer had approximately 1.3M lines of customized COBOL. Was moving from HP e3000 to HP-UX (UNIX "like" to UNIX). Resource effort was 20 engineering years that was estimated to take 11 months based on Customer requirements. Using a mix of off-shore and on-site development resources, the application porting cost on its own was Cdn$3M (no hardware, third party products or training and documentation costs included).

Example 2: Customer had approximately 1.5M lines of COBOL and was moving from OpenVMS VAX 32bit environment to the OpenVMS Alpha 64bit environment. Effort was approximately 2 full time resources for a period of approximately 6 months. Cost was Cdn$620K (no hardware, third party products or training and documentation costs included).

Example 3: Customer had extensively customized VAX DIBIOL environment with approximately 1M lines. They wanted to move this application to Tru64 UNIX on Alpha. Biggest issues was moving their DIBOL code to a third party product and dealing with printer and LAT communication issues. Cost was approximately 1 Engineer year of effort.

3.2.2 Platform Switch Considerations

Typical items for consideration when deciding to switch platforms are:

1. Total Costs
    a. Application porting and/or new application costs

b. Customizations required in order to maintain current business commitments and service level agreements.

c. Training of not only IT Staff, but also end users, partners and potential Customers as well if any changes in business flows are required.

d. New hardware that includes servers (production, development and disaster recovery), storage, tape drives, tape media (if different from current environment)

e. Third party software license, support and maintenance costs

2. Business Risk

a. A platform switch may mean that fewer IT staff resources are available to handle current day-to-day support and enhancement requirements. Even if the hard coding is done by external vendors, existing IT staff needs to be involved to ensure business logic is implemented correctly.

b. While a technical view might simply look at lines of code to provide baseline estimates, one of the biggest area's often overlooked in any platform switch is the effort required to ensure the current work flow is emulated in the new environment. This is often an issue as it might mean re-writing entire sections of business logic from scratch and this means critical interfaces to external systems might also need to be changed, or at the very least, extensively tested.

3. Application Complexity:

a. How much customization is there in the current environment that would need to be rewritten and/or re-architected in the new environment e.g. DCL lines of code, security identifiers specific to OpenVMS etc.

b. Newfoundland Power is currently running on a 64bit HW/OS platform. 64bit or 32 bit target platform is a consideration that a Customer needs to consider in their migration decision.

c. Big-endian vs. little-endian. Binary and RMS files need to move to some kind of ISAM or relational DB when migrating to Unix. Binary files will either need to converted to the new Endian format or marshalled into/out of the other Endian machine.

d. How much customization is there? Samples within Newfoundland Power might include the OpenVMS DCL based batch processes, backup procedures and end user reporting processes.

4. Security: In today's world, the issue of security and viruses has become a matter of much higher importance than in the past. These issues must now be considered as part of any platform decision.
5. Availability: With Internet based services being offered by many companies today, the need for high availability and application stability is becoming much higher than it ever was in the past. These issues must now be considered as part of any platform switch decision.

3.3 Option 2 – Improve Current CSS Platform

As part of this review, one of the items under consideration was "if we stay with OpenVMS as the primary platform for CSS, what changes could Newfoundland Power make to improve the current environment to better meet future business requirements?"

To meet this request, the following section provides a few items for consideration.

3.3.1 Adopt Industry Standards for Development and Integration Technologies

There are two main strategies for Web Services and new application frameworks that are emerging today - .Net (Microsoft) and J2EE (IBM, HP, Sun, Oracle, SAP, PeopleSoft etc).

The key message being promoted by most analysts is that few companies and ISV's are expected to adopt only one strategy. It is felt that a blend of both J2EE and .Net is what most Customers will adopt for their environment. In addition, the adoption of industry standard XML as a data interchange format means that a XML formatted document in the .Net environment will be able to be read cleanly on the J2EE environment.

This option would minimize Newfoundland Power's future risks by focusing a much smaller subset of the time, effort and $'s to adapt its current platform to take advantage of:

- latest technologies like Java (now V1.4 on OpenVMS-latest version in industry). Many Universities are now switching from traditional languages such as C, C++ to Java as it provides the capability to run applications on any platform that supports Java e.g. UNIX, OpenVMS, Windows, Linux. This means that students and/or

programmers can write Java applications using PC tools and have them run on OpenVMS, UNIX, Windows, Linux platforms.

- exposing current CSS business logic written in Cobol and other 3GL languages and data via J2EE technologies with products like Bridgeworks (free utility bundled with OpenVMS) .
- Using cross platform data interconnectivity products like Attunity
- Adopting Application Messaging architectures that allows CSS business logic to be seamlessly exposed to the .Net and other J2EE platforms
- Using cross platform tools like job schedulers, backup etc.
- Upgrading Oracle to 9i to take advantage of latest J2EE technologies
- Consider an active-active cluster with Oracle 9i RAC for increased availability when CSS hours of availability start increasing. This might include a disaster tolerant cluster which allows for things like continued availability - even in the event of a datacenter fire.

3.3.2 Adopt Cross Platform Management Technologies

Newfoundland Power should consider management solutions that support different platforms, so even if their platform changes in the future, their management tools do not have to. A few examples of this would include event notification, batch / job schedulers, backups, security auditing and monitoring, performance and capacity planning, console management etc.

Here are a few sample products:

1. ISE - scheduler and backup
http://www.i-s-e.com/Products/EnterpriseSCHEDULE/enterpriseschedule.htm
http://www.i-s-e.com/Platforms/OpenVMS_Software/index.html

2. OSYRP - Dollar scheduler (see attached press release that discusses a partnership with Appmind (OpenView Agents) and OSYRP Scheduler partnership.)
http://www.orsyp.com/
http://www.orsyp.com/software_dollar_universe.asp

3. Advanced Systems Concepts - ActiveBatch
http://www.advsyscon.com/
4. MVP Systems - JAMS Scheduler:
http://jams.argent-software.com/

5. OpenView Enterprise Management - During earlier conversations with Newfoundland Power, there was also some concern raised about OpenView and its capabilities to manage OpenVMS systems. Something that might be of interest is the following announcement from a partner ISV that came out a few weeks ago. It discusses OpenView management of a number of mission critical OpenVMS systems.

http://www.appmind.com/under.asp?menu=2&msgType=1&msgID=57

(March 3, 2003) "...The initial result of the partnership between HP and Appmind Software is a deal with a Financial Information Company in France. The customer has taken a decision to buy HP OpenView to monitor their diversified IT environment where the most business critical systems are based on OpenVMS..."

3.3.3 Adopt Security Architecture Based on Industry Standards

Future corporate security planning and architecture should include cross platform, industry standard LDAP / directory based schemes that provide the capability to have a single profile for all users on all platforms.

Note that this does not necessarily mean SSO (single sign-on), but rather RSO (reduced sign-on) as applications typically need time to migrate to new security strategies.

3.4 Option 3 - Replace CSS with New Application

While beyond the scope of this report, apparently Newfoundland Power reported that this cost was estimated to be in the $8-10M range. It is not clear if these costs also included items like:

- New server hardware including storage, servers and tape media capable of also being able to access and restore the current historical data that might be required for business or legal reasons.
- Operating System and layered products
- Third party support packages costs
- Disaster recovery estimates (servers, software, facility) for the new environment

4. HP OpenVMS Roadmap and Testimonials

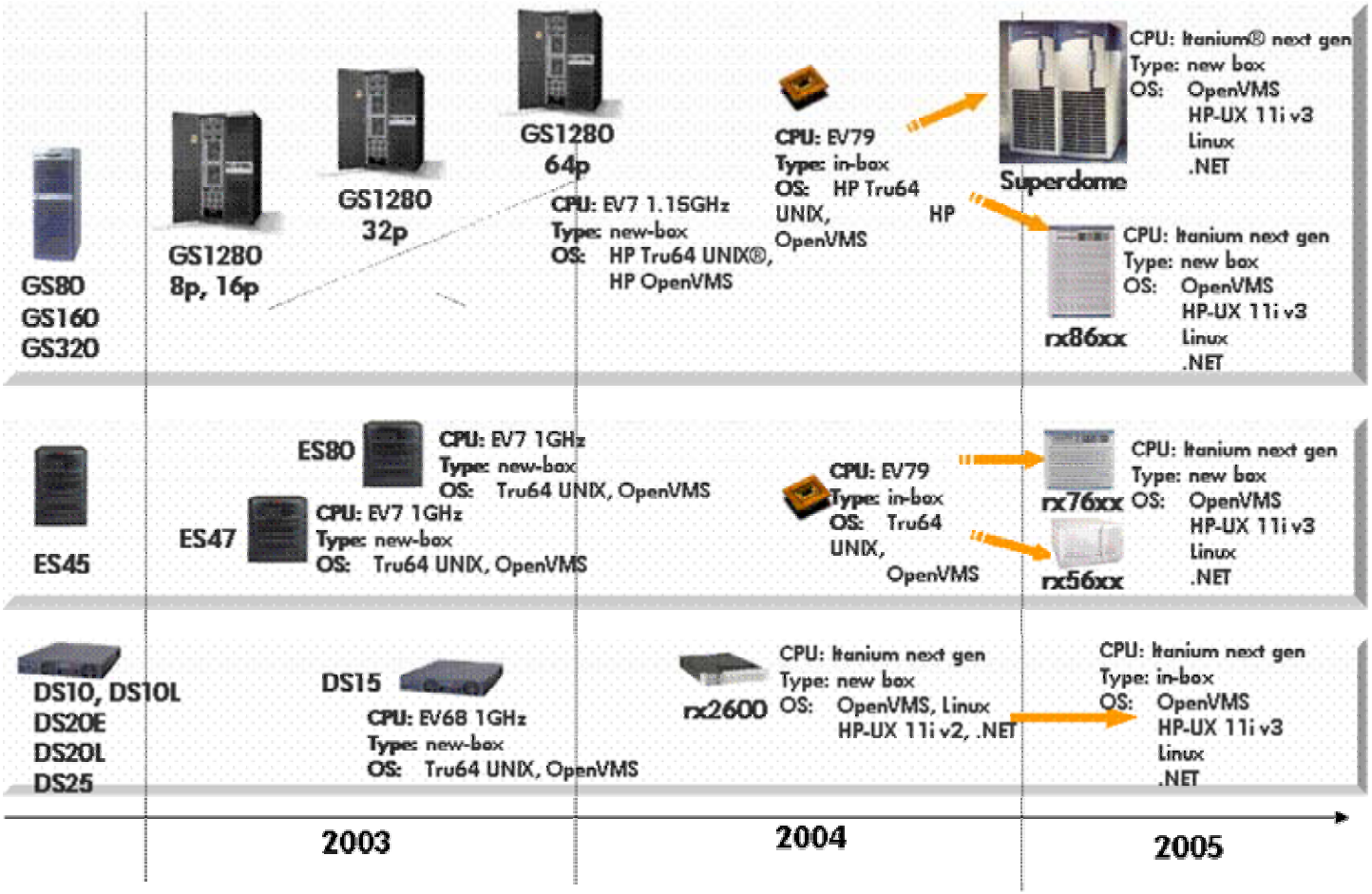
HP OpenVMS Alpha is a 64-bit multitasking, multiprocessing virtual memory operating system. Current implementations run on Alpha systems from HP, and other vendors.

Work to port OpenVMS to systems based on the Intel IA-64 architecture and specifically to the Itanium Processor Family is presently underway. Reference Figure 3 for a roadmap for OpenVMS futures.

The following is a list of recent OpenVMS testimonials from Customers and ISV Partners:

1. Cerner (Health Care)
   http://h71000.www7.hp.com/openvms/brochures/cerner/cerner.pdf
2. Commerzbank 9/11 Disaster (Bank – Financial)
   http://h71000.www7.hp.com/openvms/brochures/commerzbank/commerzbank.pdf
3. Dartmouth Medical Center (Health)
   http://h71000.www7.hp.com/openvms/brochures/dartmouth/dartmouth.pdf
4. Hydro Quebec (Power Generation and Distribution)
   http://h71000.www7.hp.com/openvms/brochures/hydroquebec/
5. India Railways (Transportation)
   http://h71000.www7.hp.com/openvms/brochures/nz_steel/nz_steel.pdf
6. SouthEastern Freight (Transportation)
   http://h71000.www7.hp.com/openvms/brochures/southeastern/southeastern_freight.pdf
7. New Zealand Steel (Manufacturing)
   http://h71000.www7.hp.com/openvms/brochures/nz_steel/nz_steel.pdf
8. HP OpenVMS Brochure:
   http://h71000.www7.hp.com/openvms/brochures/openvms_brochure.pdf

Figure 3 HP OpenVMS Roadmap



5. Future Vision

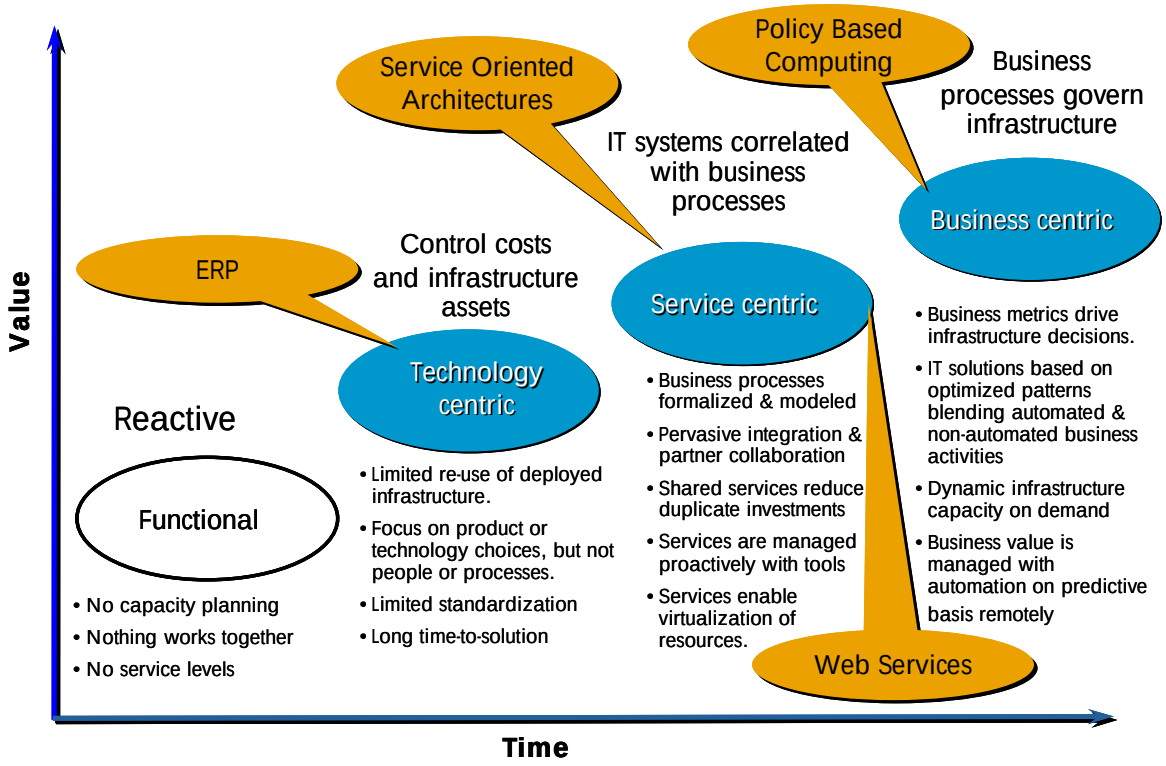
Regardless of the platform chosen, HP can assist Newfoundland Power in developing a future application architecture that will allow them to achieve the following business benefits:

1. Increased business agility e.g. respond to new requirements in shorter timeframes.
2. Protect current investments and minimize both costs and potential future business risks to Newfoundland Power.
3. Drive new business models and direction e.g. provide the capacity to provide partners, customers and employees with secure, real time access to information that they have been previously authorized to access anytime, anywhere – including the internet.
4. Reduce overall costs by simplifying the overall application infrastructure design.
5. Continue to build a highly motivated IT Development and Operations environment by providing them with the latest software development and management technologies.

HP has developed its Adaptive Application Architecture (AAA) to help Customers meet these business agility challenges. AAA is a set of methodologies, processes and services that enables organizations to redesign application infrastructure using software as a service to increase business agility. Reference Figure 4 for a description on how to achieve future business agility.

The goal of AAA is to increase efficiency in application development and management, improve architectural design, increase operational excellence, and integrate agility metrics that provide investment justification for IT improvements.

Figure 4 The Journey to Achieve Business Agility



One of the main components of AAA is the adoption of Web Services (J2EE, .Net) and other web enabling technologies. The concept of Web services is the beginning of a new service-oriented architecture designed to build and integrate future software applications.

The HP Adaptive Application and Integration Workshop provides a methodology to assess Newfoundland Power's IT environment and map out a new Service Oriented Architecture (SOA) application architecture and strategy.

Additional details can be provided on request from Newfoundland Power.

Appendix L - Oracle Commitment Information External

Oracle Corporation 500 Oracle Parkway Redwood Shores California 94065 phone 650.506.7000 fax 650.506.7200

July 11, 2003

Peter Collins
Manager of Information Services
Newfoundland Power
Mailing address:
P.O. Box 8910
55 Kenmount Road
St. John's NL
A1B 3P6

Dear Mr. Collins

Thank you for your recent inquiry regarding Oracle’s roadmap plans for HP OpenVMS Alpha. I believed the attached Statement of Directions should assist you in you project planning strategy. If you have any follow up questions or concerns, please don’t hesitate to send me a note directly.

Sincerely,

Sandy Vella
Director, Product Management HP Operating Systems
Platform Alliances
Oracle Corporation

ORACLE

Statement of Direction

Oracle for HP Alpha OpenVMS

June 2003

ORACLE'S COMMITMENT FOR OPENVMS

Oracle and HP have a long and successful history of delivering enterprise solutions to the OpenVMS marketplace for more than 20 years. The OpenVMS port remains one of Oracle's top platforms, with a large and loyal customer base. Oracle is committed to providing continued ports of its core database to OpenVMS. In fact, the next major Oracle RDBMS version is currently being ported to OpenVMS Alpha. Oracle will also be focusing on faster product delivery time (within 90 days of base release) and as always product quality on OpenVMS. Support for the next major Oracle RDBMS version on OpenVMS Alpha will be provided in accordance with Oracle Standard and Extended Support policies – at least until 2009.

PRODUCT DIRECTION & STRATEGY

Oracle continues to work very closely with HP to ensure as HP rolls out new systems and operating system versions, Oracle is certified and optimized to run on those products.

HP has announced plans to consolidate its 64-bit servers on the Itanium Processor Family. Oracle and HP are working very closely on a migration strategy and solid solution offerings for OpenVMS customers.

PRODUCT AVAILABILITY

The following products are currently available in production on HP Alpha OpenVMS:

- **Oracle8i OPS Release 3 (8.1.7) with Very Large Memory (VLM)**
- **Oracle9i RAC Release 1 (9.0.1) with VLM**
- **Oracle9i RAC Release 2 (9.2) with VLM**
  - RMAN
  - Oracle HTTP Server powered by Apache
  - Context Cartridge
  - Spatial Data Cartridge
  - Image Data Cartridge
  - Parallel Query Option
  - Parallel Server Option with Oracle8i
  - Real Application Cluster with Oracle9i
  - Distributed Database Option
  - Advanced Networking Option
  - Advanced Replication Option
  - Partitioning Option
  - Object Option
  - Pre-Compilers
    - C/C++, COBOL, Fortran
  - Network
    - TCP/IP
- **Oracle Applications Release 11.0.3**
- **Oracle Applications Release 11i backend support**

Oracle9i Release 2 (9.2) has been certified on OpenVMS 7.3, 7.3-1, 7.3-1_EV7-V0100. Oracle and HP will jointly certify future versions of OpenVMS as they become available with compatible versions of Oracle OpenVMS products.

For more information, please send email to *infodec@us.oracle.com*.

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
USA

Worldwide Inquiries:
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http://www.oracle.com/

To offer our customers the most complete and effective information management solutions, Oracle Corporation offers its products, along with support, education, and consulting, in more than 90 countries.

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Appendix M - Cognos Commitment Information External

July 28, 2003

Peter Collins
Newfoundland Power
P.O. Box 8910
55 Kenmount Rd.
St. John's NL
Canada
A1B 3P6

Dear Sir:

I would like to bring you up-to-date on the current proposed roadmap for the Cognos PowerHouse suite of tools on the OpenVMS platform. Cognos continues to have many OpenVMS customers running successful applications on the Alpha platform. With the merger of HP and Compaq now fully entrenched it is important that we communicate our product intentions for the OpenVMS platform.

Our long-term strategy is the continued support of Powerhouse/Axiant into the future however we are continuing to monitor industry developments with respect to OpenVMS and evolve our roadmap for OpenVMS accordingly. Cognos is committed to supporting PowerHouse on the OpenVMS operating system as it transitions from the Alpha hardware platform to the Itanium hardware platform. While it is too early to tell what the adoption rate of the new OpenVMS operating system on the Itanium hardware platform will be, our current plan is to have a PowerHouse version available in the 2005 timeframe if not sooner. Therefore to ensure that our existing OpenVMS Alpha customers have time to migrate their applications to the new hardware environment, development support for the existing OpenVMS Alpha platform will continue through to the end of 2006 at a minimum. Our expectation is that beyond 2006 existing customers on Alpha will be able to continue to get product support (questions, workarounds) however development support (defect correction) will be provided only in the newer versions of the product on Itanium.

As we continue to refine our current roadmap for the PowerHouse product suite we will keep you advised with specific dates when they become available. I hope that this brief overview of our roadmap for OpenVMS will keep you a happy loyal Cognos customer.

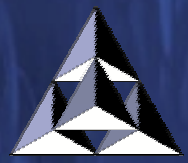
Sincerely,

Ed Shepherdson
VP, Global Customer Support & Application Development Tools
Cognos Inc.
Ottawa, Ontario
Canada
K1G 4S2
613-738-1440

Ed.shepherdson@cognos.com

Appendix N - META Group Information External

META Group Overview



- **Founded in 1989**
- **$116M (US) in 2002 revenues**
- **Trusted advisor to over 3,600 client organizations**
- **Operations in 34 countries**
- **A Leading Global IT Research and Analysis Provider**
- **META Group hire only SENIOR analysts & consultants (around 250). META Group consultants average more than 17 years of IT problem-solving.**
- **META Group maintains the industry's highest analyst-to-client ratio (50:1, up to 3 to 4 times (and more) better than our competitors). — affording clients more opportunities to speak with our analysts. Our analysts are really available to help you in your projects.**
- ***An Objective, Unbiased, and Vendor-Neutral Stance* - META Group generates unbiased research with a user focus. As a core element of our corporate promise, objectivity is synonymous with our name.**

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Profile

- Worldwide reputation: Best strategies, best practices, best methods
- META Group - REAL practice: Architecture, Infrastructure, CRM, Operations Excellence, Security
- META Group unique business model – a customized approach for each client.
- META Group is the only organization in the industry committed to delivering structured methodologies and innovative programs that speed business transformation (Infusion – Structured Transformation Programs)
- Independent Assessment Publications, Retainer Advisory Services, Consulting and Coaching / Training services
- Average of 50% of Revenue back into R&D (e.g. best practices) and client services – The best ratio in our industry!
- Personalized / customized consulting / Rapid and timely knowledge transfer

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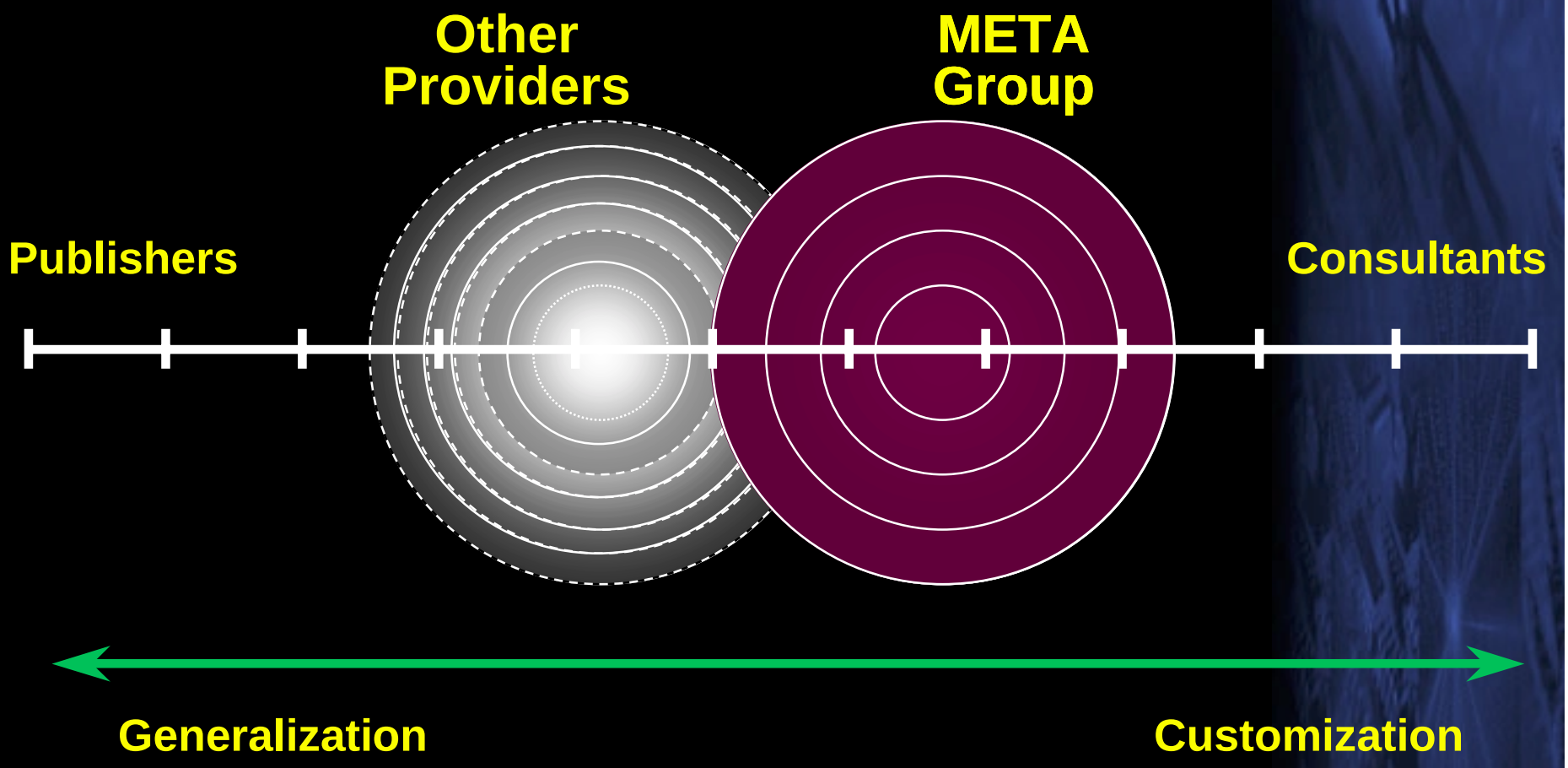
Market Positioning



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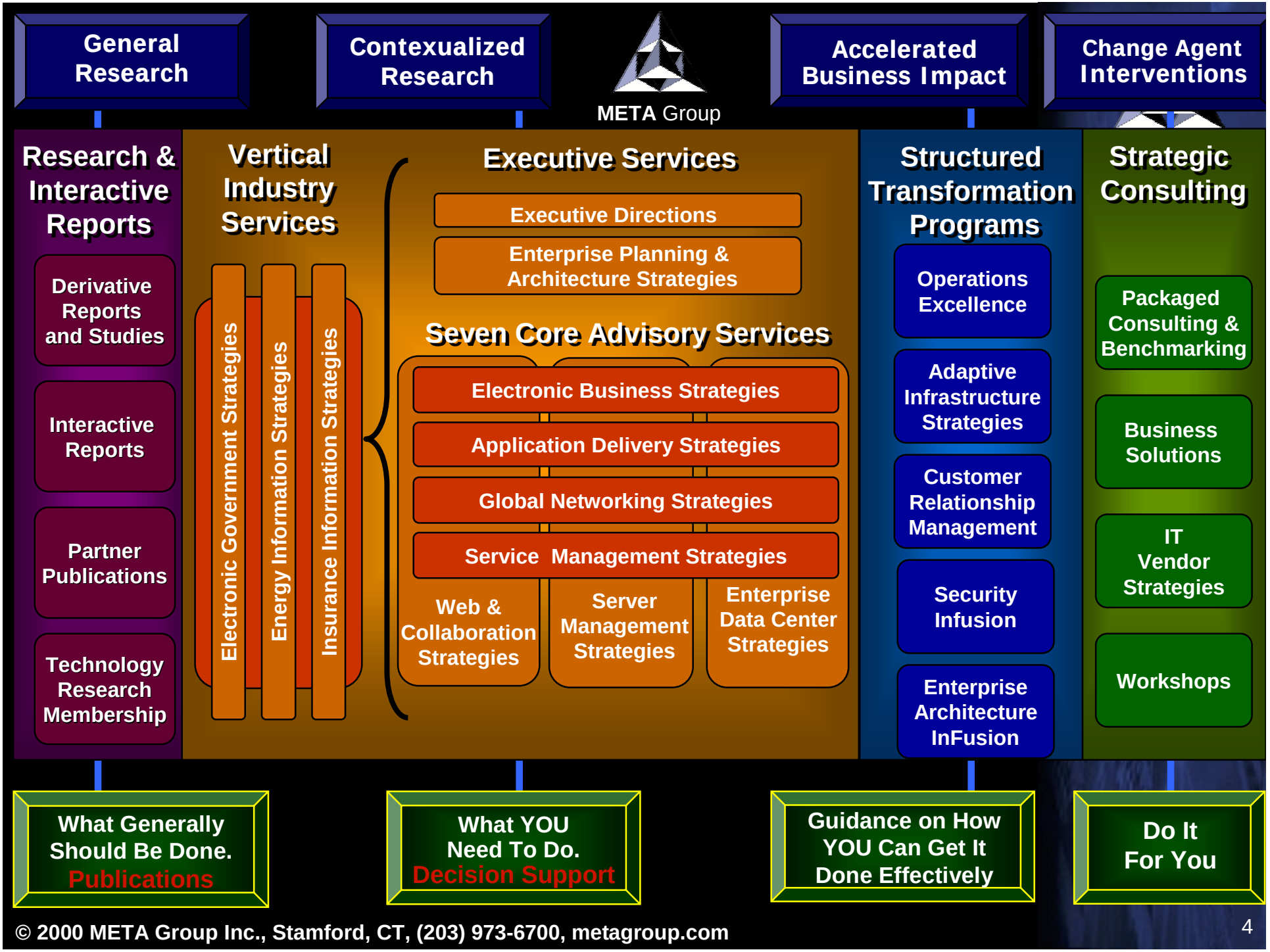

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What are infusions?
Definition: Structured Transformation Program

Structured means that we provide a method, direction, and plan on what the client needs to do. In other words, META Group provides a framework to work with us. With proven methods, tools, and dedicated support — enable clients to actively drive organizational change around key business and technology challenges.

Transformation is what the client needs to do. Almost everyone you will talk to will admit that they have to change the way they are doing business, and the balance point is "transforming while performing''.

Put the Two together, and META Group help companies transform their current organizations by providing a structured ***program*** they can follow to guide them through the change

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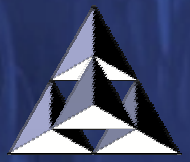
Structured Transformation Programs: META Group Infusions —



- **META Group's Infusions offer proven methods that enable clients to accelerate and drive change across their organizations. Based on solid program and project management disciplines, Infusions break up challenges into manageable projects, phases, activities, and tasks, focusing on communication to obtain buy-in, demonstrate progress, and articulate value. Integral to the programs are tools, templates, and workshops that accelerate the creation of key deliverables, as well as coaching to educate, provide guidance, and drive progress. Unique product offerings, META Group's Infusions are specifically tailored to help clients "transform while they perform."**

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Appendix O- Meta Group Viewing the CIS Market 2002 Edition External

META Group

META Delta

18 September 2002 **File: EIS 255**

Viewing the CIS Solution Market: 2002 Edition

Energy Information Strategies
Zarko Sumic

Deregulation, the main catalyst for customer information system (CIS) market growth, is virtually stalled in North America, driving increased competition among vendors. Low market demand is posing financial challenges for CIS vendors, making vendor viability a primary selection criterion.

The slowdown in deregulation activities in the North American energy market, the negative impact of Enron's demise, and the associated "round trip" trading scandals relating to energy companies' access to capital — exacerbated by the economic downturn — have resulted in low demand for CIS products and have placed additional pressure on CIS vendors.

This year's CIS Conference, held in Baltimore in June, confirmed trends and verified findings published in the 2001 METAspectrum for energy CIS (see EIS Deltas 236, 237, and 239). Low demand has turned the CIS market into a replacement market, with regulated energy companies the only potential customers for CIS vendors. Consequently, vendors are reacting to this change by shifting attention from the unregulated to the regulated market by offering functional extensions for legacy systems (e.g., complex billing, credit and collections) or adding new functionality that can enhance the value proposition for CIS replacements. Users evaluating technology vendors for CIS replacement or extension options must appropriately weigh vendor viability, product ability to meet run-the-business objectives, and vendors' proven ability to execute.

During the deregulation hiatus in the North American energy market (2002-04), low revenues and resulting low R&D investment will force vendors to offer only incremental improvements to existing product lines (e.g., introduction of portals, customer self-service, load/usage/bill presentment). Numerous vendors, after years of unsuccessful attempts to gain traction in the North American market, will cease marketing CIS software products, hoping to find a "safe haven" in the application service provider (ASP) harbor and continue their market presence as customer care and billing business process providers. To address CIS extension market needs and concentrate on customers' tactical requirements to deal with the largest pain point first, vendors will offer a "pseudo-componentized" version of their products (in reality, a partially configured whole product, packaged for a phased implementation). During 2004-06, as more mature deregulation models start to emerge, the CIS market will reaccelerate and provide a growth opportunity to vendors that will weather the market drought. Fueled by increased revenues and improved R&D investment, new truly modular CIS products will start to emerge, leveraging new technology (e.g., Web services) and creating componentized customer care and billing solutions. These new products, designed on service-oriented architecture principles, will enable closer integration within an overall CRM and/or ERP ecosystem, and enable the customer care and revenue cycle business process extension required in transitioning and deregulated energy markets (see EIS Deltas 242 and 244).

The 2002 CIS Conference confirmed the following:

- ***Focus on ROI:*** Energy utilities are becoming less willing to make "leap of faith" CIS purchases based on potential soft benefits that can be obtained by top-line (revenue growth) impact of the new CIS (e.g., improve customer acquisition/retention, create new products, reduce time to market). Rather, they are focusing on more tangible bottom-line (cost reduction) impact by improving operational efficiency and customer service efficacy. Due to the still-high CIS replacement cost (regardless of the fact that we have witnessed up to 75% discounting in product licensing due to the low demand), energy

META Trend: Faced with a slowdown in deregulation during 2002/03, energy companies will decrease overall CRM spending, focusing on tactical investments in customer information systems and customer interaction centers. As the competitive retail market accelerates during 2004-06, companies will invest in comprehensive operational, collaborative, and analytical CRM solutions.

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executives are seeking hard monetary business-case benefits. Consequently, they are proceeding only where the current system's total cost of ownership is prohibitive (e.g., if the CIS is the only system left on the mainframe), where the cost to modify the existing CIS for a deregulated market far exceeds the replacement cost, or where multiple CISs would result (as in a merger).

- ***Componentization:*** To alleviate customer buying reluctance caused by the perceived high risk and soaring costs associated with the prevalent "big bang" CIS implementation, and to address legacy CIS extension needs, vendors are touting CIS product componentization, which can enable phased implementation or customers to extend the lifetime of legacy systems by addressing the key functional deficiency. Marketed by vendors as the new modular approach, componentization is achieved by partially configuring and packaging a portion of the existing product, rather than rearchitecting/modularizing products using object-oriented design principles. Although a phased execution can successfully address numerous shortcomings of the "big bang" implementation (e.g., easier to manage/control cost, earlier target benefit realization, enabling the "try before you buy" approach), it requires the additional modification of legacy environments and increases product life-cycle and release management complexity. Without fully rearchitected modular CIS products, we see this primarily as vendors' "Trojan horse" selling strategy.
- ***ASPs:*** The nascent customer care and billing hosting market appears to be coming of age, though it is primarily based on the number of vendors offering external service provider (XSP) billing and customer care solutions (see EIS Deltas 229 and 235), rather than the number of CIS outsourcing deals closed in the past 12 months. Similarly, as on the CIS product side, supply significantly exceeds demand. In addition to typical providers (outsourcers — e.g., EDS, SAIC, IGS; utility subsidiaries/joint ventures — e.g., Enlogix, CustomerWorks; vertical solution providers — e.g., Orcom; horizontal retail industry transaction providers — e.g., Alliance Data Systems), we see a host of commercial off-the-shelf product vendors and systems integrators increasingly entering the CIS XSP market. Commercial off-the-shelf vendors are driven either by the desire to wake up a dormant market by creating more attractive financial offerings (e.g., transaction-based licenses booked as O&M expenses rather than upfront capital expenditure) or, in some cases, to lower the entry barrier by mitigating customer technology risk aversion. Less successful product vendors see outsourcing as a way to improve their financials by circumventing GAAP license revenue recognition concerns and minimizing R&D spending by offering "half baked" products in a vendor hosted environment. Systems integrators, in addition to a more traditional post-implementation application support, are steadily moving toward entire business process outsourcing — in some cases, even by acquiring ASP vendors (Accenture Canada/CustomerWorks) to compensate for the lack of implementation engagement due to the market slowdown.
- ***Functional product extension:*** To enhance the CIS replacement value proposition, vendors are extending traditional CIS product functionality to accentuate operational efficiency (e.g., scheduling, self-service, call center productivity, field crew automation, trouble call/outage management) or reduce risk exposure created by energy market volatility (e.g., energy commodity management, load forecasting, nomination). The first trend mirrors a global trend of including order processing and fulfillment in CRM environments, while the second extends CIS focus from revenue cycle management to energy commodity management (load forecasting, scheduling, nomination, aggregation, and settlement) by leveraging metering data already in existence and used in CISs for billing.

Bottom Line

In the slow customer information system market — despite bargain prices — users should proceed carefully with technology partner selection, vigilantly weighing vendor viability with product ability to meet "run the business" objectives and "future-proof" architecture.

Business Impact: During the deregulation hiatus, energy companies should re-evaluate their retail strategy and, accordingly, make appropriate decisions to replace or extend legacy customer information systems. Selected products must offer gradual implementations and provide multiple deployment options.

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Appendix P - Microsoft Newfoundland Power CCS Migration Analysis External

Microsoft Consulting Services

Newfoundland Power
CCS Migration Analysis

April, 2003

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Table of Contents

Overview

The purpose of this document is to provide insight and options for Newfoundland Power to assist with the migration of the CSS application. This application is responsible for all account billing and customer call center inquiries for NF Power and as such is critical to their daily operation and revenue billing cycle. This system is presently implemented using 10-15 year old technology, some of which is at the end of its support life cycle.

At present, the application is stable and running on an HP VMS server using a number of technologies to provide required functionality. The billing and account reconciliation process is implemented using an extensive batch processing system developed using COBOL programs, Cognos Powerhouse programs and VMS DCL Scripts. The customer call center portion of the application is implemented using Powerhouse and Axiant On-line screens and COBOL external programs. In both cases, Oracle Server is used as the backend database. Given the lifecycle of the technologies used in CSS, there is a lack of available skill sets in the industry. , When additional support is required, external resources and consulting firms are not able to provide resources in a timely and cost effective manner. In addition, the ramp-up time and training investment for new employees who have not been previously exposed to the system is significant compared to more currently supported platforms.

NF Power is investigating the migration of this application for the following reasons:
1. CSS is critical to the success of Newfoundland Power
2. Most of the business logic has been custom developed and does a good job o reflecting Newfoundland Power's current business rules
3. The current platform is getting closer to end of life making future support difficult.
4. External resources to work on the platform and application are not readily available or cost effective.

Given the size, complexity of the processes and previous investments in CSS,, it would be too risky and too costly to re-develop the system from scratch. In addition, several vendors are available which specialize in the migration of the technology in CCS to newer, more mainstream platforms.

Microsoft was engaged by Newfoundland Power to help them investigate options for migrating this system to technology, which will be supported well into the future, as well help them to move into more mainstream support and skill sets. In order to leverage Newfoundland Power's previous technology and training investments in the Microsoft platform. it was determined the moving CSS to a Windows based platform using SQL Server, could reduce current support costs. As an example, by focusing skill sets in particular areas of expertise which could then be more readily leveraged though out the IT department, Newfoundland

Power would be be able to drive more benefit from available training and support budgets..

In addition, Microsoft was asked to provide examples and support evidence that Windows Server and SQL Server are capable of supporting the type of mixed batch/on-line environment present at NF Power and to provide recommendations as to the best way in which to implement this system using Microsoft technologies such as Windows Server and SQL Server.

Three potential options are outlined within the remainder of this document as solutions for the CSS migration. These include various combinations of UNIX or Windows with either Oracle or SQL Server as the backend database. Each option has benefits and drawbacks which are discussed.

Project Budgeting

Pricing is outside of the scope of this document and quotations for each piece of the CSS application should be discussed with the potential vendors to determine a reasonably accurate price and timeline.

Given the fact that the budget for this project is somewhat fixed, project management principles dictate that an “order of magnitude estimate” be used to determine a “go/no-go” decision for NF Power. This type of estimate is a ballpark figure that states realistically what the lowest reasonable price is for the implementation of the entire system. This estimate is only expected to be accurate +/- 50% of the final total, but is intended to give an “order of magnitude” for a potential customer to determine at a high level, what an approximate budget would be.

Due to the size and nature of the CSS migration, a responsible estimate for the system would be between $3.5 and $4.5 million CAD. This is based on previous migration experience, and the nature of the hardware and software that required for operating the system.

Next Steps for CSS Project Continuance

The following outline some steps that should be taken by Newfoundland Power in order to move the CSS project forward in a responsible and timely manner.

Obtain Accurate Pricing and Schedules from Appropriate Vendors

Currently, all pricing for CSS is approximate and no vendors have been consulted to gain accurate and realistic pricing. Newfoundland Power should engage the vendors listed in the later sections of the document to help determine the overall project costs and delivery schedule.

Solidify Project Budget

Once, pricing and schedules have been determined, a concrete budget needs to be retained in order to assure that the project can move forward.

Complete Business Case and ROI analysis

Presently no business case has been completed for the CSS project. Newfoundland Power needs to determine business drivers for completing the migration project and identify acceptable levels of ROI for the migrated system. Figures for the costs of the CSS project can be attained from the project vendors and internal costs for technical resources can be used to estimate the costs for Newfoundland Power internal resources.

This phase is critical to the success of the CSS project as it will help to identify to senior management, the benefits of migrating the application to a modern platform and will ease the process of solidifying budgets.

CSS Architecture

At present the CSS application is made of two distinct but interdependent parts. These are the on-line systems and the batch systems. The following sections describe both environments and the roles they play within NF Power.

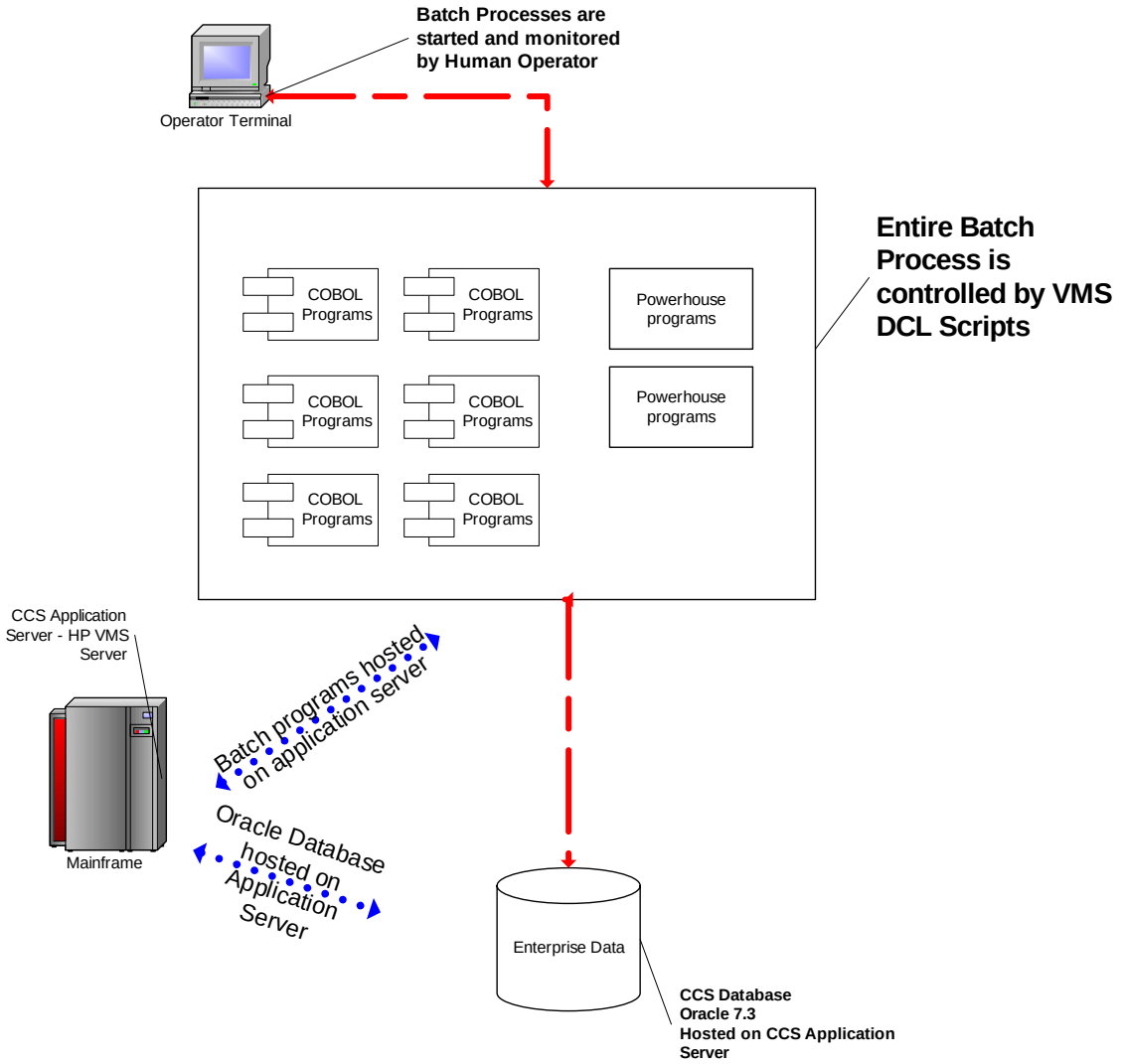
Presently, the on-line and batch systems cannot operate in parallel. The On-Line screens are used by the call center from 8:00 am to 8:00 pm during which time no batch processing is allowed. After the closing of the call center at 8:00 pm, the batch system is then prepared for the night's batch run. During the batch run, invoices are created, payments are reconciled, bank payment files are processed and reports are generated, and then balanced etc. This entire process can take upwards of 10.5 hours to complete and during which time, an operator is required to monitor the entire process manually and check and correct any errors that may occur within the process. This requires that someone be present to monitor the batch jobs during the hours of 8:00 pm to 8:00 am.

Once the batch jobs have been completed, the operator telephones the call center manager to inform them that the system is ready for use, or that the system needs to remain off-line until the batch jobs have completed. In a worse case scenario, the updates from the previous evening may not complete and the entire call center application needs to remain off-line until this finishes. This results in a loss of productivity and customer satisfaction as the call center will not be able to accept customer inquiries until this system is available.

CSS On-Line Environment

The on-line portion of CSS exists to support NF Power's call center operations and customer information system. These provide screens to access customer information, provide billing detail information, and to facilitate services to customers such as service connects and disconnects.

Figure 1: On-line environment



Application Facts:

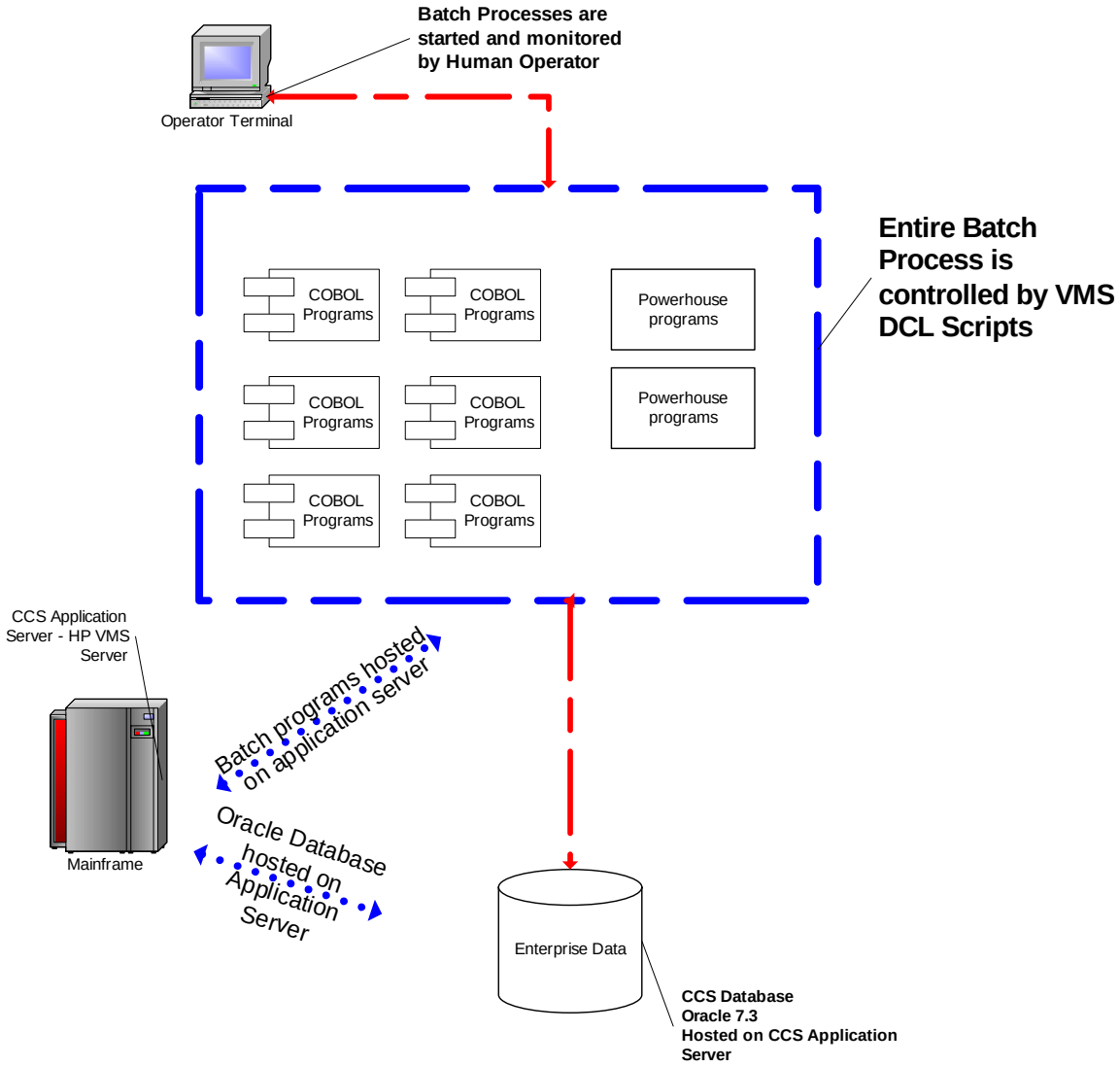
500,000 Lines of COBOL Code
1400 DCL scripts ~60,000 lines
Updates approximately 1GB of data per batch
~10 Oracle Stored Procedures

Batch updates occur during 8:00 PM to 8:00 AM while on-line system is unavailable

CSS Batch Environment

The batch environment for CSS is used balance transactions and payments made throughout the day; issue invoices and perform auditing and accounting functions. This system is entirely text based and requires an operator to be present throughout the entire process.

Figure 2: Batch environment



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Updates approximately 1GB of data per batch
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Batch updates occur during 8:00 PM to 8:00 AM while on-line system is unavailable

CSS Migration Project Risks and Assumptions

In order to analyze the options for the migration of the CSS application, it is necessary to state the risks and assumptions that have been identified at the outset of the project. These will help to determine the boundaries and criteria for which each option will be evaluated against. In addition, this will help to give NF Power a starting point for discussions with potential solution vendors.

Project Assumptions

Existence of Migration Vendors and Technologies

It is assumed that vendors will be readily available who can migrate the CSS application without having to rewrite the core business logic functionality. After having preliminary discussions with several vendors, the following short list has been created which outlines potential vendors and solution options:

Powerhouse (On-Line screens and Batch Programs)

Core Software – Core has the technology to migrate the existing Powerhouse code to a Microsoft .Net centric platform running on Windows Server. This can be either in the forms of a Thick Client application (WinForms), or a Web Client (WebForms). After preliminary discussions with Core, it was determined that this would be a viable option and would preserve the business logic coded in Powerhouse, while at the same time moving the applications to a more modern platform.

COBOL (Batch Programs and On-Line External Programs)

Sector 7 – Sector 7 has the technology to migrate the existing COBOL programs from VMS Cobol to other platforms such as Microfocus COBOL running on Windows Server.

Fujitsu – Fujitsu has recently developed COBOL.Net which will allow Newfoundland Power to migrate the existing VMS COBOL programs to COBOL.Net which will run on Windows and can talk natively to the migrated .Net front-end.

Stored Procedures and SQL migration to SQL Server

Core Software / Sector 7 – Both these vendors have the technology to forward engineer Stored Procedures from Oracle to SQL Server. This can be done in addition to migrating the code from VMS to Windows.

Enterprise Job Scheduling and Batch Management

Two potential products can be used by NF Power to facilitate the Job/Batch management features of the current system. NF power has requested that potential Windows/GUI based solutions be identified and evaluated as part of the migration effort. Two potential solutions are given below.

1. Opalis Job Engine – Opalis software
   http://www.opalis.com/products/jobengine/index.html

2. Autosys Job Management – Computer Associates
   http://www3.ca.com/Solutions/Product.asp?ID=253

The evaluation and testing of these tools is not within the scope of this document and should be completed by NF Power technical staff in order to determine the most suitable and cost-effective tool for their enterprise.

Preference not to Re-write application

Given that the entire CSS application is custom coded for NF Power, an application re-write has been deemed not feasible and too risky. This was based on the assumption that re-writing the application will introduce the possibility of new bugs which are not present in the system, and will increase overall project risk vs. simply migrating the application to a new platform.

Estimated Project Budget and Costs

In an ideal world, NF Power would prefer to replace the CSS functionality with an off shelf package such as SAP or Peoplesoft. Estimated cost for an implementation of these products would be fall within $10-$20 million CAD, a migrated solution must cost less than this option. Ideally, the project would be completed for between $4-$6 CAD million inclusive of all costs such as hardware, software and services.

Preference to Maintain a Homogeneous Environment

Currently, Newfoundland Power makes extensive use of Microsoft Technologies such as the Windows Client, Windows Server, and Office Suite. In addition, several pilots are testing additional products such as InfoPath, and Sharepoint Portal Server. It would be preferable to have CSS utilizing these technologies. This has several key benefits such as

1) Re-usability of staff skill sets – It has been identified that it would be desirable to decrease the different skill sets required to support the various applications within Newfoundland Power. In addition to IT staff skill sets, end users acceptance will be higher when applications leverage their exisiting skills and understanding.

2) Increased ability to leverage enterprise support from one vendor – Should the CSS application be developed for the Windows platform using SQL Server, it would be much more cost effective to purchase support from Microsoft and have it serve as support for all applications using Windows within the enterprise. Presently the CSS application uses VMS and Oracle and separate licenses and support are required to support the application which are separate from the enterprise licensing and support agreements from Microsoft.

3) More readily available and cost effective external resource options. When and if Newfoundland Power requires temporary external resources to supplement in house IT Services, the skill set will be more widely available and provide levels for cost comparisons.

Preference to Migrate On-Line component to thick client

After a review of the application with the call center users, if was decided that the application should be migrated to a thick client implementation using Windows Forms technologies. This was decided after agreeing that introducing a Web based application would result in higher re-training time for the call center users, as well as introduce un-wanted latency between client requests and server responses. This introduces a key assumption that the newly migrated system must provide the same level of responsiveness as the current system in order to assure client satisfaction. At present, the On-Line component of the CSS system is very responsive and performance is not an issue for end users.

Project Risks

Highly visible and reliable nature of current system

Given that the CSS system is critical to the revenue generation and day to day operations within NF Power, attempting a migration of this system inheritably brings with it, an increased level of risk. This is multiplied by the fact that the current system is quite stable and meets all performance and up-time requirements for NF Power. In addition, the On-Line portion of CSS has a >90% customer satisfaction rate. Any changes to the system will need to be thoroughly

investigated and tested before implementation to ensure that these benchmarks are met by the new system.

Incremental Cost of Migrating Database to SQL Server 2000

Currently, the CSS system uses Oracle as its backend data store. Given that NF Power has expressed an interest in having the new system use SQL Server as its database brings with it an increased amount of risk as it is another change that will have to be implemented and supported within the new application. However, this risk needs to be weighed against the licensing and support costs the Oracle requires specifically for the CSS application along with additional support resources that are specifically dedicated to supporting Oracle. Given that NF Power has already deployed SQL Server on many of their internal applications, there should be cost savings associated with migrating CSS to use SQL Server as well. These cost savings will need to be compared against the incremental costs of converting CSS to use SQL Server instead of Oracle during the migration phase of the project.

Perceived Scalability of Windows Platform by NF Power

During initial discussions with NF Power technical staff, there was a perceived notion that the Windows Platform would not be able to perform as well as other CSS platform options. Several concerns were raised including

1) Performance of Windows in a highly batch orientated environment

2) Scalability/Reliability of Windows & SQL Server within the CSS environment.

3) Security of Windows Server when compared to Unix/VMS

These issues can be addressed by Microsoft sales/technical resources upon further investigation with NF Power personnel. Specifically, case studies and customer references can be provided to prove the stability and reliability of the Windows platform in relation to Unix/VMS to a level where NF Power is comfortable with Windows and SQL Server as the primary technologies for CSS.

Potential CSS Architecture Options

Option 1 (RECOMMENED) – Migration of CSS to Windows using SQL Server

This option would entail migrating the Axiant PowerHouse application to a .Net Application using Windows Forms. The database would also be replaced with SQL Server using an Active/Passive cluster. An application Server can be used to shared application logic and common programs across all clients. This would allow NF Power to shared database access and common COBOL programs to all CSS Workstations without deploying them to each computer. The application servers can also be used to run batch processing at the end of each business day.

The COBOL external programs and Batch programs would be migrated to a Windows Environment running on the shared application servers. At the end of the business day, the application servers would be used to execute batch processing logic and access data on the SQL Server database cluster.

A reporting database would be maintained via SQL Server replication and would be updated once the batch updates have been completed at the end of the batch processing run.

Figure 3 – Option 1 On-Line environment

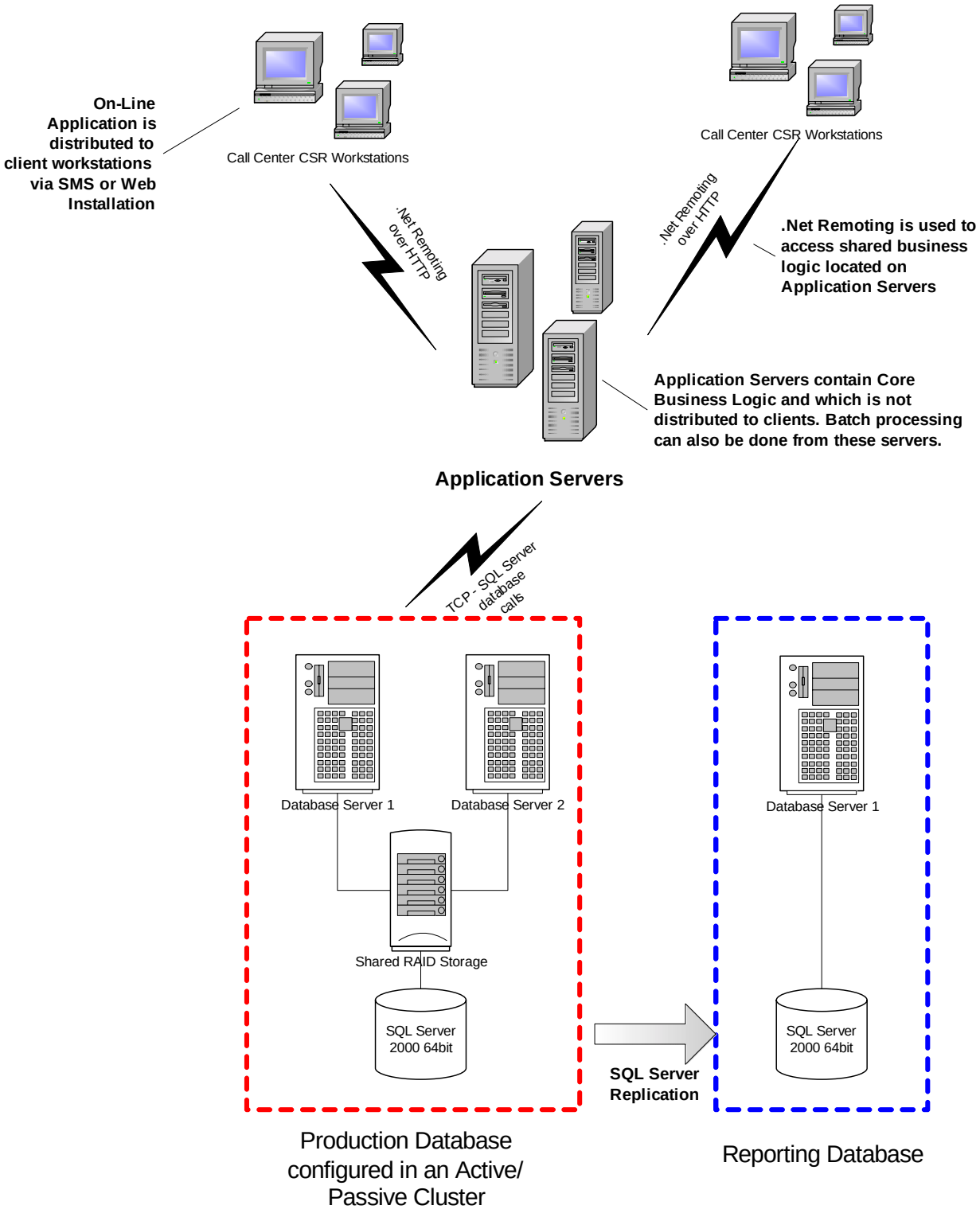
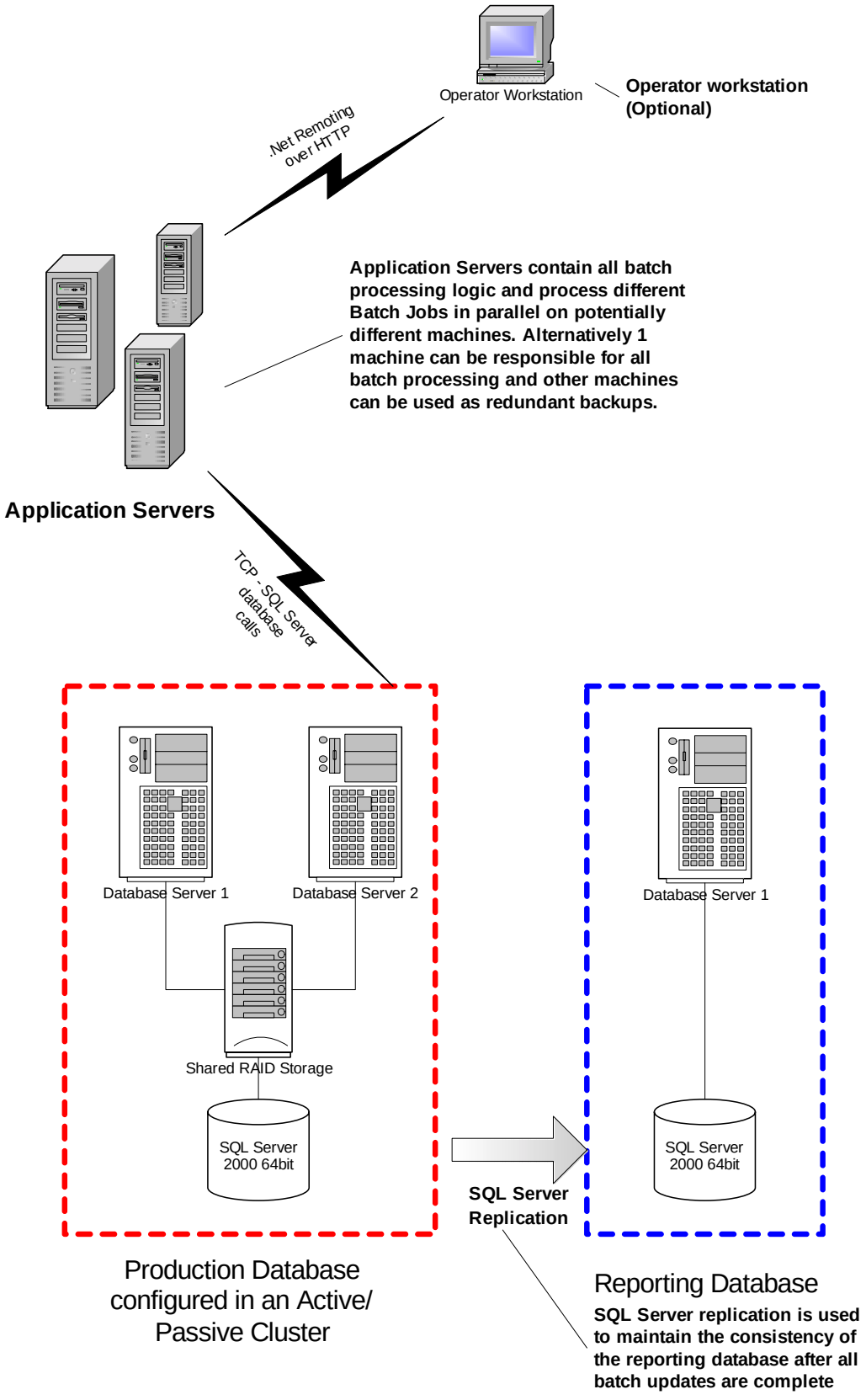


Figure 4 – Option 1 Batch environment



Environment Components and Descriptions

Client Workstations – These are the current workstations for people who are accessing the CSS application. They would have the Thick client application installed from either an SMS install package or from an installation executable. All forms would be hosted on the client as well as some business logic. Communication with the application servers is done via .Net remoting over HTTP. This allows each client workstation to access shared .Net objects which are hosted on a separate machine. The communication protocol would be standard HTTP. Direct Database communication would be done through the standard SQL Server communication libraries over TCP.

Required Software:

1. CSS Thick client application
2. .Net framework redistributable
3. SQL Server client for database connectivity

Application Servers – The application servers are used to distribute business logic throughout the CSS application in a shared and common manner. The application servers would host common COBOL routines and application logic such as database access methods and security settings. These would be Compaq Proliant Servers using Windows Server. These servers can be configured in a Windows Network Load Balancing service to distribute client requests across all machines in the NLB domain. This will help to reduce response times during extremely high usage.

In addition to supporting the On-Line environment, the application servers would be used to process the batch updates and routines at the end of the business day. This can be accomplished in a variety of ways. Each server can be configured to run only certain batch processes and jobs which can run in parallel can be executed on different machines. Jobs that require pre and post processing logic can be run on 1 machine.

This will allow the batch jobs to get maximum CPU usage across the application server farm and at the same time, maximize access to the database cluster. Microsoft Operation Manager and Application Center 2000 can be used to monitor the health of each server and ensure that each machine is properly utilized.

Approximate Number of Servers: (2 – 3 Depending on amount of batch processing to be executed on each machine)

Required Software:

1. COBOL External On-Line Programs
2. Windows Network Load Balancing
3. Windows Server Standard
4. .Net Framework redistributable
5. SQL Server client for database connectivity
6. Batch Scheduling and Monitoring tool
    a. http://www3.ca.com/Solutions/Product.asp?ID=253
    Autosys from CA
    b. http://www.opalis.com/products/jobengine/index.html
    Opalis Job Engine
7. COBOL Batch processing code

Optional Software:

1. Microsoft Operation Manager
2. Microsoft Application Center 2000

Production Database Servers – This component would entail a SQL Server 2000 64bit cluster of database servers in an Active/Passive configuration. This would allow NF Power to maintain a "Hot Standby" database server in the event one database server was to become unavailable. In this case, the hot standby would take ownership of the cluster and then begin to respond to database requests while the other server in the cluster was offline.

Shared storage is accomplished through the use of a shared raid array storage device which is connected via fiber channel to each node in the cluster. All database datafiles and transaction logs would be stored on this shared array allowing both nodes in the cluster to access it.

Again, MOM and Application Center can be used to monitor the health and status of each node in the SQL Server cluster as well to notify support technicians of any hardware failure or cluster failover.

Approximate Number of Servers: (2 Cluster Node Servers with 1 shared Raid array storage device)

Required Software:

1. Windows Advanced Server 64Bit
2. Windows Clustering Server
3. Microsoft SQL Server 2000 Enterprise 64 bit

Optional Software:

1. Microsoft Operation Manager
2. Microsoft Application Center 2000

Reporting Database Servers – The reporting database would contain an update copy of the previous evening's batch updates available for ad-hoc queries and OLAP cube analysis. At the end of an evenings batch updates, SQL Server replication would be used to transfer a read-only copy of the production database to a smaller, non-clustered SQL Server which would be available to users on an ad-hoc basis to run non-standard queries and reports.

In addition to ad-hoc queries, the reporting database could be used to run the standard batch reporting that currently executes on the production database server. This would allow NF Power to separate the batch updating and batch reporting into two separate processes thus allowing a greater window for batch updating to occur as well as decreasing the amount of time an operator needs to be present during the batch updating process. The standard batch reports can be executed automatically against the reporting database once the SQL Server replication from production is completed.

Approximate Number of Servers: (1 Non-Clustered SQL Server)

Required Software:

1. Windows Server
2. Microsoft SQL Server 2000 Standard

Optional Software:

1. Microsoft Operation Manager
2. Microsoft Application Center 2000

Option 1 Benefits

Decreased Oracle licensing / support costs

Option 1 allows NS Power to decrease the Oracle licensing and support costs and utilize a standard Enterprise Support Agreement for all Microsoft technologies. This will give NF Power the ability to leverage Microsoft PSS support for both Desktop and Server support. This will also remove the need to purchase annual Oracle support

Reuse of existing SQL Server Skill sets

NF Power already has SQL Server skill sets internally and these can be re-used for the CSS project rather than maintaining a separate Oracle/VMS skill set for CSS

Less Expensive Hardware than Unix solution

Hardware costs for option 1 will be less expensive than a similarly architected Unix solution.

Ability to Integrate other technologies such as Sharepoint and Infopath

As NF Power is presently investigating other Microsoft technologies which can access SQL Server as a native datasource, integrating these technologies into CSS will be much easier with a SQL/Windows solution. In addition, should NF Power use BizTalk Server as a mechanism to transfer text and XML files or to facilitate Business Process Automation, licenses will already be purchased for the SQL Server component of BizTalk and will not need to re-purchased.

Option 1 Major Drawbacks

Need to convert Oracle portion of CSS during application migration

As the current application is written using Oracle, all in-line SQL Statements and Stored Procedures will need to be converted to use SQL Server syntax. This will also increase project risk as it adds another level of complexity to the migration effort.

Option 2 – Migration of CSS to Windows using Oracle

This option is nearly identical to option 1 with the exception that the migration to SQL Server would not be attempted and Oracle would be used as the backend database platform. Similar clustering and failover for the production system can be implemented using Oracle's RAC technology and Windows Clustering. Oracle replication can also be used to synchronize the reporting database with the production database after each night's batch processing completes.

It is important to note that because Oracle does not currently have a 64bit implementation for the Windows platform, all database servers will need to be Windows Server 32 bit versions. The application servers should also be 32 bit windows as in option 1 as the majority of the application processing is completed in the database servers and increasing processing power on the application servers most likely would not yield any benefit.

Figure 5 – Option 2 On-Line environment

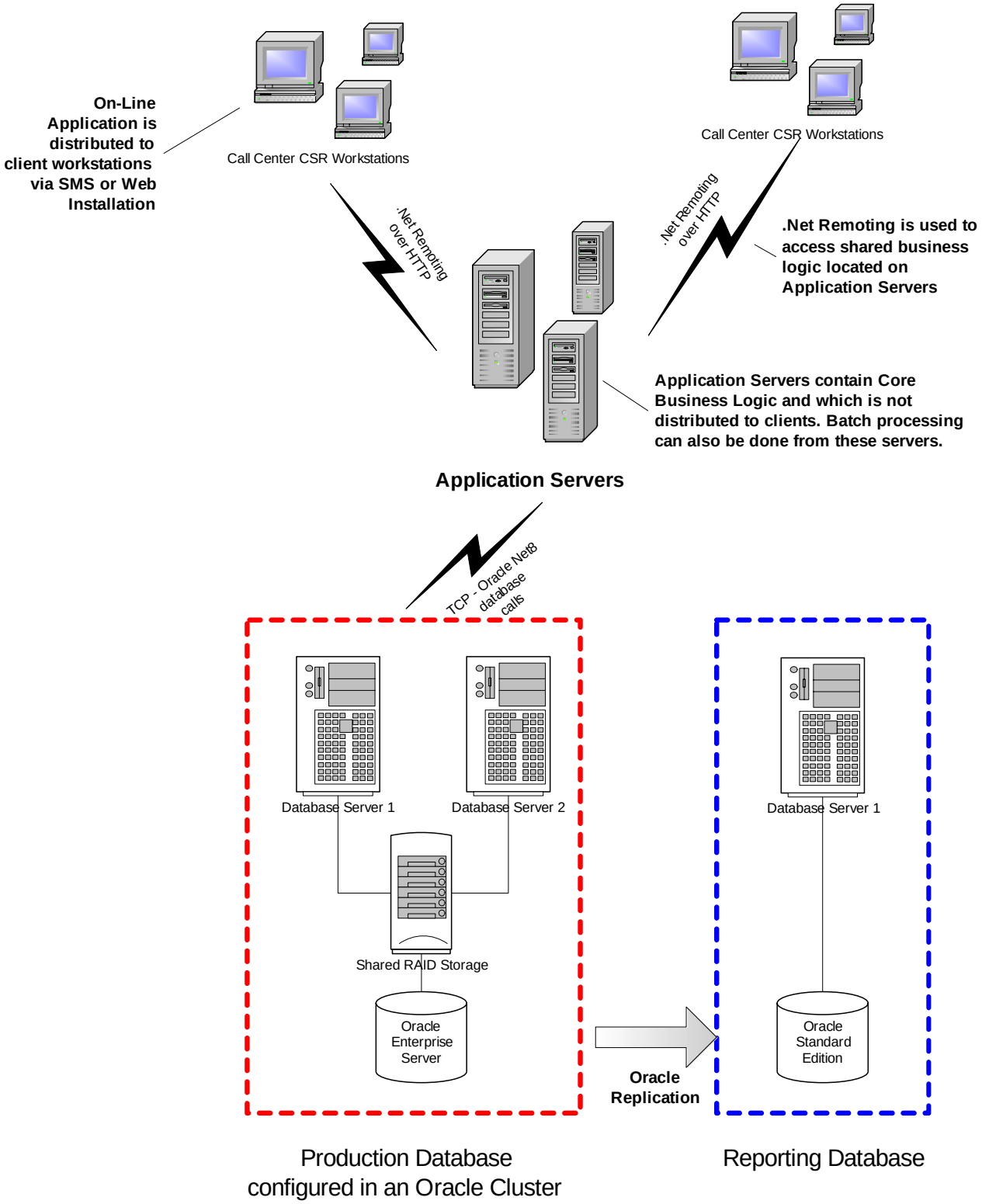
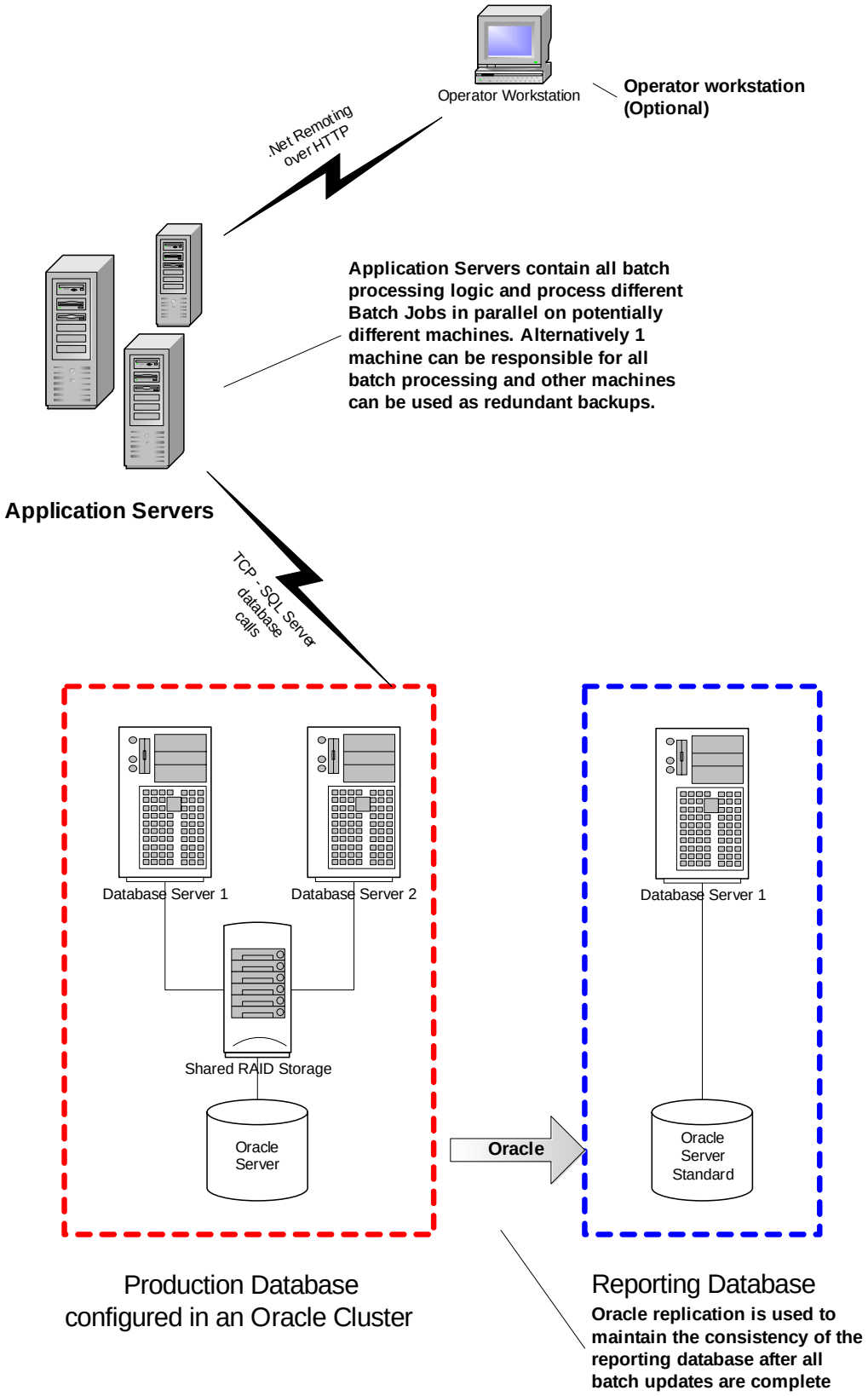


Figure 6 – Option 2 Batch environment



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Required Software:

1. CSS Thick client application
2. .Net framework redistributable
3. Oracle client for database connectivity

Application Servers – The application servers are used to distribute business logic throughout the CSS application in a shared and common manner. The application servers would host common COBOL routines and application logic such as database access methods and security settings. These would be Compaq Proliant Servers using Windows Server. These servers can be configured in a Windows Network Load Balancing service to distribute client requests across all machines in the NLB domain. This will help to reduce response times during extremely high usage.

In addition to supporting the On-Line environment, the application servers would be used to process the batch updates and routines at the end of the business day. This can be accomplished in a variety of ways. Each server can be configured to run only certain batch processes and jobs which can run in parallel can be executed on different machines. Jobs that require pre and post processing logic can be run on 1 machine.

This will allow the batch jobs to get maximum CPU usage across the application server farm and at the same time, maximize access to the database cluster. Microsoft Operation Manager and Application Center 2000 can be used to monitor the health of each server and ensure that each machine is properly utilized.

Approximate Number of Servers: (2 – 3 Depending on amount of batch processing to be executed on each machine)

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4. .Net Framework redistributable
5. Oracle client for database connectivity
6. Batch Scheduling and Monitoring tool
    a. http://www3.ca.com/Solutions/Product.asp?ID=253
    Autosys from CA
    b. http://www.opalis.com/products/jobengine/index.html
    Opalis Job Engine
7. COBOL Batch processing code

Optional Software:

1. Microsoft Operation Manager
2. Microsoft Application Center 2000

Production Database Servers – This component would entail an Oracle database cluster which would be available to respond to incoming database requests. This would allow NF Power to maintain a redundant database server in the event one database server was to become unavailable.

Shared storage is accomplished through the use of a shared raid array storage device which is connected via fiber channel to each node in the cluster. All database datafiles and transaction logs would be stored on this shared array allowing both nodes in the cluster to access it.

MOM could be used to monitor the health of the servers in the database and Oracle Enterprise Manager would be used to monitor and administrate the database.

Approximate Number of Servers: (2 Cluster Node Servers with 1 shared Raid array storage device)

Required Software:

1. Windows Advanced Server
2. Oracle Enterprise Server

Optional Software:

1. Microsoft Operation Manager

Reporting Database Servers – The reporting database would contain an update copy of the previous evening's batch updates available for ad-hoc queries. At the end of an evenings batch updates, Oracle replication would be used to transfer a read-only copy of the production database to a smaller, non-clustered Oracle Server which would be available to users on an ad-hoc basis to run non-standard queries and reports.

In addition to ad-hoc queries, the reporting database could be used to run the standard batch reporting that currently executes on the production database server. This would allow NF Power to separate the batch updating and batch reporting into two separate processes thus allowing a greater window for batch updating to occur as well as decreasing the amount of time an operator needs to be present during the batch updating process. The standard batch reports can be executed automatically against the reporting database once the Oracle replication from production is completed.

Approximate Number of Servers: (1 Non-Clustered Oracle Server)

Required Software:

1. Windows Server
2. Oracle Database Server

Optional Software:

1. Microsoft Operation Manager

Option 2 Benefits

Reuse of existing CSS Oracle Skill sets

As CSS currently is implemented using Oracle, this solution will allow NF Power to re-use the same support skills that are currently in place. In addition, existing database tools can be re-used across between the old system and the new system.

Less Expensive Hardware than Unix solution

Hardware costs for option 1 will be less expensive than a similarly architected Unix solution.

Simpler Database Migration Effort

As CSS is currently implemented using Oracle on OpenVMS, migrating the system to Windows using Oracle will present less problems than if CSS were to use SQL Server as the database platform.

Option 2 Major Drawbacks

Continued need to purchase separate Oracle support for CSS

CSS will still require that additional Oracle support be purchased in order to support the CSS environment. This will be over and above any enterprise support that is purchased from Microsoft.

Additional products required for OLAP and Cube analysis functionality within the reporting server

Since, SQL Server will not be available for OLAP and cube analysis, Oracle Analysis server or Cognos Server will need to be purchased should NF Power wish to use this functionality within CSS. This functionality is included within SQL Server and is part of the install.

Option 3 – Migration of CSS to Unix using Oracle

This option is nearly identical to option 1 with the exception that the migration to SQL Server would not be attempted and Oracle would be used as the backend database platform. Similar clustering and failover for the production system can be implemented using Oracle's RAC technology and Windows Clustering. Oracle replication can also be used to synchronize the reporting database with the production database after each night's batch processing completes.

It is important to note that because Oracle does not currently have a 64bit implementation for the Windows platform, all database servers will need to be Windows Server 32 bit versions. The application servers should also be 32 bit windows as in option 1 as the majority of the application processing is completed in the database servers and increasing processing power on the application servers most likely would not yield any benefit.

Figure 7 – Option 3 On-Line environment

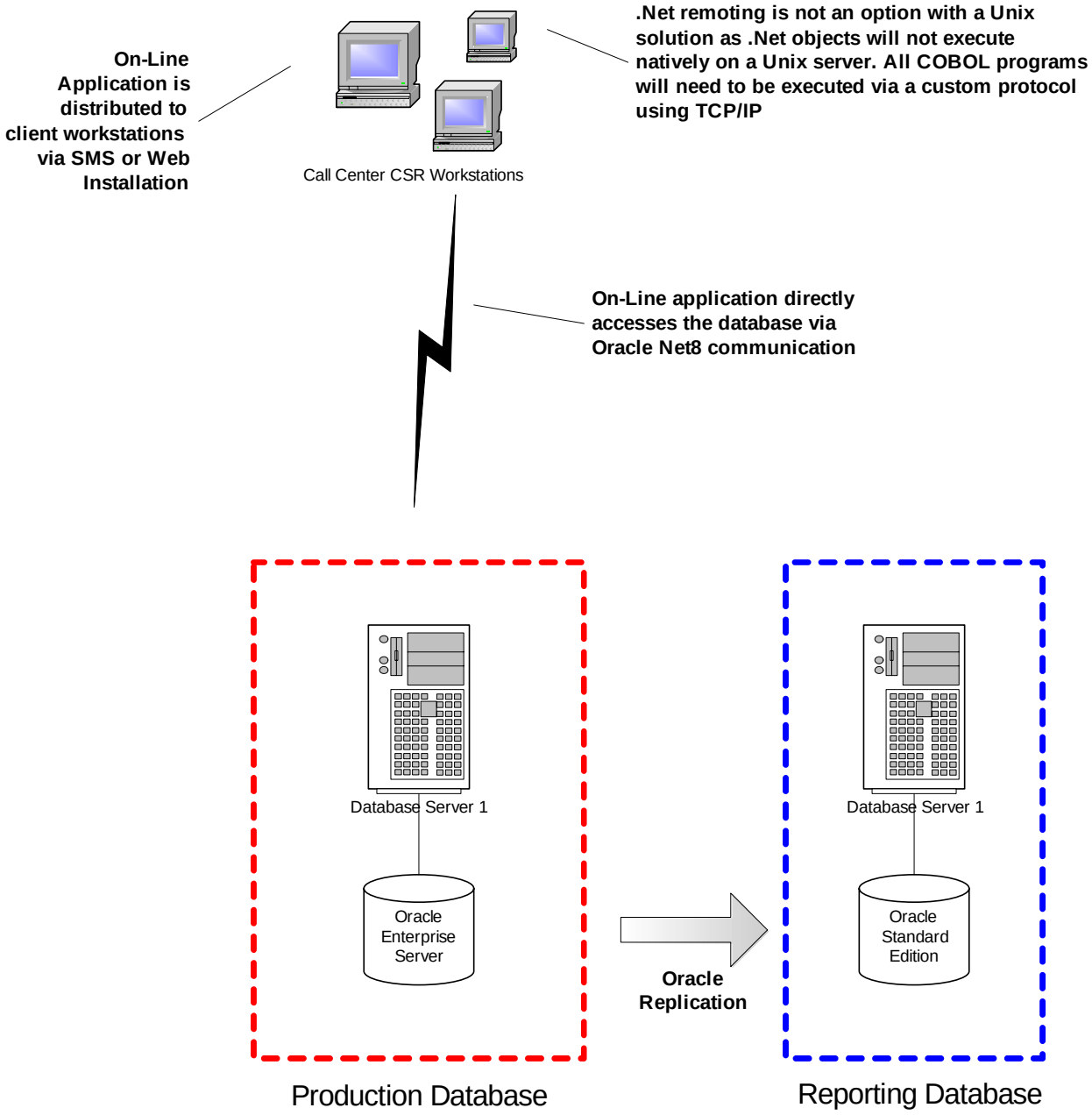
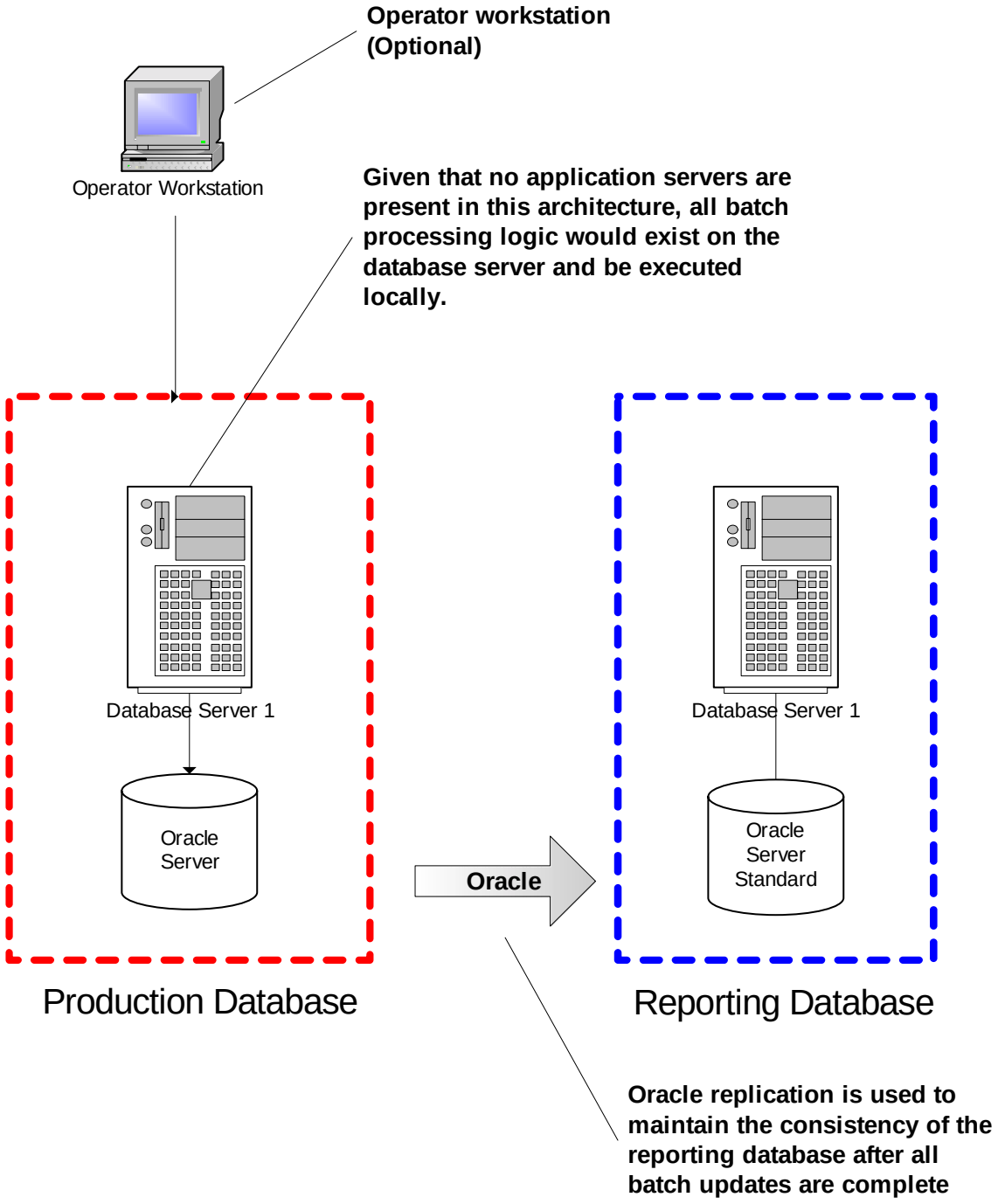


Figure 8 – Option 3 Batch environment



Environment Components and Descriptions

Client Workstations – These are the current workstations for people who are accessing the CSS application. They would have the Thick client application installed from either an SMS install package or from an installation executable. All forms would be hosted on the client as well as some business logic. Communication with the application servers is done a custom protocol using TCP. This allows each client workstation to access shared COBOL code which is hosted on a separate machine. Direct Database communication would be done through the standard Oracle communication libraries over TCP.

Required Software:

1. CSS Thick client application
2. .Net framework redistributable
3. Oracle client for database connectivity

Application Servers – After discussions with NF Power personnel, it was decided, that this option would not include an application server. This was decided for a number of reasons. The most of important of these reasons was the incremental cost of additional UNIX servers to the architecture would increase the cost of the project to a point where the benefit of the additional processing power was not justified.

Given that no application servers would be present in this architecture, all batch processing would be performed on the database server and be run as local programs and jobs.

Production Database Servers – Essentially the production database server would host the entire CSS application. The database server would serve as both the application server and the database server for all batch components.

Approximate Number of Servers: (1 UNIX server)

Required Software:

1. Unix
2. Oracle Enterprise Server
3. All batch processing code
4. All batch COBOL code
5. Enterprise Batch scheduling and Management tools

Reporting Database Servers – The reporting database would contain an update copy of the previous evening's batch updates available for ad-hoc queries. At the end of an evenings batch updates, Oracle replication would be used to transfer a read-only copy of the production database to a smaller, non-clustered Oracle Server which would be available to users on an ad-hoc basis to run non-standard queries and reports.

In addition to ad-hoc queries, the reporting database could be used to run the standard batch reporting that currently executes on the production database server. This would allow NF Power to separate the batch updating and batch reporting into two separate processes thus allowing a greater window for batch updating to occur as well as decreasing the amount of time an operator needs to be present during the batch updating process. The standard batch reports can be executed automatically against the reporting database once the Oracle replication from production is completed.

Approximate Number of Servers: (1 UNIX Oracle Server)

Required Software:

1. UNIX
2. Oracle Database Server

Option 3 Benefits

Reuse of existing CSS Oracle Skill sets

As CSS currently is implemented using Oracle, this solution will allow NF Power to re-use the same support skills that are currently in place. In addition, existing database tools can be re-used across between the old system and the new system.

Simpler Database Migration Effort

As CSS is currently implemented using Oracle on OpenVMS, migrating the system to Windows using Oracle will present less problems than if CSS were to use SQL Server as the database platform.

Option 3 Major Drawbacks

Continued need to purchase separate Oracle support for CSS

CSS will still require that additional Oracle support be purchased in order to support the CSS environment. This will be over and above any enterprise support that is purchased from Microsoft.

Additional products required for OLAP and Cube analysis functionality within the reporting server

Since, SQL Server will not be available for OLAP and cube analysis, Oracle Analysis server or Cognos Server will need to be purchased should NF Power wish to use this functionality within CSS. This functionality is included within SQL Server and is part of the install.

Lack of UNIX Skill sets within NF Power

At present, NF Power does not have the skill sets internally to support a large scale UNIX implementation. These skill sets would have to be purchased externally or existing staff would need additional training and ramp-up time to attain the same level of comfort and skill that is present with the OpenVMS platform and Windows.

Cost of Hardware and lack of skill sets make clustering less attractive

Since each UNIX server is quite expensive, scaling and clustering becomes less of an attractive option with the UNIX solution. The outlined architecture has no-redundancy or scaling-out potential defined and should this be required, additional servers would need to be priced and purchased.

Appendix Q - HP Technical Migration Assessment Report External

HP Technical Migration Pricing

----Original Message-----
From: Spriggs, Arthur [mailto:Arthur.Spriggs@hp.com]
Sent: Monday, May 12, 2003 8:49 AM
To: dbatston@newfoundlandpower.com
Subject: RE: Newfoundland Power Assessment

I have done a review of the pricing with the boys in the states.

What we don't want is a situation (that is common in the conversion industry) that you would received a quotation and the end result is much higher than quoted due to a number of "change requests", as the project went on. We also wanted to reflect an "industry standard" conversion that would not require any proprietary porting tools that would result in costs associated with licensing the conversion result for the lifecycle of the app.

With this being said we have estimated on the high side to allow you to do a more accurate cost of ownership and a more realistic budget preparation.

Based on the number of days involved the costs should come in at $CDN 800K without the conversion of the Cognos side, and $CDN2.5 million if all was converted.

At your request I will set up a con call for a pricing review and overview review for your team.

Newfoundland Power

Application Migration Assessment Report

Preface

Distribution Control

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People Involved in the Preparation of This Document

Function	Name
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Solution Architect	Kerry Main
Systems Engineering Team	Michael O'Neil Petter Erik Carlson

Review List

Reviewed by	Date

Change History

Version	Date	Revision Description
1.0	25 April 2003	Initial Report
1.1	29 April 2003	Review comments included
1.2	1 May 2003	Spelling and format edits

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Acknowledgements

HP would like to express its sincere appreciation to all Newfoundland Power staff that helped with this review by providing their time, information and technical support.

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This version of the document supersedes all previous versions.

TABLE OF CONTENTS

1. Executive Summary

Hewlett-Packard Corp., an HP Company (hereinafter "HP") was requested to review Newfoundland Power's CSS application environment and provide a quick assessment and recommendations on migrating different parts of the CSS application off of the OpenVMS system to either Microsoft or HP-UX operating systems..

Estimate to reengineer Axiant Powerhouse source files and eliminate the dependence on PowerHouse and migrate DCL batch, Cobol, and all other related applications is 1000 engineer-days of effort on either Unix or Windows platforms.

Estimate to migrate all applications and continued use of Axiant/Powerhouse is 300 engineer-days of effort on either Unix or Windows platforms.

See Section 9 "Sizing" for assumptions details on these estimates

Recommendations

1. The Estimates are based on a strict migration of existing application functionality to a different platform, which would not take full advantage of the next operating system's strong points. HP recommends that an architectural review of the current and target environments be performed to exploit the architecture of the future environment.

2. If the Axiant application development tools are to be replaced (e.g. migrated to MS asp's or Java) this would constitute a substantial amount of change to the existing CSS application and user environment. Refer to Section 5. In this scenario, HP's recommendation is for a phased migration approach and a detailed migration assessment or architectural review of the CSS environment as a prudent next step to mitigate risk.

3. For performance, security, and minimizing migration efforts, HP recommends to wait on making a comprehensive migration to Microsoft until

- Microsoft supports 64 bit hardware (no point in migrating from 64 to 32 hardware and then back again in the future)
- The .NET product becomes a bit more mature (continue to train and work with .NET development, but minimize the risks to the production system)
- Security improves a bit more

4. Recommend a wait on making a comprehensive migration to HP-UX until 2005 when HP-UX 11.i version 3 will include the AdvFS Advanced file system, Tru cluster support and available on Alpha and Itanium processors.

4. Based on your current rate of software builds and updates to your system, HP would not recommend using hardware or software emulators to migrate parts or the entire system to another platform. Refer to Section 3.

2. The Migration Process

Successful migrations and reengineering programs require careful planning and project management to mitigate and reduce risks. An application migration is more than recompilations or modification of existing code onto another hardware platform. One must also consider the impact of test verification and the application environment build process, which are key components of any migration.

3. Hardware and software Emulators

While there are software and hardware emulators that can be used to mimic an existing operating system environment or language, they are not magic bullets. They are fast to implement, they require proprietary software to remain resident on the new platform to support the original software. Obviously, this does not reduce the dependency on multiple vendors.

Emulators and translators tend to leave support engineers in quasi-state of development, debug, and deployment over two operating systems. Until a complete migration or reengineering off of the original platform is completed, the total cost of ownership includes both platforms, emulator licensing, and service contracts.

While emulation is usually good for quick, short term, migrations or work-a-round; they are not recommended for long term application support, especially if the environment is updated and rebuilt on a regular basis.

4. Why migrate or reengineer the application environment?

Migration should be considered for performance reasons

- improved data processing throughput (moving from 32 to 64 bit processing)
- increased capacity and improved response times

Migration should be considered in keeping pace with the evolving business environment when moving to

- more integrated software packages and tools that consolidate business practices and require less internal I.T. support
- open standards and reducing dependencies on single source vendors
- languages and tools that are known to a wider segment of the job market

Reengineering should be considered when the application environment

- does not match the future business model
- there are too many manual work-around with application and the existing business process

- the end user's support and expectations cannot be met with the environments existing technology

5. Migrating off of Axiant tooling

If the Axiant application development tools are to be replaced (e.g. migrated to MS asp's or Java) this would constitute a substantial amount of change to the CSS application and user environment. A migration implementation of this extent is known as a 'Big Bang' approach. The scope of change and potential impact requires a plan and methodology for a very comprehensive acceptance testing.

In this scenario, recommendation for a detailed migration assessment and a phased migration approach would be a prudent next step. If the Axiant applications are to be reengineered, then an architectural review of the CSS environment would also be prudent.

5.1 Why an architectural review?

Moving from a forms oriented application to an event driven interface, whether the interface is on the web or a conventional GUI interface, presents an opportunity to improve on the User interaction with Customer support, information retrieval. In some cases an event driven application can actually streamline the business process and automate and integrate other parts of the process.

6. Migrating application environment to Microsoft

Many application environments have been migrated to Microsoft and there are good and bad points to this approach. The following sections outline the tradeoffs and advantages of migrating OpenVMS applications to Microsoft

6.1 Tradeoffs and Advantages of Microsoft Environment

6.1.1 Security

The Microsoft environment requires more operational diligence and careful design to achieve the same level of security as Unix or OpenVMS systems.Because Microsoft is the most popular operating system, it is a favored target by Hackers and virus software . The most recent example was the SQL slammer virus which disrupted financial, manufacturing, and government computing systems. Refer to Appendix C

Recent statistics on documented on virus attacks to the different O/S

- tens of thousands of new viruses on Microsoft
- about five thousand on Unix based systems
- zero virus attacks on OpenVMS
-

Since Microsoft operating systems originally were focused at the single user environment, security technology within Microsoft O/S systems and applications had to be built in as they moved to support servers. While security and authentication has

improved in recent years, they still lag behind more traditional enterprise level operating systems.

It is recommended that any MS based server be put behind a firewall to aid in protecting the system from various network attack strategies.

6.1.2 Availability

While Microsoft does not have the same level of application runtime fail-over as OpenVMS and UNIX, it can provide box level fail-over restart of applications. In the web services environment, the user experience is typical of browser refresh or reconnection.

6.1.3 Batch Process

Third party applications and VB can be used to replicate batch processes, but they are not built into the operating system and are typically not as robust as Unix and OpenVMS batch systems. While the command language interface has improved in recent years to aid in processing data center types of operations, most processes on Microsoft tend to operate at the same priority level, so interactive jobs will be competing with batch process at the same rate of resource consumption.

This author does not have any performance benchmarks on batch operations on Microsoft, but going back to 32 bit processing with faster processors may match the performance of your existing 64 bit systems.

6.1.4 Web and GUI development tools

MS Web and GUI development tools offer easy to use IDE for VB script, and Active Server Page generation. While the .NET and SOAP promotion is very active, .NET may be a bit premature (bleeding edge technology) to pursue at this time. The one drawback to MS Web interfaces is their reliance on 32 bit PC and server platforms and Microsoft's reluctance to use the Java standard that is platform independent.

6.1.5 Office and Data Integration

Microsoft is the top end-user environment with MS Office providing seamless integration to Word processing, spreadsheet, drawing, database, email, and multi-media applications.

- ODBC provides reliable connection to MS and competitor databases. Active directory provides a secure connection to MS and competitor directory structures. COM and DCOM allow VB to provide customized and automated business solutions with the MS Office suite.

6.2 Migrating User interfaces to Microsoft

Typical User interfaces in Microsoft can be implemented as standalone applications in VB or C/C++, as web-based active server pages (ASP), or .NET applications. Interfaces can also be to COM server objects through any of the Microsoft Office applications. ASP interface implementation is the most common, especially in a protected intranet environment to integrate access database records, flat files, and reports. XML, XSL and SOAP help in expediting data and displays for thin clients.

Secure Sockets (SSL), XML, and .NET promise to improve the security of user information

In the current CSS implementation, user interfaces are constructed with Axiant, the 160 screens will have to be re-written in either active server script, Vbscript, Javascript, or Java. Whether implemented in Microsoft or Java based tooling, this is a substantial amount of change on the existing CSS environment.

See section 5, on "Migrating off of Axiant tooling"

6.3 Migrating business logic to Microsoft

Since the current OpenVMS Cobol is using the ANSI standard compilation switch, it is our expectation that most of the Cobol should migrate directly through recompilation.

Based on our statistical analysis of the sources, our expectation is to have 8-10 minor migration issues that will require some code modification.

6.4 Migrating batch process to Microsoft

Recasting DCL into VB can be done with some automation by using search and replace scripts. However, there are approximately 2000 references to eighteen different types of system calls (lexicals). An abstraction layer for the eighteen lexicals will need to be created to call MS functions to mimic the VMS call and return values.

7. Migrating Databases to Microsoft

MS SQL Server, while being a very reliable and high performance database, cannot compete with the performance, security, reliability, or scalability of Oracle database systems.

Furthermore, there is a trend in the industry to use the near real-time and simultaneous update and retrieval and analysis of database records to recast batch processes into continuous runtime applications. Reengineering to using an ODS Operational Data Store could make the printing of bills and other batch oriented jobs less reliance on a batch window.

There are no known migration tools for directly moving RMS files into other relational database systems, whether they are Jet, Access, SQL Server, or other database systems. However, a script and small VBA[1] application could be created to convert FDL files into database tables.

If existing data from these RMS files are also needed. The following steps will be required to migrate the data. The VMS CONVERT/EXTRACT utility can be run to extract the data as sequential text files. After the database tables have been established, an

[1] All Micrsoft office applications are supported with a resident Visual Basic interface for macros and customization. This resident Visual Basic is known as VBA

additional script and VBA application will need to be created to load the tables with the sequential text file data.

While moving all of the RMS files at once to a relational database sounds like a reasonable approach, it does mean the replacement of all RMS calls in the entire source modules will have to be done at the same time to complete the migration of these data. This does incur risk at a systems level, because so much change is incurred in the system at one time.

If the migration were to be done in a phased approach, a tool like Attunity could be used to continue to access RMS files on the existing OpenVMS system. Over time, individual RMS files could be incorporated into a larger Oracle database system and procedure calls could be implemented to replace the existing RMS calls in the existing source code modules.

8. Migrating application environment to HP-UX

8.1 Tradeoffs and Advantages of HP-UX Environment

If there is one advantage to Unix environments it is the access to multi-vendor supported Open Standards in languages, Interfaces, and Web communications.
HP-UX is the most popular enterprise level Unix operating system on the market. It is expected by 2005 that HP-UX 11i version 3 will include the best technologies from the Tru64 UNIX operating system; Tru Cluster support and the Advanced File System (AdvFs). The Advanced File System improves the reliability and recovery time from system failures. Tru Clusters provide improved performance and capacity scaling and high availability.

8.1.1 Security

Generally, security on Unix systems is in tighter control than Microsoft at this time. Various Unix systems and more widely used applications (web browsers) continue to come under attack, but not at the frequency or severity that Microsoft products have received.

8.1.2 Availability

Current HP-UX has fail-over capability, but not the same level of application availability as Tru Clusters. However, HP-UX is being upgraded to take the best technologies from Tru64 UNIX and will eventually support cluster operations and the advanced file system.

8.1.2 Batch Process

Unix systems perform batch using shell scripts. HP-UX can operate under several different shell scripts. There are third party and OpenSource batch processors that will provide load sharing on the Unix platform.

8.1.4 Web and GUI development tools

HP-UX and Unix in general share a wealth of tools in the OpenSource software environment including Web Servers, Web Browsers, and Java[2].
There are several OpenSource and Web standards that can be used to implement User interfaces. Java and the J2EE runtime environment have similar look and feel as the Microsoft visual programming tools.

With the use of XML and Java, user interfaces can be web enabled, platform independent, and easily migrated to other system platforms, if needed.

Unix also supports a number of GUI interfaces when directly connecting to the platform system including X, Motif, Common Desktop Environment, and KDE.

8.1.5 Office and Data Integration

HP-UX and Linux systems have followed the lead set by Microsoft. OpenSource supports OpenOffice, which is a similar user office environment to MS Office. Tooling and system support operations of the HP-UX system is GUI based. Furthermore, OpenView allows a single GUI interface to all nodes on the intranet (OpenVMS, UNIX, NT,…).

8.2 Migrating User interfaces to HP-UX

While Microsoft has more flexibility in the development of standalone interfaces to data and integrated office objects; Java development and deployment is on par with the Visual development environments and is vendor independent. Java and Javascript integrate very well with XML, XSL, and other web standards.

In the current CSS implementation user interfaces are constructed with Axiant. The 160 screens will have to re-written in either active server script, Vbscript, Javascript, or Java. Whether implemented in Microsoft or Java based tooling, this is a substantial amount of change on the existing CSS environment.

See section 5, on “Migrating off of Axiant tooling”

8.3 Migrating business logic to HP-UX

Since the current OpenVMS COBOL is using the ANSI standard compilation switch, it is our expectation that most of the Cobol should migrate directly through recompilation.

[2] Java is a Platform independent Application Development Language. J2EE is the platform independent development environment. And, JavaBeans is a high level programming abstraction of the more common algorithms used in developing applications.

Based on our statistical analysis of the sources and a migration from OpenVMS to HP-UX, our expectation is to have less than 8 minor migration issues that will require some code modification.

8.4 Migrating batch process to HP-UX

Recasting DCL into one of the Unix shell scripts can be done with some automation using perl or awk scripts. However, there are approximately 2000 references to eighteen different types of system calls (lexicals). While most system calls can be duplicated with equivalent Unix calls or piped calls, a few of unique OpenVMS lexicals may need to be abstracted into a C or perl routine to mimic VMS call values.

8.5 Migrating the databases to HP-UX

There are OpenSource databases and ISAM file support on Unix systems, but our recommendation is to use Oracle for enterprise level database support. It is multiple platform supported, scalable, reliable, and highly available.

As stated earlier in the Microsoft database discussion, there is a trend in the industry to use the near real-time and simultaneous update and retrieval and analysis of database records to recast batch processes into continuous runtime applications. Reengineering to using an ODS Operational Data Store could make the printing of bills and other batch oriented jobs less reliant to a batch window.

There are no known migration tools for directly moving RMS files into other relational database systems, however, Oracle's SQL*Loader can be used to create database tables. A perl or awk script could be created to convert FDL files into scripts suitable for SQL*Loader to create the database tables.

If existing data from these RMS files are also needed. The following steps will be required to migrate the data. The VMS CONVERT/EXTRACT utility can be run to extract the data as sequential text files. After the database tables have been established, an additional perl or awk script could be created to load the tables with the sequential text file data using the SQL*Loader utility.

While moving all of the RMS files at once to a relational database sounds like a reasonable approach, it does mean the replacement of all RMS calls in the entire source modules will have to be done at the same time to complete the migration of these data. This does incur risk at a systems level, because so much change is incurred in the system at one time.

If the migration were to be done in a phased approach, a tool like Attunity could be used to continue to access RMS files on the existing OpenVMS system. Over time, individual RMS files could be incorporated into a larger Oracle database system and procedure calls could be implemented to replace the existing RMS calls in the existing source code modules.

9. Migration Sizing

Although HP was not able to perform a two-day assessment workshop, HP was able to obtain a copy of the CSS application sources, DCL scripts, and Axiant's PowerHouse source code from Newfoundland Power to analyze its size and complexity and determine a worst case estimate.

Sizing Assumptions

- Migration work does not include re-architecting the environment or the application, the migration effort assumes the same basic application functionality once moved to the new platform
- Sizing is based solely on the source code collection supplied by Newfoundland Power.
- Sizing is based on screen counts, build and test information supplied by Newfoundland Power referenced in Appendix B
- HP assumes that Newfoundland Power will assist in duplicating the CSS environment and application at HP. This system is to act as a reference site during any migration project as a migration test reference system
- HP assumes a migration verification test can be constructed from existing system validations and user verification tests created/owned by Newfoundland Power

Estimate to reengineer Axiant Powerhouse source files and eliminate the dependence on PowerHouse and migrate DCL batch, Cobol, and all other related applications is 1000 engineer-days of effort on either Unix or Windows platforms.

Estimate to migrate all applications and continued use of Axiant/Powerhouse is 300 engineer-days of effort on either Unix or Windows platforms.

This sizing estimate currently does not include

- on site training for Newfoundland engineers for operations and software development (e.g. Web, Unix, or MS training)
- hardware acquisition and deployment costs
- software licenses and support costs
- any maintenance or post project activities
- Newfoundland engineering time or project management
- Operations and user-impact and retraining

Appendix A - Source Code Analysis and Statistics

A.1 Source Code Statistics

dataset	dataset id	File Count	Total NCSS	Total Lines	Total Commentlines	Total Complexity	Total Volume
dcl	13	1369	58049	135550	76787	6124	1913.36059914807
Cobol	14	239	112859	239554	89655	7038	3915.46771401135
PreCOB	15	385	353611	688116	189670	15448	13127.7170694178
Sort	16	8	64	64	0	8	3.49026725691973
SQL	17	4	737	836	10	28	39.7269881447419
COB_LIB	18	598	15515	23486	7069	884	640.460546847298
FDL	19	151	4331	4958	0	151	51.3964024667489
PowerHouse	20	804	44798	56269	0	1251	2905.77238593677
Power_Forms	21	11	784	972	0	11	33.0673318141293
Powerhouse_Def_lang	22	7	23736	33600	0	12	1979.46907639642
SMR	23	1	7	7	0	1	0.25025142037603 4

A.2 Software metrics and Statistics

When we do a code assessment we want to determine how big a module is and how complex the module is. The module size. We use three common software engineering measures to determine size:

- non-comment source lines(NCSS)
- volume
- complexity

A.2.1 NCSS

Non-comment Source Statements is a count of those source code statements in a module that are not comments. When we refer to "Lines of Code" we are referring to non-comment source statements.

Using NCSS as a measure of size does not account for multiple operators/commands in a source statement or the number of unique data types and variables (operands) used. It doesn't tell you the number of different operations/commands that are used. It doesn't tell you how many operations the module does or how often it uses the operands.

A.2.2 Code Volume

The volume metric we use is a better measure of the operators/commands and operands used. It can be viewed as a measure of the richness of the Language used, how many different commands used, how many total commands, how many different operands used

and how often they are used. It is a measure of the amount of information represented in the module. The volume metric we use is the Halstead Volume Metric.

While the Halstead Volume Metric does give you a measure of complexity in the volume of information in the module it doesn't tell you about the structure or logic of the module.

A.2.3 Code Complexity

The complexity of the module. We use the McCabe Cyclomatic Complexity Metric to measure complexity. This metric assess the control flow through the module. It measures the number of decisions/branches made and how many of these decisions/branches are interconnected. The more decisions and the more interconnections the more complex the module is.

These metrics have been used by the Carnegie Mellon University's Software Engineering Institute, NASA's Software Assurance Technology Center, The US Army and many commercial firms. The Software Engineering Institute, the Software Assurance Technology Center and The US Army have published papers on the correlation of the Halstead and McCabe metrics to the maintainability and reliability of software. It is our experience that these metrics and their ratios are excellent indicators of the complexity of the code, it's reliability, how well it has been maintained and the ease in migrating the modules.

The distribution of the volume of the modules is one indication of ease of maintenance. Remember volume is a measure of the amount of "information" in a module. The more information in a module the more difficult it is to comprehend therefore more difficult to maintain.

When you plot the volume of the modules (log of) against the cumulative number of modules you should see a line sloping upward to the right which truncates in the 70th percentile with only a few points beyond .

One of the ratios we use is complexity density. Give the volume of the module how much logic is packed into it. The larger the module volume the less dense it should be. Large modules containing a large amount of logic are more difficult to write, debug, maintain and migrate. We therefore look at the distribution of the modules with respect to their complexity density.

Well structured applications keep the complexity in any one module to a density less than 2. Although it usually is impossible to completely avoid higher densities the number of modules with densities greater than 2 should be small. If you graph the module density (log of) against cumulative number of modules you should see a line sloping upward to the right which truncates when the density exceeds 2. You should see a small number of points beyond density 2.

Some problems are more complex than others and therefore the modules
Solving these problems will have higher complexity densities. However by plotting the complexity density (log of) against volume (log of) we get an indication of how the logic and functions of the application where divided up, packaged. This graph has a very definitive base line, (slope=1) that slopes from top left, very complex modules with small volume, to bottom right, large volume less complex modules. The points to the right of the base line should form a triangle. The angle formed by the base line and the far right side of the triangle is an indicator of reliability. The smaller the angle the more reliable the modules. The closer to 90 degrees the angle becomes the less and less reliable the code.

A.2.4 Complexity Density

We use the volume metric, the complexity metric, complexity density (complexity/volume) and graphs of their relationships to assess the reliability of the code, how the code has been maintained and the degree of difficulty to migrate the code. Our experience has been that these metrics and graphs are very accurate in pointing out modules that have been difficult to maintain, which modules are currently causing the most problems and which modules will be difficult to migrate.

1. Halstead Volume Metric

   n1= number of distinct operators/commands.
   n2= number of distinct operands/variables.
   N1= Total number of operators/commands.
   N2= Total number of operands/variables.
   Program Vocabulary n=n1+n2.
   Program Length N=N1+N2.

   Volume= N*log(n)

2. McCabe Cyclomatic Complexity Metric

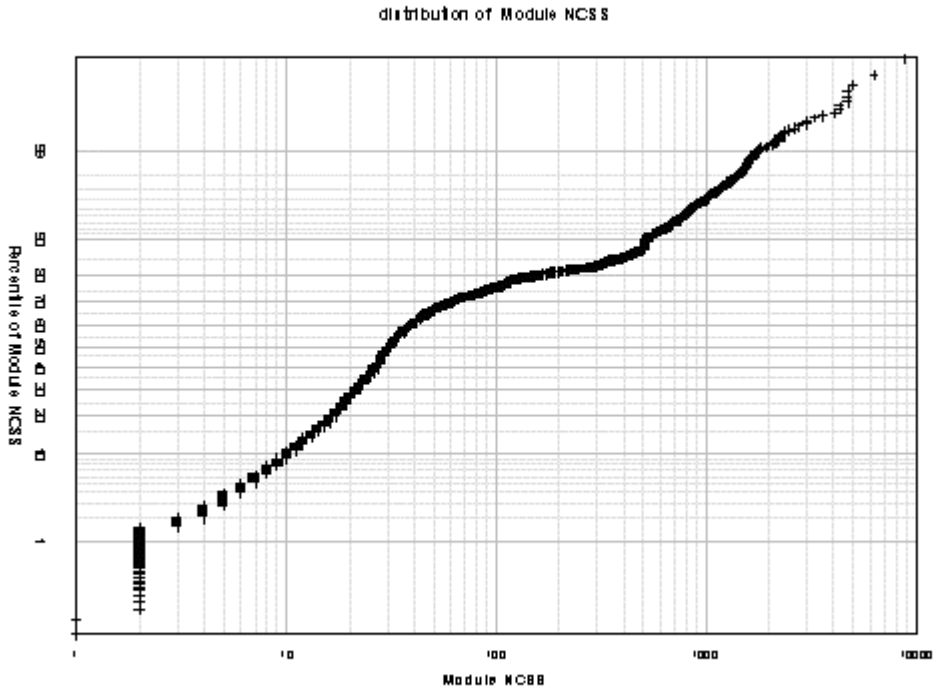
   This metric is computed from a connected graph of the module (topology of the control flow within the module).

   E= number of edges of the graph.
   N= number of nodes in the graph.
   P= number of connected components.

   Cyclomatic Complexity Metric= E-N+P

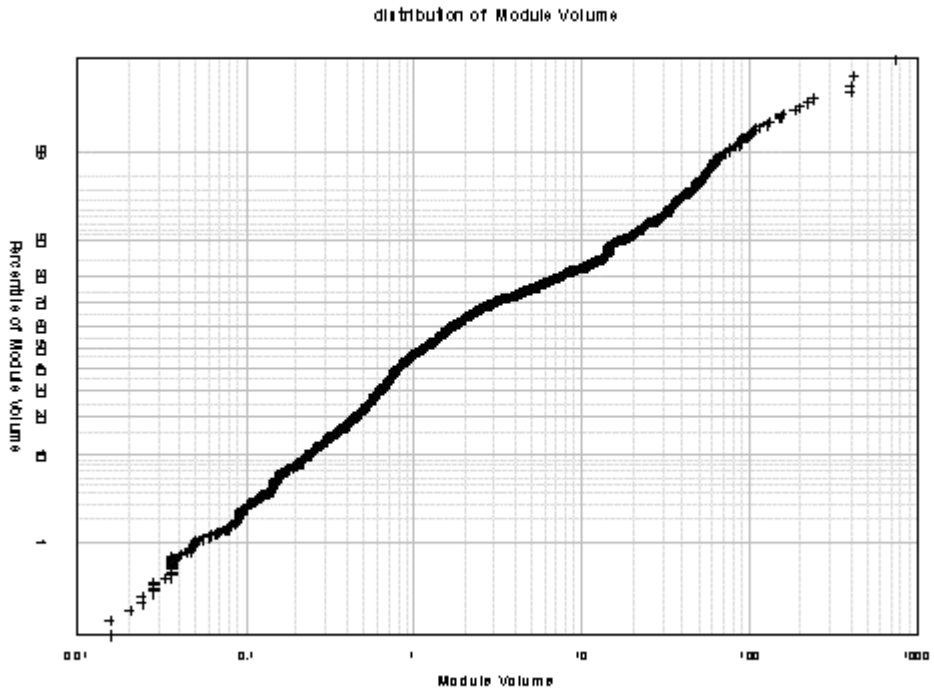
A.3 Code Analysis

A.3.1 Distribution of Module NCSS



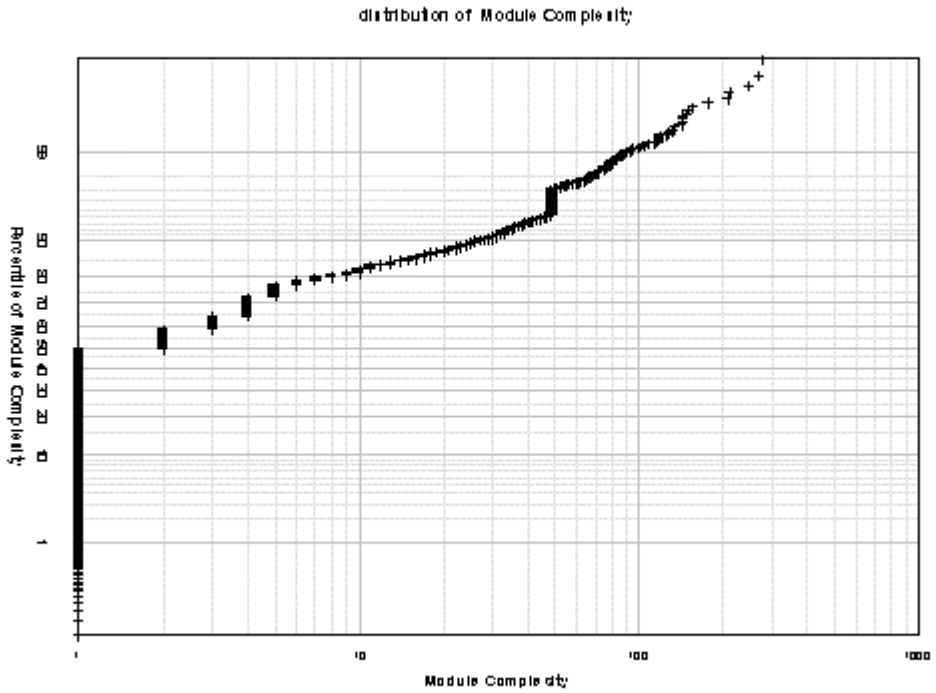
NCSS 80% at 200ncss with plateau, but last 20% rises to 10,000. Module volumes of 200 ncss is indication of following a design and development practice in a waterfall development process. While the 80% plateau indicates a regimented architecture and design, the 20% high slope is indicative of a long term maintenance practice that never revisited or never given time to permit adaptations to base architecture. Maintenance/re-architecture effort will be impacted 15%

A.3.2 Distribution of Module Volumes



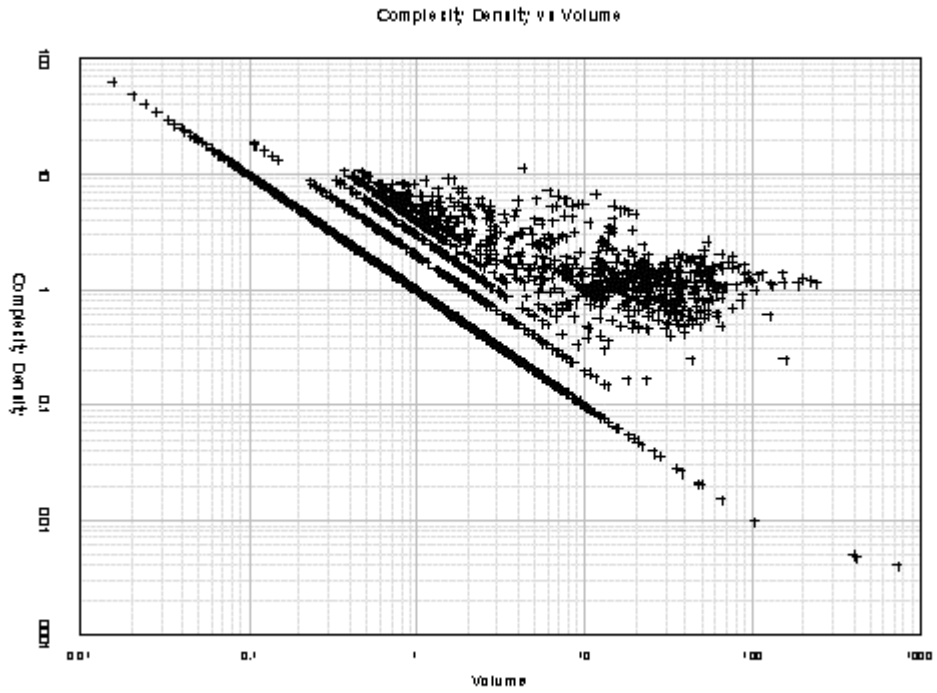
Halstead Volume at 80% of modules at 8, this is a typical value for controlled environments. In this case, the Halstead Volume and NCSS closely match.

A.3.3 Distribution of Module Complexity



The large bands on the left are indicative of large numbers of declarative files (record structures and other formatting and setup files). 80% of the modules are at or below the McCabe complexity of 10, which is indicative of trying to limit module complexity. This is an aid to maintaining or migrating code.

A.3.4 Complexity Density versus Volume



Appendix B – Other CSS Application Migration Data Points

1. How many RMS files currently support the environment - 1350 rms files - roughly 4 gigs
2. What is standard switch do they use on fhe OpenVMS Cobol - ANSI
3. If migrating off of Axiant is part of this estimate
   - how many screens are currently supported? - approx 160, today
   - approx number of concurrent screens opened - 15
4. When was the last time the entire software environment was rebuilt?
   Full on-line was rebuilt for an application upgrade last week. Full batch was approx 1 year ago. In the last year the full application was re-compiled through various projects and enhancement efforts.
5. Is the total software build process documented? Yes - THere are build scripts for the procobol/cobol and the Axiant is compiled from the repository with the native powerhouse compoiled on the server. I do believe we have scripts for everything. I can confirm.
6. Is there a test process, tools, or test harness to validate the current production system? –

Development environment utilizes a Development/Test/Prod approach. Unit testing is ad-hoc and is performed in the development environment.
Functional testing is formal (test plans are developed) for most changes whereby test plans are created and test data is identified/created usually by extracting live data from the production area (a procedure in place to do this) and put into the test area.

For almost all of the online functionality and most of the core Batch processes there is a functional specification for each conversation or major batch module. For a subset, but most of these processes, functional test plans are in place as well. These test plans are used as templates for development of test conditions for new or changed functionality. The analyst based on the scope of the change determines how much of the full test plan to execute for the new functional test.

Integration, regression and performance testing is performed as required.

The disaster recovery site is used for these types of testing. To test the batch procedures system back-ups are recovered to the DR environment (which is an exact copy of production in almost every respect - CPU, database etc. type and size). Specific information is identified for before and after checks as required. Batch processes are ran with timings taken and both broad checks (number of bills, report totals, journal entry totals etc.) and specific checks where identified are completed. Online performance testing is extremely rare for level of change and when performed is done manually in the DR environment. No online testing tools are in place. We used Visual Test in the last technical migration (COBOL/Install/1 to Axiant/Powerhouse) but because of the nature of Powerhouse it was very manual intensive to set

up.

There is no repository of test data or a regression test environment (with predefined test data) for the overall system.

For rate calculation and bill presentation only, there is a small regression test environment (called CATS) with predefined test data and refresh and execute procedures.

There is a bill checking excel spreadsheet environment which is used to download a sampling of bills each day and check them for accuracy. This is sometimes used to assist testing.

We are strong proponents of a release strategy where we batch up changes into a release usually once per month bust sometimes weekly.

In terms of time it takes to perform the various tests it varies on scope of changes.

The client group is very mature with respect to testing methodology. Traditionally IS performs all testing accept User Acceptance test however we have a number of client analysts who perform functional testing now as well.

We never have the same person performing a functional test and an acceptance test.

Typically because the system is quite stable Integration test, Performance testing and Acceptance testing are completed together however if we have specific performance or integration concerns we complete this testing separately or with functional testing.

Hardware and System management tests are rarely required and are based on scope of change. When we add a new CPU or some other module we will install in Disaster Recovery environment first and run batch processing etc and check. Having said all of this the existing procedures will have to be re-developed/modified for the new environment and this is a significant part of the effort.

Appendix C - A Security Timeline On Microsoft Software

This timeline is based on a number of articles from eweek, The Inquirer, C/Net News, and the Gartner group.[3]

June 18, 2001 - Microsoft reveals Web server hole
vulnerability lies within the code that Microsoft's IIS server uses to support indexing, a feature that speeds searching on Web servers[4]

July 19, 2001 - First outbreak of Denial of Service attack on IIS servers

Sep 18, 2001 - Nimda work DOS attack on IIS servers

Sep 19, 2002 - Gartner recommends moving off of IIS servers[5]
This move should include any Microsoft .NET Web services, which requires the use of IIS

May 3, 2002 - C/Net "Code Red still threatens Net "
Code Red and its two variants use a security hole in IIS

Aug 19, 2002 - Microsoft Security Under Fire

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Twice in the past three weeks, experts have issued reports of
security flaws in Microsoft products, and both times the company
remained silent, making no immediate public comment and issuing
no fix.
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Aug 20, 2002 - researchers find a new flaw in Microsoft Corp.'s SQL Server database software.

Jan 3, 2003 - Yaha worm - DOS attack on MS email servers

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[3] www.eweek.com, www.gartner.com, www.theinquirer.com www.news.com

[4] . The module, known as the Indexing Service ISAPI Filter, does not properly check for buffer overruns, a common problem in software. Maiffret estimated that at least 50 percent of all IIS servers--about 3 million--still have the default component installed and are thus vulnerable.

[5] Gartner recommends moving off of IIS servers that enterprises hit by both Code Red and Nimda immediately investigate alternatives to IIS, including moving Web applications to Web server software from other vendors, such as iPlanet and Apache.
Gartner believed that rewriting of IIS would not occur before year-end 2002 (0.8 probability).

Appendix R - Sector7 Technical Migration Assessment External

Sector7

NORTH AMERICA • EUROPE • ASIA PACIFIC

Budget and Planning Estimate to

NEWFOUNDLAND POWER
A FORTIS COMPANY

Re-Hosting of Customer Service System (CSS) from HP Alpha OpenVMS 7.2.1 to HP HP-UX

Date: 27 May 2003
Revision: 1.6

Contact: Lyman Lundquist (Lyman_Lundquist@sector7.com) +1-512-340-9717

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Tables

Figures

1 Definitions

‘Sector7’ refers to Sector7 USA, Inc. and/or Sector7 (U.K.) Ltd.

‘NFP’ refers to Newfoundland Power Inc. of St. John's, NF Canada

‘CSS’ refers to NFP’s Customer Service System application

‘Time and Materials’ or ‘T&M’ means actual hours worked will be billed at a pre-determined rate on bi-weekly basis

‘Fixed Price’ means client will be billed at each payment milestone date for a pre-determined amount. Billing is not based on actual hours worked

2 Executive Summary

Sector7 is pleased to present NFP with a Budget and Planning Estimate for Sector7's effort to provide services to port the CSS application(s) owned/developed by NFP from HP Alpha OpenVMS 7.2.1 to HP HP-UX.

Sector7 is partnering with NFP to make the re-hosting of the CSS application very cost effective — with minimal risk. Software migration is a complex process that requires meticulous planning. Platform migrations are a specific competency, comprising complex engagement managers, powerful migration tools, migration skills, and hardware and packaged applications, all of which Sector7 is able to provide.

2.1 Introduction

Newfoundland Power Inc. operates an integrated generation, transmission and distribution system throughout the island of Newfoundland, and serves approximately 220,000 customers in 600 communities. These customers constitute 85 per cent of all electrical consumers in the province.

Sector7 has been providing application re-hosting and renovation solutions for companies needing new hardware technology that maximize their software investments since 1985. The Sector7 Professional Services Group has been involved in porting projects for many of the top companies in the world. Our broad range of experiences allows us to effectively help in all aspects of a porting project from the business case to the most detailed technical problem.

Sector7 is one of the world leaders in "Preserving software investments through cost-effective, low-risk migration." Until recently, migration was either too costly, involved laborious re-engineering, or there were no tools available.

Sector7 have devised a five-step process that efficiently coordinates every aspect of a migration. We begin with an in-depth analysis of your current environment, establish a road map for each component then outline a detailed "start-to-finish" solution that guides you through migration and systems integration. Each stage of this proven "Blueprint" process is designed to build upon the previous stage and move seamlessly into the next. Sector7 has performed numerous migrations using this process

2.2 Our Understanding of the Business Problem and Opportunity

NFP utilizes a number of corporate applications that run on OpenVMS. This platform is no longer part of NFP's long-term target architecture strategy, and so they are reducing dependence on this platform through replacement of systems via package acquisitions, re-development and technical migrations. The Customer Service System (CSS) is by far the largest corporate application running on the platform today.

Developed in house, the Customer Service system (CSS) provides NFP's primary accounts receivable and direct customer billing for electrical sales. It consists of cash, customer billing, credit and collections, accounts receivable, service orders, processing meter reads, inquiries, data maintenance, and reporting modules.

NFP is interested in examining all viable approaches to a technical migration of CSS within two basic alternatives:

1. Move the existing CSS from the OpenVMS platform to a new platform(s) while keeping major technology components (e.g. keep COBOL, Powerhouse, Axiant etc.).

2. Move the existing CSS from the OpenVMS platform to a new platform(s) while redeveloping major technology components according to the Company's Target Technology Architecture (Wintel with .net technologies)

The results of this Budget and Planning Estimate will provide NFP with the means for approval to move forward with a Sector7 Stage One or Stage Two Assessment, which will assist in determining their on-going strategy for platform replacement.

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2.3 Migration Approach Overview

While NFP is interested in examining all the viable approaches to the migration of CSS within the two basic alternatives described above, this Budget and Planning Estimate specifically addresses option (1) - Move the existing CSS from OpenVMS platform to a new platform while keeping major technology components (i.e. keep COBOL, Powerhouse, Axiant). This approach reduces risk by virtue of reducing the amount of re-engineering required to make this transition. Reduced risk greatly increases the opportunity for project success and positions CSS on the new platform so that subsequent redevelopment of major technology components can safely take place.

Sector7 does not recommend option (2) because in Sector7's experience the re-engineering required to re-architect an application such as CSS towards Microsoft .Net technology is so large as to virtually constitute a complete re-write. This is therefore an extremely high-risk strategy, one which often suffers "scope creep" as technologies change during the lifetime of a long project, presenting a moving target and making it almost impossible to reach a satisfactory end.

2.3.1 Target Platform

In Sector7's experience, upwards of 95% of OpenVMS installations choose UNIX-based platforms when migrating. This is because UNIX is a true multi-user system, whereas Windows is not. That is, Windows is designed to be used by one person at a time. Databases running under Windows allow concurrent access by multiple users, but the Operating System itself is designed to deal with a single human being at a time. UNIX is designed to handle multiple concurrent users and therefore matches the architecture of OpenVMS. Windows is designed with fat client/server architecture in mind. There is however a multi-user version of Windows called Terminal Server (TSE).

On TSE and multi-user Windows systems from commercial companies such as Citrix and others, the Windows NT kernel is modified to allow each session to create a complete virtual machine execution space for each new session. This means the entire Win32®-based subsystem gets "cloned" for each new session and a dedicated section of memory and other resources are reserved for each new session. Each user runs their session in a protected virtual machine on the server and has access to their own virtual memory and devices. While the virtual machine concept is technically viable, there are issues with resource consumption. Since each user needs their own virtual memory space, typically a minimum of 20-40 megabytes of RAM is required for each session that is hosted on the server. If the user is running large memory intensive applications, even more can be required. The result is that most large installations of TSE run with what has come to be known as "server farms." Companies install multiple systems with TSE and load-balance users across the multiple networked servers. As more users join the network, additional servers can be added to take up the load. The obvious disadvantage is the tremendous cost in hardware system resources.

2.3.2 CSS Architecture

The on-line parts of CSS are developed using Cognos Axiant 4GL deployed in thin-client mode, which means that while the user-interface processing takes place on the client, the application and data processing are on the server. Indeed, CSS is heavily reliant on server-side COBOL programs called from the on-line Axiant screens – these contain much of NFP's business rules and logic.

In Sector7's experience, a server-biased application such as CSS with high on-line user concurrency (100 users for CSS) and a heavy batch processing (10 hours/night for CSS) sits better on a UNIX-based database server such as HP HP-UX rather than a Microsoft platform such as Windows 2000/XP, due to the architectural differences between the two platforms outlined above.

NFP has expressed interest in changing from Oracle RDBMS to Microsoft SQLServer. Sector7 believes that this would be a major re-engineering effort because the existing CSS code is very heavily reliant on embedded SQL (Oracle Pro*COBOL) and SQLServer does not support Embedded SQL well (see Appendix C). NFP has further expressed a strong desire to re-engineer CSS to Microsoft .net architecture.

In relation to both these points, Sector7's experience is that re-engineering while migrating is a very high risk strategy prone to failure: typically, the amount of time, effort and funding required is severely under estimated while on-going technology advancements and business change present a moving target and thus a never-ending project. Testing a re-engineered application on a new platform is particularly fraught as it is virtually impossible to create consistent test data comparable test cases between the source and target systems.

To re-engineer an CSS for SQLServer means, in practical terms, stripping out all EXEC SQL statements and replacing them with API calls to the SQLServer ODBC API. The cost of this re-engineering is proportionate to the number of embedded SQL statements contained in the CSS COBOL, plus additional costs for the analysis and re-design of the data access methodology. Please refer to Appendix C for a more detailed discussion of this topic.

CSS is heavily dependent on the VMS DCL command language, and NFP has expressed a desire to “go native” with regard to command procedures on the target platform. However, Sector7 would recommend using its VX/DCL DCL emulator as this enables the CSS DCL procedures to be moved quickly and cheaply to the target platform – refer to Appendix B for details.

2.3.3 Summary

In consideration of the above, this Budget and Planning Estimate focuses on a “like-for-like” migration of CSS from HP OpenVMS to HP HP-UX while keeping major technology components of COBOL, Powerhouse, Axiant, DCL, etc.

However, Sector7’s approach in selecting open technologies such as MicroFocus COBOL and Oracle RDBMS will allow NFP to defer the final deployment decision until the port to HP-UX is completed.

In this way, the port to HP-UX can be seen as moving CSS onto a “spring board” platform, ready for any future developments and technologies as NFP may choose.

2.4 Schedule & Pricing

When creating a Budget and Planning Estimate to re-host an application, we apply the experience and knowledge gained from prior projects to develop an estimated Schedule and Price.

The assumptions and determinations within this document are based on the information, application metrics and any source code provided to us by NFP – we have not performed an in-depth analysis of any code supplied. Any deviations in the information provided to Sector7 that affects Sector7’s understanding of the application, application metrics, or portability of any third-party products mentioned in this document might impact the estimated Schedule and Price specified.

Based upon our current understanding of the project scope and requirements from NFP and the migration approach described above, our Budget and Planning Estimate is shown in Table 1.

Table 1 – Budget and Planning Estimate

Name/Nature of Application	NFP / CSS
Current Platform	HP Alpha OpenVMS 7.2.1
Target Platform	HP HP-UX
Liability	This is a Budget and Planning Estimate for a Time & Materials effort
Estimated Duration	7 to 9 calendar months
Estimated Price Range	US$720,000.00 to US$905,000.00 excluding Sector7 VX/Tools licenses

Figure 1 – Breakdown of Project Costs including Project Management

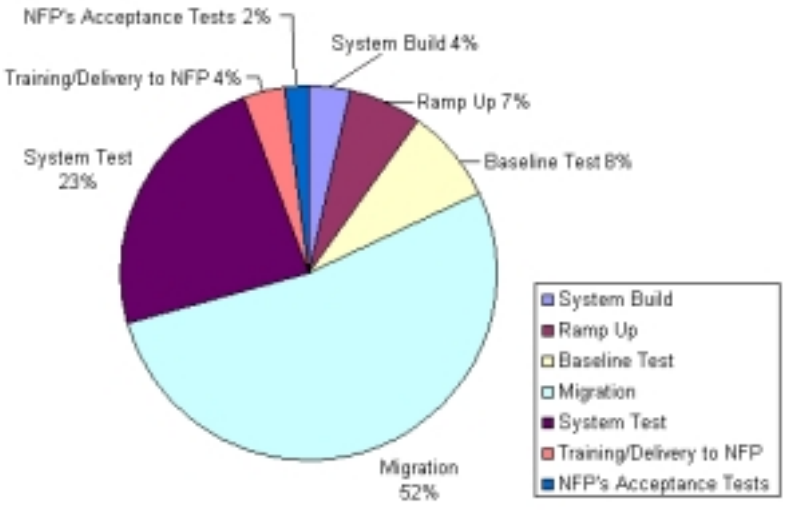
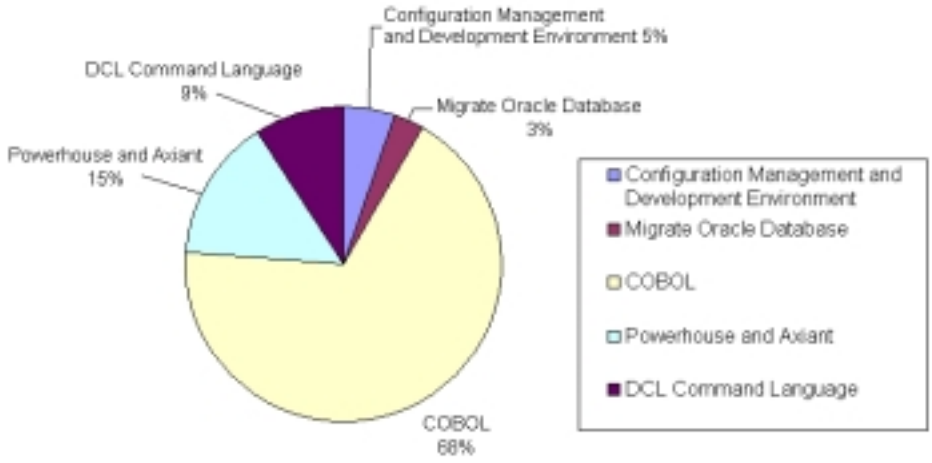


Figure 2 – Breakdown of Migration Costs including Project Management



2.4.1 Sector7 VX/Tools Pricing

Sector7 is recommending usage of the following elements of its VX/Tools suite of migration tools. Please refer to Appendix B for a full description of these products. Note that maintenance for the first year is mandatory.

Product Name	Cost of 4-User Development License	Cost of Unlimited User Run-Time License	Cost of Annual Maintenance
VX/DCL	N/A	US$10,000.00	20% of license fee
VX/JSP	N/A	US$5,000.00	20% of license fee
VX/RT	US$35,000.00	US$20,000.00	20% of license fee
VX/RMS	Included in VX/RT	Included in VX/RT	Included in VX/RT
TOTAL	**US$35,000.00**	**US$35,000**	**TOTAL: US$70,000**

Note: where possible, CSS' usage of VMS System Services will be migrated native HP-UX equivalents. Alternatively, Sector7 may use its VX/RT library to replace these calls. This determination requires additional analysis.

2.5 Recommendation/Next Step(s)

Depending on the requirements of NFP, there are three options to be considered as the next step:

- Initiate the migration project on a Time & Materials basis as described in Table 1
- Perform a Stage One Assessment to determine the order of magnitude price and duration for the project. Typically this takes 6-8 weeks and we can provide a T&M estimate to within ±30% of the final price. There will be a fee of US$30k charged for the Stage One Assessment, however, a portion of this fee will be waived if the migration project is awarded to Sector7.
- Perform a Stage Two Assessment to determine a fixed price and schedule for the project. Typically this takes 8–10 weeks and there will be a fee of US$100k charged, however, a portion of this fee will be waived if the migration project is awarded to Sector7.

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3 Project Approach

3.1 Introduction

Sector7's approach to the migration and implementation of NFP's application is driven by an integrated methodology, offering proven Project Management and technical delivery methods. The focus of our approach is to provide high-quality deliverables within the schedule and budget committed.

In this section, we will describe in more detail each of the following:

- Project management roles and responsibilities
- A phased approach
- Risk management
- Quality assurance
- Critical success factors
- Benefits of re-hosting
- Teaming

3.2 Project Management Roles and Responsibilities

Effective project management (PM) is probably the most critical skill required to implement a successful project/solution. Sector7's project management approach follows consistent, well-defined processes, and has a proven track record in delivering results. At Sector7, we recognize project management as a core capability and our service professionals, who have chosen this career path, are held to very high standards and expectations.

The keys to Project Management are demonstrated leadership, high productivity, effective communications, and the ability to properly manage the following activities within the framework of the project.

- Detailed project planning, which allows for high-confidence in project schedules and estimates
- Closely tracking project activities against the project plan, so that course corrections can be applied quickly, if needed
- Ongoing management of project issues and risk contingency plans
- Quality assurance and deliverables management
- Tight scope and change management disciplines
- Daily management of project concerns, team chemistry, and morale management
- Accurate reporting of results that are achieved

In addition to Sector7's methodologies and capabilities, Sector7 project managers are also highly skilled in the use of PM and tracking tools, such as Microsoft Project. In summary, our experience has shown that the combination of methods, capabilities, and tools consistently yield positive results.

3.3 A Phased Approach

Sector7 is recommending a multi-phased approach to the development and implementation of the migrated CSS application. We believe that this approach provides reduced risk and increased opportunity for project success.

Step One – Migration Assessment

The Migration Assessment provides an initial assessment to determine the rough order of magnitude price and duration for a project. This stage determines the project scope.

The entire environment is reviewed for porting to the desired platform. Sector7 will review the software components such as; language, databases, user interfaces, communications and COTS software.

Step Two – Migration Planning

Migration planning focuses on gaining a comprehensive understanding of the migration pursuit, and concludes with a refinement of the original budget and planning estimates provided. The primary tasks performed during this phase are additional application and database analysis, detailed project and test planning, and validation of our readiness to enter phase three. This activity can be performed separately, or as a component of the migration project itself.

Steps Three, Four & Five – Migration, Testing, and Deployment

Migration, testing, and deployment are the final and largest steps in the migration process. Multiple levels of testing of the migrated components and a formal User Acceptance Test will be included. Each of the tasks included in this stage are set out in appropriate section of this document.

3.4 Risk Management

Risk is a natural part of any systems integration project and its proper management can determine its success or failure. Sector7 begins risk management during the proposal process by identifying the foreseen risks in the project and developing an associated Risk Management Plan. This plan identifies and quantifies the risk and Sector7's recommendations.

- Avoidance – eliminating the cause of the risk through clearly-defined actions/events/tasks
- Mitigation – acknowledges that the risk is not avoidable, but defines steps to mitigate the level of risk
- Acceptance – acknowledges an awareness of the risk and documents the associated consequences

New or additional risks are also identified during the progression of the project and are included and managed via the Risk Management Plan. The Sector7 Project Manager utilizes this plan as an instrument to verify our progress against avoidance or mitigation plans with the focus being to reduce the overall risk of the initiative.

There is acknowledged risk in the re-hosting of any application from one platform to another. A strong Risk Management Plan, effectively managed in concert with NFP, will be essential to a successful delivery.

3.5 Quality Assurance

The process that Sector7 utilizes to validate adherence to proper project management processes, our systems integration methodologies, development, and implementation of sound technical architectures is known as Quality Assurance (QA). The objective of QA is the recognition, containment, and/or mitigation of any issues or risks that would jeopardize the success of a project. Success is defined as Sector7's ability to deliver the project to our contractual obligations and to the expectations (satisfaction) of our customer.

We refer to this as assessing the 'project health'. There are two types of QA processes that will be included in our approach – Project Management QA and Technical QA.

The Project Management QA process begins during the development of the proposal under review. Prior to delivery of our proposal, it has already received review from multiple levels of QA to validate that the initial approach is consistent with the proven techniques and methodologies practiced by Sector7.

Shortly after project initiation, Sector7 will perform a QA review to verify that the project is off to a good start, as this is critical to the overall success of the effort. Throughout the life of the project, Sector7 will perform periodic reviews of the project to assess its health and report the findings to Sector7 management. If there are concerns identified then the review frequency is increased until such concerns are alleviated.

It should be noted that client participation is an important aspect of these QA reviews. Sector7 solicits clients' input as part of the process and responds to their concerns, even if they have not surfaced in discussion with the Sector7 team members, or through our review processes. A team comprised of experienced QA representatives, senior project managers, technical staff, and management representatives conduct the QA reviews. The culture of Sector7 welcomes these reviews; we understand their importance and value to the process of delivering quality migration services.

The Technical QA process also begins during the development of our proposal. The proposed solution architecture is reviewed prior to inclusion in our document. At logical milestones in the project life cycle, Sector7 provides an independent technical review of the solution architecture and reconfirms its ability to meet the functional and technical requirements of the project. Senior systems architects and other technical staff, with a focus in the technologies involved, staff the reviews.

3.6 Critical Success Factors

Sector7 has identified the following key-factors believed to be critical to the success of this initiative. Our overall approach and solution addresses these factors as follows:

Strong relationship and open communications

Projects of this nature are successful when both parties are in 'lock step' regarding the project objectives, approach, issues, and ongoing status. The team, which addresses this effort, should be comprised of NFP and Sector7 personnel, which appear seamless. Maintaining open and clear communications at all levels of the project is vitally important.

Proven migration, systems integration, and project management skills coupled with a strong understanding of source and target technology

This project will likely require the choreography of multiple efforts with interdependencies and integration with multiple vendor hardware, software, and networks. Sector7's approach directly addresses this need by providing strong project management and systems integration skills in our service professionals. Sector7 brings a real depth in knowledge of the source architecture, and possesses a proven record of performance in managing similar complex projects with high-customer satisfaction.

Industry knowledge, experience, and leadership

Sector7 has over fifteen years of industry experience, and is well recognized for our leadership in the migration industry. We believe that the combination of our knowledge, skills, and solutions coupled with your subject matter expertise will yield a superior result for NFP.

Training

The migrated applications will utilize technologies and concepts that may appear new to many of the technical staff at NFP. A well-conceived Training Plan that is associated with the proper level of financial investment is imperative for success of the project. Sector7 will work with NFP to assist in defining training needs based on our experience in working with other clients.

Executive Sponsorship

As this initiative crosses many areas of the organization, it becomes increasingly important that there be a consistent level of importance and priority given to the project. NFP senior executives must be in full support of this initiative and provide the appropriate priority of internal resources and financial commitments for the project to succeed.

3.7 Benefits of Re-Hosting

There are numerous benefits of re-hosting, which include:

Business Benefits

- Lower cost of ownership - the escalating costs of hardware maintenance and the associated third-party software maintenance fees will be greatly reduced
- Minimum risk migration with Sector7
- Potential for increase in performance
- Retraining of application users not required
- Opportunity for the current engineering staff to re-skill
- Minimizes system operations training requirements

Technical Benefits

- The application structure will not have changed beyond recognition: development staff will still be familiar with the application code ported to the new platform
- Application logic will remain intact: current staff can support the migrated application

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3.8 Teaming

Sector7 believes that fundamental to the success of any client engagement is a desire to establish and maintain a sense of teamwork throughout the project. Teamwork brings the winning combination of skills from both organizations and encourages the necessary level communications, dedication, and synergy to be successful. We welcome the opportunity to work together; it's our engagement model!

The team of Sector7 and NFP personnel will provide the blend of skills and experience needed for a successful project. Each organization's strengths, when coordinated as a team on this migration effort, will assure success.

Where possible, it is preferable to perform tasks that do not require Sector7 staff to be 'face-to-face' with NFP staff off-site, to minimize expenses and maximize productivity.

Sector7 is sensitive to NFP's requirements and wishes in all aspects of the project, and are happy to discuss a permanent Sector7 presence on site if NFP feels more comfortable with it. This will of course be subject to agreement on both sides regarding expenses.

4 Scope of Work

This section outlines and quantifies (at a high level) the scope of work to be accomplished by Sector7.

4.1 Key Assumptions

This Budget and Planning Estimate and Sector7's estimates to perform are based on the following key assumptions:

1. This is not a substitute for a formal assessment or proposal by Sector7. This Budget and Planning Estimate focuses on migration tasks and may not necessarily include other tasks that may go into the planning or execution of a migration services engagement. Prices and durations for any future requirements should not be directly extrapolated from this Budget and Planning Estimate, since a variety of other technologies and risk factors may be involved
2. Application information and metrics have been provided to Sector7, and are set out in Table 2 and Table 3. Access to application source code was provided to Sector7 for the purposes of the preparation of this Budget and Planning Estimate – subsequent review of the application source code supplied at the start of the project could impact the Schedule, Charges, or other terms of this Budget and Planning Estimate.
3. Some Sector7 activities on this project will be performed at one or more Sector7 locations, and the remainder at NFP's location in St. John's, NF Canada
4. All source code delivered to Sector7 must be complete, include no extraneous files and will be "frozen" during the migration project
5. Unless otherwise stated, Sector7 will not be responsible for:
    a. the physical relocation of any hardware components
    b. the sizing/acquisition/installation/configuration/connectivity and management of hardware components including, but not limited to, workstations, servers, storage/backup devices, printers and network components required to fulfill the objectives of this project
    c. the acquisition/installation/configuration/tuning/connectivity and management of foundation software components including, but not limited to, operating system, compilers, administration tools and database software required to fulfill the objectives of this project
    d. the design/planning/acquisition/installation/implementation/tuning and security of the network infrastructure required to fulfill the objectives of this project
    e. the acquisition/installation/configuration/tuning/porting and/or debugging/validation of third-party software components including, but not limited to, development tools, networking, middleware, messaging, and groupware required to fulfill the objectives of this project
    f. the acquisition/installation/configuration/tuning/porting and/or debugging/validation of 'open source' components used by the application(s) required to fulfill the objectives of this project
    g. the reverse engineering of software components used by the application for which no source code is available, or for which the source code does not match that of object libraries or executable programs currently used in the production environment
    h. porting development code, which is unstable, untested and unproven. However, we recognize that there may be code that would need to be moved/loaded as-is from development/QA servers to servers in the new consolidated environment. Such code will be moved 'as-is' without any effort made to port, test or validate.
    i. functional changes or enhancements to the code being ported beyond the scope of the project; such as 32 to 64-bit conversion
    j. diagnosis and repair of all code defects unrelated to migration changes
6. Sector7 will work with NFP to ensure that the performance of the migrated application, will be equal to or greater than the original performance on the original platform, given that the target platform(s) is/are properly sized, configured and can provide the resources required to meet the performance metrics
7. NFP has expressed interest in sub-contracting parts of this project, specifically the Powerhouse and Axiant elements, to a third party (Core). In this event, Sector7 would retain the lead project management position as this would be essential for overall project control and vision which in turn eliminates a project risk factor
8. NFP will be responsible for performance of the Acceptance Test task of this project and for providing test resources to support the Baseline Testing and System Testing tasks

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4.2 Scope

The purpose of this project is to port NFP's CSS application from HP Alpha OpenVMS 7.2.1 to HP HP-UX.

The CSS application and databases are hosted on a single HP Alpha 4100 running OpenVMS 7.2.1. CSS is based on 2-tier architecture with the PC Client and Application/database server.

The online environment consists of a Client/Server GUI architecture built with Cognos' Axiant client/server Integrated Development Environment. Axiant is complemented with some backend calls to Cobol from the online environment.

There is a large batch environment for high volume transactions and larger reporting requests (e.g. post readings, post cash payments, edit accounts, calculate late payment charges, calculate forfeited discount charges, calculate bills, print bills, perform audit checks, populate collection queues, issue form letters, produce daily, weekly and monthly reports etc.)

Powerhouse QTP QUIZ is used on the OpenVMS server for reporting and batch processing with a huge reliance on DCL for the batch architecture. The Nightly batch environment is run by operators.

Data storage consists of Oracle Server enterprise edition version 8.1.6.0.0 plus some native VMS RMS files. RMS files are primarily used to hold interim transactional data, control data and some reporting information and as well to load database tables during batch processing. Powerhouse sub-files are also used.

Integrations are built with Itron's Hand Held Meter reading application and Great Plains e.Enterprise Financials. All integrations are strictly point to point data file transfer.

Development languages and version are:

- Client Desktop:
  - Cognos: Axiant 3.0.
  - Visual Basic module for specific screen handling technique
- OpenVMS Application/Database Server:
  - Cognos' Powerhouse 4GL for VMS Version 820.d3.
  - OpenVMS Cobol 2.4
  - Oracle Pro*COBOL
  - OpenVMS DCL

NFP has provided the following information to Sector7 in April 2003, which forms the basis of Sector7's determinations in this estimate, and should assume to be incorporated into the Key Assumptions.

- The migration target will be HP HP-UX and MicroFous COBOL
- There is no third-party product usage on HP Alpha OpenVMS 7.2.1
- For each test cycle, Sector7's estimate includes 2 Sector7 test resources for 20 days working with NFP testers

Table 2 – Application Information

Development Language	COBOL, Pro*COBOL, Cognos Powerhouse
O/S Dependencies	Some usage of OpenVMS SYS$ and LIB$ system services
Data Storage and Access	Oracle RDBMS version 8.1.6 (2 databases, 30GB total data) Approx 1350 RMS files and 410 Powerhouse Sub-Files
Third-Party Products	Itron Meter reading; Great Plains e.Enterprise Financials
User Interface	Cognos Powerhouse 4GL and Axiant 4GL 3.0 Some character-based VT screens for the batch environment
Networking and Communication	TCP/IP
Middleware	None
Messaging/Groupware	None
Command File Usage	DCL
COTS Usage	None

Table 3 – Application Metrics

Module Type	File Total	Total Lines	Comment Lines	SLOC
COBOL	242	243,146	56,663	186,483
COBOL Copylibs	597	23,532	1,515	21,071
Pro*COBOL	388	700,645	40,578	512,369
Total COBOL	**1,227**	**967,323**	**98,756**	**719,923**
Powerhouse Axiant (.QKP)	167	221,957	118,843	103,114
Powerhouse Axiant (.QKS)	31	3,260	292	2,968
Total Axiant	**198**	**225,217**	**119,135**	**106,082**
Powerhouse QTP (.QTS)	146	9,870	2,025	7,845
Powerhouse QUIZ (.QZS)	659	46,624	7,738	38,886
Powerhouse PDL Source	7	43,554	295	43,259
Total Powerhouse Source	**812**	**100,048**	**10,058**	**89,990**
PVCS Build Files (.BLD)	344	47,807	22,628	25,179
SQL Source	4	8,218	464	7,754
DCL COM Source	1,369	138,112	78,498	59,614

**Note:* *Total lines includes comments & blanks*

4.3 NFP's Testing Strategy for CSS

NFP provided Sector7 with the following outline of the existing testing strategy for CSS:

The development environment utilizes a Development/Test/Prod approach. Unit testing is ad-hoc and is performed in the development environment. Functional testing is formal for most changes whereby test plans are created and test data is identified/created usually by extracting live data from the production area and put into the test area.

For almost all of the online functionality and most of the core Batch processes there is a functional specification for each conversation or major batch module. For most of these processes functional test plans are in place, and these are used as templates for development of test conditions for new or changed functionality. Based on the scope of the change, the analyst determines how much of the full test plan to execute for the new functional test.

Integration, regression and performance testing is performed as required. The disaster recovery site is used for these types of testing. To test the batch procedures, system back-ups are recovered to the DR environment (which is an exact copy of production in almost every respect - CPU, database etc. type and size). Specific information is identified for before and after checks as required. Batch processes are ran with timings taken and both broad checks (number of bills, report totals, journal entry totals etc.) and specific checks where identified are completed. Online performance testing is extremely rare for level of change and when performed is done manually in the DR environment. No online testing tools are in place. NFP used *Visual Test* in the last technical migration (COBOL/Install/1 to Axiant/Powerhouse) but because of the nature of Powerhouse it was very manual intensive to set up.

There is no repository of test data or a regression test environment with predefined test data for the overall system. For rate calculation and bill presentation, there is a small regression test environment (called CATS) with predefined test data and refresh and execute procedures. There is a bill checking excel spreadsheet environment which is used to download a sampling of bills each day and check them for accuracy. This is sometimes used to assist testing.

In terms of time it takes to perform the various tests it varies on scope of changes.

The client group is very mature with respect to testing methodology. Traditionally IS performs all testing accept User Acceptance test however NFP has a number of client analysts who perform functional testing now as well. NFP never has the same person performing a functional test and an acceptance test.

Typically because the system is quite stable Integration test, Performance testing and Acceptance testing are completed together however if there are specific performance or integration concerns NFP complete this testing separately or with functional testing.

4.4 Migration Approach

The estimated Schedule and Price is predicated on the following approach to the migration of CSS to HP-UX:

- Build Baseline OpenVMS system at Sector7; rebuild application
- Run tests and verify results
- Build Target HP-UX system at Sector7; install Oracle database and development tools (Oracle, Powerhouse, Axiant)
- Migrate Oracle database from OpenVMS to HP-UX and validate
- Using Sector7 tools, convert VMS COBOL and Pro*COBOL code to MicroFocus COBOL and compile on HP-UX
- Where possible, convert usage of VMS System Services to native HP-UX code. Alternatively, Sector7 may use its VX/RT VMS API library to replace these calls. This determination requires additional analysis. See Appendix B for a description of VX/RT.
- Migrate all Powerhouse code and Axiant screens to HP-UX
- Modify DCL command procedures for Sector7 VX/DCL on HP-UX
- Test / Break / Fix
- Delivery / Handover to NFP
- NFP runs acceptance tests and verify results
- Project completion and sign-off
- Sector7 provides on-site support during installation and client acceptance testing

The above steps are very "high level", but nevertheless show the key components of the project. A staged approach reduces risk and streamlines the migration process, allowing easier testing and more rapid deployment on the new platform.

4.4.1 Benefits of the Proposed Migration Approach

Apart from the general benefits that can be realized through any application migration, such as lower cost of ownership of newer cheaper hardware infrastructure, Sector7's specific migration approach for NFP brings additional benefits:

- Moving the existing CSS from OpenVMS while keeping major technology components reduces project risk by reducing the amount of re-engineering required to make the transition. Reduced risk greatly increases the opportunity for project success and positions CSS on the new platform so that subsequent redevelopment of major technology components can safely take place.
- Retaining the COBOL programming language allows NFP to retain its existing business logic and rules, thereby maintaining the considerable investment NFP has made in this language over the past years.
- Adoption of MicroFocus COBOL gives openness and portability across UNIX and Windows platforms and opens the door for a move to the Microsoft .NET architecture using the MicroFocus NetExpress 4.5 for .NET compiler.
- Retaining the Oracle RDBMS allows the database engine to be deployed on either a Windows or UNIX platform, this decision being dependent on performance factors as well as NFP's corporate choice of platform.
- Retaining the Axiant and Powerhouse elements of the CSS application will enable these components to be moved quickly and easily to the new platform. Axiant and Powerhouse are both extremely portable.
- Retaining the VMS DCL command language enables the DCL elements to be moved quickly and cheaply to either a UNIX or Windows platform, as VX/DCL is available on both.
- To summarize, Sector7's approach in selecting open technologies such as MicroFocus COBOL and Oracle RDBMS will allow NFP to defer the final deployment decision until the port to HP-UX is completed. In this way, the port to HP-UX can be seen as moving CSS onto a "spring board" platform, ready for any future developments and technologies as NFP may choose.

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4.4.2 Sector7's VX/Tools suite of Migration Tools

Sector7 is recommending usage of the following elements of its VX/Tools suite of migration tools. Please refer to Appendix B for a full description of these products.

- **VX/DCL** - *VX/DCL* provides a powerful emulation of the VMS DCL environment for both interactive and batch usage in a UNIX or Windows environment. Logical names are supported, mapping to the host file structure. Files and directories may be handled with VMS syntax and with VMS context-sensitive pattern matching, allowing users to continue to work within a familiar programming environment, and may migrate to the new host operating system at their own pace, and through choice, not through necessity.
- **VX/JSP** - *VX/JSP* is an add-on module for *VX/DCL* that provides an implementation of the VMS BATCH & PRINT spooler API and command line interface for UNIX and Windows. With support for over 30 different commands, both batch execution and printer queues are implemented, and function as they would in a VMS environment.
- **VX/RT** - *VX/RT* is a collection of libraries written by *Sector7* that provides the equivalent VMS API functionality on the target UNIX or Windows-NT systems. Over 400 of the most commonly used VMS APIs have been faithfully reproduced with the identical names, arguments, return code and functionality. The *VX/RT* (and other libraries) link into the application to provide the functionality the VMS application requires to perform the application intended task.
- **VX/RMS** - Part of *VX/RT, VX/RMS* is an implementation of Digital's VMS/RMS system for UNIX and Windows. *VX/RMS* allows VMS programs, which access RMS directly, to function without change. All VMS file types and access modes are supported. Support for relative, sequential and block mode files is supplied by direct access to the UNIX/Windows file system.

4.5 Future Re-Engineering Options

Moving CSS to a new platform provides a springboard for future developments and enhancements, examples of which are shown here. These items are not Sector7's recommendations for future technology directions, but merely examples which serve to illustrate some of the options open to NFP for re-engineering CSS once migrated:

- Once the Oracle database is resident on an HP-UX platform, it is simple to add web-enabling technology, such as Oracle Application Server (OAS). Oracle Application Server provides an open, standards-based architecture that is ideal for developing and deploying business and commerce applications for the Web. Its scalable, distributed architecture and superior database integration are the foundation for supporting business-critical, transaction-based applications. OAS might therefore offer NFP a fast track to web-enable the CSS database, with the ability to give users and perhaps customers on-line access through a browser interface. To achieve this, the existing Axiant and COBOL on-line programs could be rewritten/replaced with a mix of Oracle Forms GUI and Java programs creating a 3-tier architecture (database / application / client) where the database and application components could be deployed on UNIX or Microsoft platforms.
- Re-compile all the COBOL code with the MicroFocus NetExpress 4.5 for .NET compiler. This compiles directly to Microsoft's Intermediate Language, and the applications run as managed code within the .NET Common Language Runtime. Developers will have a choice of using Microsoft's Visual Studio .NET IDE to build their COBOL apps or can continue to use Micro Focus' own COBOL development environment.
- Re-engineer the batch COBOL programs as Oracle PL/SQL containerizing them in the database itself and allowing the entire database and batch processes to be deployed on any Oracle supported platform including Microsoft.
- Replace DCL usage with a mix of enterprise products and native HP-UX shell scripts or Windows VBScript/Jscript running under WSH(Note 1). Note that based on past-project experience, the cost of Sector7 re-engineering NFP's existing VMS DCL command procedures "like-for-like" to another scripting language such as UNIX KSH or Microsoft Script would cost around US$250,000, but this is almost certainly the wrong approach. The optimum approach is to undertake a review of how and where DCL is used in CSS at present and to choose strategic replacements for the various elements (e.g. batch processing, batch operations menu, general utility programming language).
- Replace the Sector7 VX/JSP VMS-compatible batch scheduler with a cross-platform enterprise-wide scheduler for streamlined batch processing and unified batch management.
- Option to replace Oracle RDBMS with Microsoft SQL Server, although Sector7 believes that this would be a major re-engineering effort as the existing CSS code is very heavily reliant on embedded SQL (Oracle Pro*COBOL) and SQLServer does not support E/SQL.

Note 1:

Microsoft currently offers three hosts for running scripting language code. They are:

- Internet Explorer (IE)
- Internet Information Server (IIS)
- Windows Script Host (WSH)

The Internet Explorer, and to a slightly lesser extent, the Internet Information Server are well known to developers. However, many developers may not be familiar with the Windows Script Host. WSH is a very useful tool that allows you to directly run VBScript, JScript and XML encoded scripts natively within the operating system.

Windows Script Host comes free with Windows 2000 and 98. Once WSH is installed, it is easy to run a VBScript or JScript program by double-clicking on any file that has the .js or .vbs extension. That file will be executed within the Windows Script Host environment. You can also schedule script execution through the Windows Task Scheduler.

WSH offers a suite of eight objects that can be used for network, registry and shell manipulation. These objects offer greater functionality than that which is available when using either JScript or VBScript alone.

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Appendix A About Sector7

Sector7 provides source-code level re-hosting tools and services to organizations in every industry sector, including software, consulting, manufacturing and finance. We offer experience of successfully managing large projects, and a demonstrated ability to manage resources from different organizations. We place great value on our well-defined process, strong project management, technical leadership and emphasis on testing

We have successfully performed many thousands of migration projects for all kinds of companies, all over the world. We specialize in mission critical systems and have migrated many major applications for Fortune 150+ companies. Our toolkits and consulting practice have helped thousands of other companies to migrate their own applications.

For the past 5 years, IBM has chosen Sector7 to be an integral component of their worldwide competitive organization – we provide IBM with sales and marketing support, pre-sales support in the form of our Assessment process, and application migration services. We have performed several thousand application migration projects on behalf of IBM, which makes us a valuable part of their Team.

Utilizing our 5-Step process (refined over the years during many successful re-hosting projects) we are in a position to consider the migration of anything to anywhere, regardless of source and target platforms.

Sector7 was established in the UK in 1985, and since then have migrated many leading-edge applications from one operating platform to another. The experience we've gained is of obvious benefit to new clients: it reduces the time required to migrate and reduces overall cost and risk.

- Offices in North America, Europe and Asia Pacific
- Headquarters and engineering division in the US
- European sales, support and Windows engineering facility in the UK
- Sales office in Asia Pacific
- Provide migration and co-existence tools and services around the world
- Sector7 tools and services provide application developers across all industry sectors with a cost-effective way to migrate existing applications from proprietary systems to other operating systems including, but not limited to, Windows NT and UNIX

Sector7 has clients that span every industry sector, each with their own unique needs, and application requirements.

- Finance
- Banking
- Stock Exchanges
- Global Retail
- Telecommunications
- Manufacturing
- Software
- Consulting
- Chemical
- Aerospace
- Defense
- Government

Sector7 has a multitude of offerings, all built on experience and skill - our core strengths:

- Complete application migration services
- Migration consulting
- Testing and implementation
- Migration toolkits
- Server consolidation using IBM ALIGN methodology
- Application Renovation - Web-enabling, flat file to RDBMS etc.
- 32 to 64-bit porting/empowerment
- PDP-11 RSTS/E, RSX, RT-11 to LINUX/UNIX
- VAX/Alpha VMS/OpenVMS to Windows, LINUX/UNIX, IBM iSeries & zSeries
- UNIX to Windows/LINUXUNIX
- IBM/Amdahl Mainframe to LINUX/UNIX
- HP 3000 MPE to Windows/LINUX/UNIX/IBM iSeries
- RDBMS conversion

A.1 Sector7's 5-Step Process

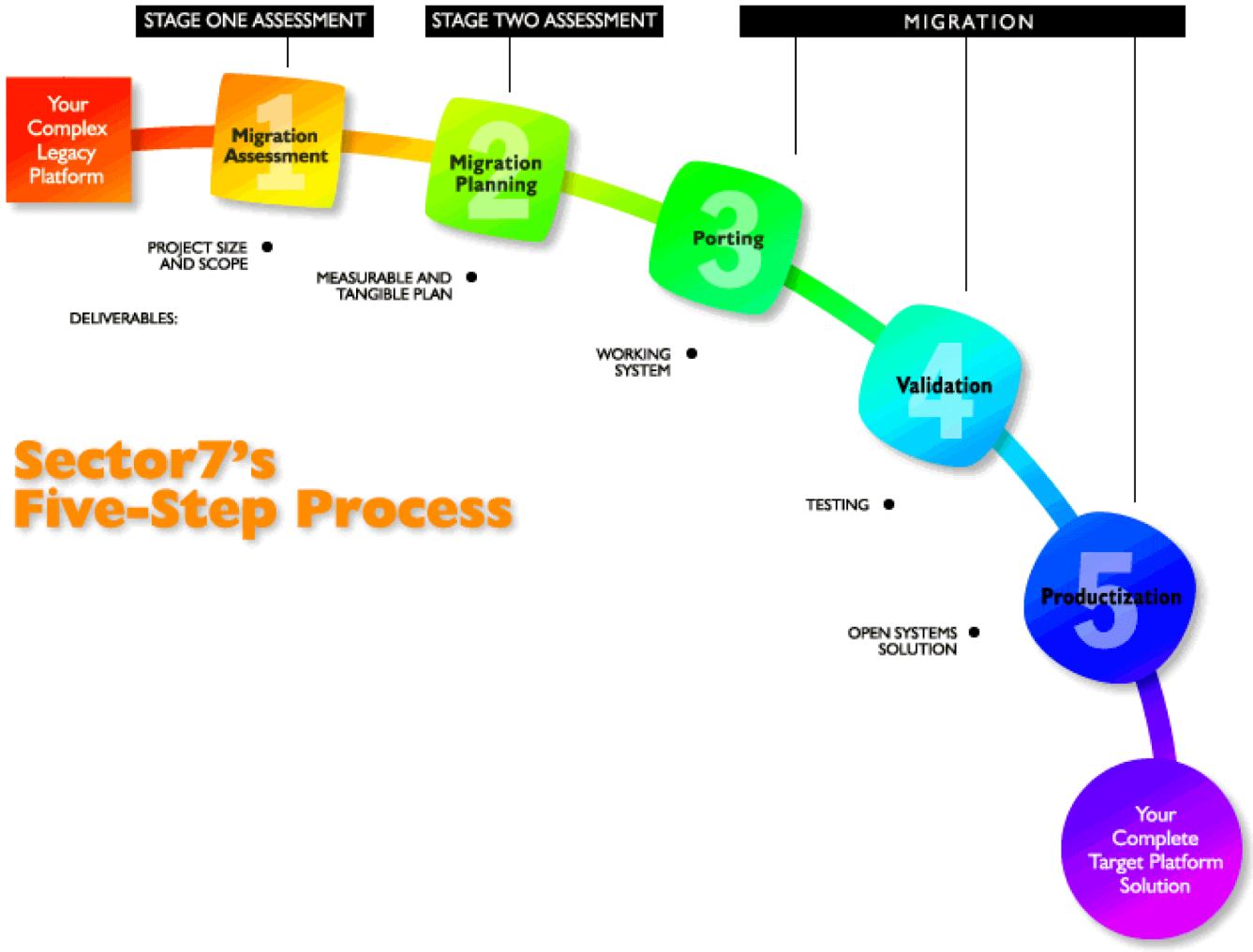
Sector7 uses a proven 5-Step process to ensure successful application re-hosting. These five steps are shown below with the analogous sales/engagement processes. Enhanced and refined over the past 10 years, this 5-Step process forms the basis of all of our project engagements, and allows for "step deliverables" which will provide the Client with information before each stage.

Before embarking on a significant migration project, an organization must be aware of potentially significant challenges in project management and project implementation. Lack of migration experience may cause these challenges only to become apparent in the middle of a migration project.

However, when expected and planned these challenges become opportunities for organizations to learn, grow, and improve. Compatible compilers and porting/migration/emulation tools provide the solution for the obvious technical problems when moving from one operating platform to another. Technical problems, while important, are only part of a business-critical migration project.

To ensure that success, the engagement process consists of the following steps:

- Stage One Assessment (Project Scope)
- Stage Two Assessment (Migration Strategy and Plan)



A.2 Stage One Assessment

The Sector7 Stage One Assessment provides a sound beginning for a successful migration effort.

Process: Migration Assessment – Determine the project scope

Objective: Provide an initial assessment to determine the rough order of magnitude price and duration for a project. Typically, we can provide an estimate to within ±30% of the final price.

Description: The entire environment is reviewed for porting to the desired platform. Sector7 will review the software components such as; language, databases, user interfaces, communications and third party software.

Typical Tasks for Stage One Assessment

- Inventory the code
- Understand application build procedures. The ability to build the application quickly will impact the cost of migration
- Review application source code for porting complexity
- Determine if the existing database is portable to the target platform. If not portable, determine a replacement
- Determine if the existing user interface is portable to the target platform. If not portable, determine a replacement
- Determine if the existing communication protocols are portable to the target platform. If not portable, determine a replacement
- Understand application test and validation procedures, to help determine completion criteria for the project

Deliverables

- Situational Analysis
- Migration Approach
- Overview of Project Tasks
- Budget & Planning Price, usually accurate to ± 30%
- Outline Project Plan
- Application Code Inventory
- *Optionally*, a proposal to perform a Stage Two Assessment

A.3 Stage Two Assessment

The Sector7 Stage Two Assessment provides a sound second step for a successful migration effort.

Process: Migration Planning

Objective: Provide a detailed assessment to determine the maximum price and duration for a re-hosting project.

Description: During the Stage Two Assessment we review any unresolved issues from the Stage One Assessment, and perform a more detailed investigation of the application code.

Typical Tasks for Stage Two Assessment

- Detailed code review for porting complexity
- Develop a plan for database replacement
- Develop a plan for user interface replacement
- Develop a plan for communication protocol replacement.
- Develop a plan for source code control and build procedures
- Develop synchronization criteria
- Develop completion criteria

Deliverables

- Migration specifications
- Detailed migration project plan
- Test plan with completion criteria
- Synchronization plan

A.4 Migration

Process: Porting

Objective: Deliver a working system on the target platform

Description: Perform porting activities defined in migration planning stage

Typical tasks for Migration Stage

- Re-target source language to compile on target platform
- Database replacement
- User interface replacement
- Communication protocol replacement.
- Design and implement new source code control and build procedures
- Acceptance testing
- Assist client with integration activities
- Delivery of a working application

Deliverables

- Working applications on the new target platform in preparation for testing

A.5 Testing

Process: Validation

Objective: Test the ported system on the target platform

Description: Perform all testing activities defined in migration planning stage. This step is tightly integrated with the migration stage as opposed to being a linear task.

Typical tasks for Testing Stage

- Complete regression scripts
- Complete functional testing
- Acceptance testing
- Documentation

Deliverables

- Working applications on the new target platform

A.6 Deployment

Process: Productization

Objective: Deliver a working system on the target platform in a production environment

Description: Perform all deployment activities defined in migration planning stage. This step is tightly integrated with the migration and testing stages as opposed to being a linear task.

Typical tasks for Deployment Stage

- Build applications without internal debugging and use optimization where appropriate
- Configure operating environment for batch processing, user login, and so on.
- Migrate production data from the original platform to the new system
- Cutover to the production system

Deliverables

- Working applications on the new target platform in a production environment

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Appendix B Description of VX/Tools

This section is a description of the migration tools that will be used on this project.

One of the greatest value-adds that *Sector7* provides to its customers is a suite of very powerful migration tools. These migration tools will:

- Reduce project cost;
- Mitigate migration risk;
- Automate as much of the migration process;
- And reduce project duration.

Since 1985, *Sector7* has been developing and enhancing a family of conversion tools targeted at significantly reducing the time it takes to migrate an application from OpenVMS to UNIX/Windows. By using our tools, the time, cost and risk associated with a migration or port can be reduced by up-to 90%. Collectively called *VX/Tools*, they fall into 3 groups:

- Automatically convert the extended VMS source language to its ANSI equivalent (COBOL, BASIC, C, PASCAL).
- Providing the VMS API (Application Program Interface) to the most commonly used VMS libraries (FMS, SMG$, SYS$, LIB$, MTH$ etc).
- Providing applications that directly reproduce VMS behavior on UNIX and Windows (DCL, BATCH and PRINT spooling, RTR V2 etc).

B.1 Language Conversion

Sector7 has automatic language conversion tools for VAX BASIC, VAX FORTRAN and VAX C. Details on these tools are omitted from this report as they will not be used.

For VAX COBOL and PASCAL, Sector7 has an “in-house” toolkits which assist in making these language transformations. Details on these tools are omitted from this report as they are Sector7 internal tools.

B.2 System Services Replacement

Product name: VX/RT

VX/RT is a collection of libraries written by *Sector7* that provides the equivalent VMS API functionality on the target UNIX or WindowsNT systems. Over 400 of the most commonly used VMS APIs have been faithfully reproduced with the identical names, arguments, return code and functionality. The *VX/RT* (and other libraries) link into the application to provide the functionality the VMS application requires to perform the application intended task.

Once the VMS specific language extensions and behaviours have been resolved the program can be compiled to object form ready for linking with any external subprograms. Most VMS applications make calls to the VMS operating system to perform system tasks (BAS$, CLI$, CONV$, EDT$, FDL$, FDV$, FOR$, LBR$, LIB$, MTH$, OTS$, SOR$, SMG$, STR$, and SYS$.)

These VMS APIs allow VMS applications to perform complex tasks without the programmer having to write the equivalent functions. It is also these same APIs that cause the greatest difficulty when moving those applications to an operating system that does not support the equivalent APIs.

Sector7 designed *VX/RT* to enable the application to be ported with the minimum number of code changes. To this end, the *VX/RT* APIs accept VMS file specifications and return VMS return codes. For example SYS$OPEN takes a pointer to a FAB and would return RMS$_FNF (98964) if the fine is not found. The FAB requires no changes and most of the fields are supported (obviously some field such as number of extents make no sense on some target systems).

B.3 Filesystem & Database

Product name: VX/RMS

Part of *VX/RT, VX/RMS* is an implementation of Digital's VMS/RMS system for UNIX and Windows. *VX/RMS* allows VMS programs, which access RMS directly, to function without change. All VMS file types and access modes are supported. Support for relative, sequential and block mode files is supplied by direct access to the UNIX/Windows file system.

Features include but are not limited to:

- Support for all RMS file organizations: relative and sequential file types are mapped directly onto the UNIX/Windows file systems. Keyed files are mapped onto an extended version of the industry-standard index file system, C-ISAM
- Fixed and variable length data objects are supported for index and sequential data files. Relative record files support direct access with fixed record lengths
- *VX/RMS* is VMS/RMS call-compatible and uses identical RAB, FAB, XAB and NAM data structure for information exchange between the users, program and *VX/RMS*. All of the fields are compatible, thereby eliminating the need to change application code when porting applications to UNIX/Windows
- VMS file and record locking is fully supported in order to provide the same level of functionality and integrity as VMS/RMS in a multi-user environment. In addition to VMS/RMS record-locking compatibility, *VX/RMS* also retains UNIX/Windows record-locking standards, thereby allowing concurrent access to the data from both migrated and native applications
- *VX/RMS* allows the user to set up and maintain VMS device names and device attributes in a device database. VMS device allocation and de-allocation integrity is maintained allowing shared and exclusive access to specific devices
- *VX/RMS* will recognize I/O to mailboxes, files, and terminal devices
- *VX/RMS* allows optional re-use of deleted record space thereby reducing the need to re-organize index files
- *VX/RMS* supports an optional synchronous data and asynchronous index update mode for fast secure file I/O

Product name: *VX/DataX*

VX/DataX allows users to transport data files from the VMS operating system to UNIX/Windows. *VX/DataX* also allows users to specify a programmable schema to convert the data to the appropriate format (DEC to IEEE, Little Endian to Big Endian, Quadword Data/Time to UNIX/Windows) for the target platform.

B.4 User Tools

Product name: VX/DCL

VX/DCL provides a powerful emulation of the VMS DCL environment for both interactive and batch usage in a UNIX or Windows environment. Logical names are supported, mapping to the host file structure. Files and directories may be handled with VMS syntax and with VMS context-sensitive pattern matching, allowing users to continue to work within a familiar programming environment, and may migrate to the new host operating system at their own pace, and through choice, not through necessity.

Features include, but are not limited to:

- Commands and statements
- Complete batch processing
- Fully integrated lexical functions
- Symbol and logical expressions
- Powerful parser
- Line editing and command history
- User-defined commands
- Interface to *VX/RMS* for file functions (OPEN, READ etc.)
- Print and job spoolers
- SORT/MERGE

Product name: VX/JSP

VX/JSP is an add-on module for *VX/DCL* that provides an implementation of the VMS BATCH & PRINT spooler API and command line interface for UNIX and Windows.

With support for over 30 different commands, both batch execution and printer queues are implemented, and function as they would in a VMS environment.

Features include, but are not limited to:

- Assign/De-assign Queue
- Define Form
- Delete (Characteristic, Entry, Form, Queue)
- Device
- Initialise
- Print
- Set Entry
- Show (Entry, Printer, Queue)
- Start/Stop (Queue, Manager, Entry, Requeue, Reset)
- Submit

VX/JSP is fully integrated with *VX/DCL* to provide a rich set of extended functionality. The job spooler environment includes support for both batch execution and printer queues with the necessary commands to START and STOP the queues, SUBMIT and PRINT.

Product name: EDT+

EDT+ provides a consistent editing interface. Based on the popular EDT editor found on Digital's OpenVMS operating system, EDT+ has been enhanced to include the most requested features of EVE/TPU.

Avoid the expense of retraining, user frustration, and loss of productivity by providing a familiar and powerful tool as users integrate other operating systems into their OpenVMS environment. EDT+ can also be fully integrated with *VX/DCL* to provide a seamless migration path.

Features:

- VAX EDT Gold-Key Editing Plus
- Supports Microsoft Windows editing interface
- Multiple Windows, Status Line, and Other EVE/TPU features
- Powerful User-Defined Keys and Macro Language
- Dynamically Adapts to Current Screen Size
- Supports LINE, KEYPAD, and NOKEYPAD editing modes
- Column Cut and Paste, 4000 Character Line Length
- Enhanced Disaster Recovery
- Easy-to-Use OpenVMS Style Help System

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Product name: nu/TPU

nu/TPU is a fully programmable text editor modeled after Digital's TPU (Text Processing Utility). It includes the EVE, EDT and WPS interfaces for easy and familiar text editing across all your platforms, including Windows 2000/NT, Windows 95 and 3.1, DOS, and all major UNIX vendors.

When migrating from OpenVMS to Windows and/or UNIX, it is most beneficial to remain consistent with native application development tools, such as the TPU text editor with its EVE and EDT interfaces. nu/TPU offers full emulation of these interfaces, and is compatible with DEC TPU so that customizations can be ported to a new target system without change. nu/TPU can also be fully integrated with *VX/DCL* to provide a seamless migration path.

- Motif and MS Windows compliant
- Complete TPU programming language
- VMS TPU 5.4 source code compatible
- EVE, EDT, and WPS interfaces
- Supports unlimited files, buffers, and windows
- Fully customizable on the fly
- Column cut/copy/paste operations in insert/overwrite mode
- Horizontal and vertical scroll bars in every window
- Dynamic keyboard definitions
- Unique simple interface (si) shipped with its source code
- Color and other video attributes support
- Unlimited undo
- Command line with abbreviations
- Free and bound cursor movement
- Word wrap
- Wildcard and case-sensitive searches

Appendix C Microsoft SQL Server Data Access

When you choose a development tool and decide how to implement your application, you must also choose the interface by which your application will communicate with SQL Server. The best interface to use depends on the development language and the type of application under development. The choices fall into three categories:

- Call-level interfaces
- Object interfaces
- Embedded SQL

This appendix provides an examination of the interface choices, and is mostly copyright Microsoft Corp.

C.1 Choosing an Appropriate Interface

C.1.1 Call-level Interfaces

A call-level interface offers a set of function calls or APIs that enable client applications to interact with a server database. Call-level interfaces usually use parameters specified as pointers to data input and output buffers owned by the application. Because of this reliance on pointers, call-level interfaces are almost always used from the C/C++ language. With some mapping code, these interfaces can be called from languages that lack pointer support, such as Visual Basic, but usually developers in these languages are more comfortable and productive using an object interface.

SQL Server offers two call-level interfaces:

- Open Database Connectivity (ODBC)—an industry-standard, call-level interface
- DB-Library—the original call-level interface that is specific to SQL Server

At a functional level, ODBC and DB-Library are similar interfaces. They both offer function calls to perform tasks such as opening a connection to SQL Server, executing an SQL statement, and retrieving data from SQL Server. They also have similar performance characteristics. For SQL Server, these two APIs are implemented at the same logical layer in the software architecture; both are "native" interfaces for SQL Server. Both APIs offer full access to the same feature sets, with minor exceptions.

ODBC is the recommended interface and offers the following advantages over DB-Library:

- ODBC is easier to learn

  DB-Library uses different API sets for similar functions that are implemented differently, such as retrieving data using a default result set versus a server cursor. ODBC implements these similar functions using the same APIs and a simple statement option to distinguish a default result set from a server cursor. Because of these special-purpose function calls, DB-Library has many more APIs to learn than ODBC (150 versus 50).

- The ODBC driver uses the performance features of SQL Server automatically

  For example, SQL Server stored procedures can be executed using an efficient procedure call network format. DB-Library uses a separate set of APIs to send requests in the network format. ODBC uses the same APIs used for sending nonstored procedure requests and looks for the standard ODBC "call" syntax to trigger the use of this efficient network format.

- ODBC is an industry-standard interface

  The code and skills used building a SQL Server application on ODBC can be leveraged to build applications for almost any other SQL database. Of course, the code that uses SQL Server features that are not implemented in other ODBC drivers may have to be isolated in a common code base, but this is usually a small portion of the code.

These advantages present a strong case for developing new call-level applications using ODBC. If a company has existing DB-Library applications, there is no need to rewrite them to ODBC unless they are being revised to take advantage of ODBC features. DB-Library applications have excellent performance and will continue to be supported by Microsoft SQL Server for some time. DB-Library, however, will not generally receive feature enhancements in future releases of SQL Server.

C.1.2 Object Interfaces

Object interfaces offer a model of database programming "objects" that can be created by your application and used to send and retrieve data from the database. You can use the objects by calling methods defined for the object and by setting or getting properties on the object.

Object interfaces vary widely in their level of abstraction, exposure of database features, and performance characteristics. They are also usually restricted to specific programming languages. Microsoft offers several object interfaces with overlapping functionality, including OLE DB, ActiveX Data Objects (ADO), Remote Data Objects (RDO), and Data Access Objects (DAO). Other vendors of database programming tools such as PowerBuilder or SQL Windows offer their own object interfaces as part of their tools.

C.1.3 Embedded SQL

Embedded SQL is an ANSI-standard programming interface in which SQL statements, delineated by EXEC SQL tags, are incorporated into the source code of an application. The source code is input to a pre-compiler, which identifies the SQL blocks and replaces them with the appropriate low-level function calls for communicating with the database. An Embedded SQL pre-compiler for SQL Server is currently available for programs written in C in the form of a toolkit that ships on the MSDN™ Library, professional level subscription. This pre-compiler technology has also been licensed to Micro Focus, who offers it as a toolkit for Cobol programmers.

Embedded SQL offers a familiar programming model for developers of applications for other databases such as Oracle or DB2. For Cobol programmers, Embedded SQL is also the most commonly supported database interface of any kind and is an excellent solution for accessing SQL Server. For applications written in C, however, Embedded SQL is somewhat slower than the call-level interfaces and doesn't allow you to take advantage of specific SQL Server features and performance optimizations. The primary design goal for Embedded SQL for C is to follow the strict ANSI standard for maximum portability of applications. Embedded SQL for C is useful if you are porting an application from another database and have a large code base that would be difficult to adapt to ODBC. For these applications, Embedded SQL for C will perform adequately but may not offer optimal performance and control.

C.1.4 Sector7's Conclusion

For optimal performance, Microsoft recommends that Embedded SQL is not used, and instead recommends ODBC for maximum performance. It is further noted that the Microsoft Embedded SQL for "C" and MicroFocus Embedded SQL for COBOL are strictly ANSI compatible and do not therefore allow advantage to be taken of SQLServer's full feature set.

To re-engineer an Embedded SQL application means, in practical terms, stripping out all EXEC SQL statements and replacing them with API calls to the SQLServer ODBC API. As noted above, because of a reliance on pointers, call-level interfaces are almost always used from the C/C++ language. With some mapping code, these interfaces can be called from other languages.

The cost of this re-engineering is proportionate to the number of embedded SQL statements contained in the original source language, plus additional costs for the analysis and re-design of the data access methodology considering different database manufacturer's implementations of locking etc.

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Appendix D Testing Guidelines

The definition and creation of a viable test plan is critical to the success of a migration project. Used during various stages of the project, test plans serve to validate the base-line system, assist the developers in performing unit and system tests, and provide the framework for final acceptance testing.

Specific test plan details vary from project to project, however Sector7 employs the same overall approach with the same basic requirements for all project test plans. This document describes test plan creation and usage at Sector7.

D.1 Overview

Generally speaking, the more time spent up front putting together a detailed test plan, the greater the chances for success in meeting project deliverables, schedules and expectations. Like many other similar exercises however, the law of diminishing returns comes into play at some point in time.

The danger lies in developing a plan with procedures so complex or comprehensive that it becomes impractical or too time-consuming to execute efficiently. The challenge then, is to define a test plan sufficiently detailed to ensure application integrity and validity; yet simple enough to allow efficient and repeatable execution.

It is, of course, important to consider that the time required to run the tests is dependent upon the speed of the platform on which the testing is being performed.

D.2 Subject Matter Experts

Subject Matter Experts, individuals thoroughly familiar with the application and all of its operational details, must ultimately construct test plans. The individual tests should be documented in sufficient detail such that testers not necessarily familiar with the application can efficiently execute them.

In some cases, comprehensive automated test suites exist and can be employed effectively for validation of migration projects. In cases where they do not exist, we recommend the use of manual procedures, scripted out in step-by-step detail. Undertaking the development and implementation of an automated test procedure can be an involved and significant task.

We realize that creating a test plan can be a resource intensive and time-consuming task. To help alleviate these problems, Sector7 has experienced test managers available to work directly with clients in developing test plans tailored to their specific environment and project requirements. The rest of this appendix will describe the manner in which Sector7 projects utilize test plans as well as the steps we recommend for test plan creation:

D.3 Test Plan Usage

D.3.1 Baseline Validation

The “baseline” system forms the agreed-upon starting point for a migration project. The overall objectives of baseline validation include verification of the fact that source code received from the client can be built and validated on the source platform at *Sector7*. This assures we are migrating the correct version of the code, and that we have all necessary source modules.

Successful execution of the test plan validates the system and forms the reference point for functionality comparisons. Successful test plans include mechanisms for capturing and saving output in the form of screen-prints or hard-copy reports.

D.3.2 Unit Testing

During the development and debugging stages, programmers need to be able to run parts of the application to recreate and track down problems. Although programmers may not execute entire scripts each time they wish to test, the tests should be sufficiently well documented such that basic program functionality can be inferred. Naturally, this assumes the client provides SMEs (Subject Matter Experts) to train *Sector7* personnel on application details and interpreting test results.

D.3.3 System Testing

After all modules are migrated and successfully unit tested the project enters the system test phase. During this phase the target environment is created, data is migrated or converted and the code moved to an isolated test system.

Installation and configuration procedures are devised and tested, and trial deployments performed to identify and document setup procedures, necessary hardware and software components along with the required revision levels. After the target environment is stabilized the test plan is used to perform system tests and ensure the migrated application functionality is complete and correct.

When allocating time for system testing, we normally allow triple the time it takes to perform the baseline test (e.g. if the baseline takes 60 hours to run end-to-end, then we allow 180 hours for system testing).

D.3.4 Acceptance Testing

Acceptance testing performed by the client at project completion validates the results of the entire migration project. It forms the basic agreement by both parties that the migrated code on the target platform is functionally equivalent to the code on the original source platform. It is imperative the plan be agreed upon by both parties prior to this task to ensure successful project conclusion.

In terms of project deliverables and risk management, this task represents the most critical utilization of the test plan. Care must be taken therefore, to ensure the plan specifically address application “hot spots” (i.e. heavy usage/traffic) as well as functional areas devoted to supporting “mission critical” business processes. Interfaces to external systems almost always present high exposure, so test plans usually stipulate individual detailed tests for each interface.

The final acceptance test generally takes the same amount of time as the baseline. The assumption is that once all the system testing is done, we then run through the baseline/acceptance from end to end on the basis that it will be clean and ready to pass over to the client.

D.4 Test Plan Creation

D.4.1 Defining the Testing Approach

The first step in creating a test plan is to define the testing approach. This need not be a complex or detailed process; it is often sufficient to simply indicate how different application areas will be tested. For example: on-lines will be tested by operators manually entering data from scripts, batch jobs will be submitted and reports saved, etc.

Besides specifying how the tests will be performed, consideration must be given to the logistics necessary to make the tests repeatable (e.g. restoring data to known state before each test run, etc.). In addition, the manner in which results will be captured, saved and compared to the baseline validation system should be carefully defined and documented.

Perhaps most critical to the beginning of testing is the definition of what activities and results constitute completion of the project. These activities are known collectively as *“Acceptance Criteria.”* These acceptance criteria, included as part of the test plan, include a list of specific tests where the migrated code results will be compared with the results generated from testing the original code. The completion of testing and the comparison, or resolution of discrepancies encountered, is used to indicate completion of the project. The customer and *Sector7* are required to approve the specific conditions for acceptance testing.

D.4.2 Defining the Application Subset to Test

After deciding upon an overall test methodology, the next step defines a subset of the application to test. Obviously, it is not practical to attempt to validate every possible code path in a large complex application. Our experience shows that testing 70-80% of the modules is generally sufficient to validate the migration, depending on application flexibility and complexity.

There are several reasons for this:

- Analysis and profiling reveals the vast majority of application utilization is generally performed using a subset of the full application functionality.
- Profiling also reveals that even within highly utilized application functions, specific code paths are executed much more frequently than others.

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- Applications are usually constructed with subroutines or library calls performing complex or common application functions. When these routines are indirectly tested within one functional test, there is usually no need to validate them from other functional tests as well.
- Migration projects are unique in the sense that they do not introduce new functionality into the application. The same overall approach is usually taken in migrating all modules (i.e. automated tools, procedures, etc.). This generally means that corrections to migration-related defects resolve all instances of the problem.

These reasons combined with the fact that test plans must be complete and detailed, yet simple enough to execute efficiently, support the approach of defining an application subset for testing. The difficulty lies with choosing the appropriate modules for inclusion in the plan. *Sector7* recommends that QA personnel developing the test plan consult application SMEs as well as technical architects to ensure the proposed plan includes sufficient coverage.

D.4.3 Defining Tests for External System Interfaces

Sector7 recommends the application subset approach not be taken for testing external system interfaces. These components normally represent high risk factors and are sufficiently different enough from each other to warrant individual test plans. This argument is reinforced by the fact that SMEs for the external systems are not usually available, and sometimes the tests must be performed by, or requires extensive support from, technicians.

D.5 Training Sector7 on Test Procedures and Interpreting Results

Throughout the migration project, engineers and testers perform partial or complete test procedures for unit and system testing. Furthermore, it is often necessary during problem analysis and troubleshooting, to run application tests under the debugger for investigation and resolution.

It is therefore necessary for client testers or SMEs to provide training for *Sector7* migration engineers and testers to enable them to run the tests independently and verify the correctness and completeness of observed results.

D.5.1 Define Test Results Approval Process

It is extremely important to specify the exact method by which test results will be captured, reported and approved. Forms or other control vehicles should be defined and created, sufficiently general enough to cover all types of individual test results. Other factors covered in this task include designating which individuals are responsible for approval, mechanics for communication and follow-up and establishment of turn-around time frame expectations.

D.5.2 Script Each Functional Test

Sector7 recommends that client QA personnel or SMEs actually produce written scripts for each functional test. These detailed documents list each prompt the tester sees when performing a test and indicate the data entry keystrokes necessary to advance to the next step within the test. Screen prints are not necessary, although they do help in quickly identifying format problems. The scripts also list expected results or output generated in response to keystrokes or actions taken by the tester.

The client needs to allocate sufficient time for this activity, as development of test scripts is not a trivial task. Similar to programs, all but the simplest of scripts must be executed multiple times and debugged by the author to ensure they accurately reflect the actual application dialog with the user.

D.5.3 Approval and Agreement by All Parties

The final step in defining a test plan is to obtain approval and agreement from all involved parties that the plan is viable and complete enough to fulfill the needs described above.

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Appendix E Application Code Inventory

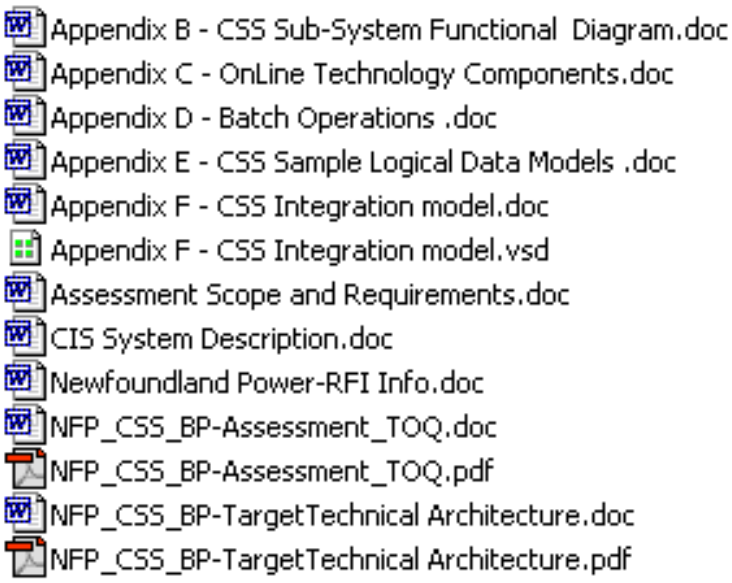
The accompanying Adobe PDF file '*NFP_CSS_BP-Inventory_v1.3.pdf*' contains an inventory of the application source code that was delivered to *Sector7* in April; 2003 for analysis. The analysis, content, assumptions and determinations of this document are based on this inventory.

Appendix F Technical Analysis Questionnaire

The accompanying Adobe PDF file contains the original Technical Overview Questionnaire submitted to Sector7 by NFP.

NFP_CSS_BP-Assessment_TOQ.pdf

The following documentation was also provided by NFP:



The analysis, content, assumptions and determinations of the Budget and Planning Estimate are in part be based on the information provided in this documentation.

End of Document

Appendix S - CSS Technical Migration Alternatives
Internal

Customer Services System

Technical Migration Analysis

May 2003

1. Introduction

The objective of this document is to detail the alternatives for the technical migration of Newfoundland Power's Customer Service Application (CSS) from an OpenVMS platform to a Windows and/or Unix platform. The OpenVMS platform and the Powerhouse 4GL application development environment is no longer part of the Company's long-term target architecture strategy.

Two basic alternatives with respect to the application development language is being explored:

OpenVMS re-platform while keeping major technology components (e.g. Powerhouse, Axiant etc.).
OpenVMS re-platform but redeveloping the major application development technology components according to the Company's Target Technology Architecture (eliminate reliance on Cognos Axiant and Powerhouse proprietary software).

Information to validate these alternatives were gathered through discussions with our existing Technology Partners: Microsoft, Hewlett Packard and Cognos. IT industry (Non vendor biased) information was retrieved from discussions with leading analysts from Gartner and Meta Group IT analysts. Several relevant vendors specializing in migration services were contacted and provided initial assessments
OpenVMS migrators; Sector7 and HP
Powerhouse retooling vendor; CORE
Powerhouse porting vendors: Intertech and Inbusiness solutions

2. Technical Migration Alternatives

For the purposes of this document these are the five technical migration alternatives with respect to the Company's future target architecture that are deemed to be acceptable with respect to the level of effort and overall risk to the company at this time. For the purposes of this document:

the term **re-platform** refers to a move to another operating system environment,
retooling refers to changing the underlying application development code, and
DBMS conversion refers to a migration from Oracle to MS Sql Server relational DBMS product.

Regardless of the alternative migration path, improvements to the batch architecture by the purchase and implementation of automated batch submission control software and improvement to CSS reporting environment are considered in scope, and are in addition to the estimated costs of the alternative outlined below.

OpenVMS Replatform : ***UNIX***
(Online:Windows Batch/DBMS: UNIX retain Powerhouse Axiant/QTP/QUIZ, Oracle DBMS)

OpenVMS Replatform : ***WINDOWS***
(Online/Batch/DBMS retain Powerhouse Axiant/QTP/QUIZ, Oracle DBMS)

OpenVMS Replatform/AD retooling ***WINDOWS***
Online/Batch/DBMS migrate off Powerhouse Axiant/QTP/QUIZ, Oracle DBMS

OpenVMS Replatform/AD Retooling W*INDOWS/UNIX*

Online: Windows Batch/DBMS: UNIX migrate off from Powerhouse Axiant/QTP/QUIZ, Oracle DBMS

#5 **OpenVMS Replatform/AD Retooling/DBMS Conversion WINDOWS** Migrate off of Powerhouse Axiant, Database conversion MS SQL Server DBMS

The strengths and weaknesses associated with each of these alternatives are explored in more detail.

2.1 #1 OpenVMS Re-platform – UNIX

Description:

Migrate off of the OpenVMS platform but keep all major applications development components (Axiant, Powerhouse and COBOL). Maintain Oracle DBMS but migrate to UNIX platform. This would involve:

CSS Online to UNIX

- Axiant migrates to Axiant on UNIX server. (Alternative would be Axiant on Windows via a thick client/server deploy because Axiant is not supported via CITRIX). While it is true Axiant is not supported on Citrix it would not have to be a thick client. Powerhouse on Windows supports a thin client install where the application logic sits on the Windows server just as it does today on the OpenVMS server and only the presentation layer is on the clients desktop.
- Online COBOL back-ends convert to Microfocus COBOL

Batch to Unix

- Batch COBOL migrates to Microfocus Cobol on Unix.
- Batch Powerhouse QTP and QUIZ migrates to UNIX.
- DCL converts to Unix shell script (or utilize DCL emulating software which is not our preferred method).

Strengths:

- Overall the least amount of technical effort and risk as compared to all other options. There are many translation/emulation software products on the market (Sector7 and Accelr8).
- Overall the least risk with respect to availability and scalability issues as compared to options 2, 3 and 5 because of similarities between OpenVMS and UNIX platforms (95% of OpenVMS migrations are to the UNIX operating system).
- Least amount of new investment in hardware required for production, disaster recover, and development environments because some of the existing OpenVMS hardware could be reused.
- This would be a starting point for a phased migration effort.
- This is the least inexpensive migration path for Newfoundland Power of all other options.

Weaknesses:

- Niche AD toolset (COGNOS Powerhouse 4GL/AXIANT)
- Concerns regarding future of application development tools from COGNOS whose key revenue stream and R&D is in the BI reporting suite.
- Skill set shortage and lack of local training
- UNIX is not part of Newfoundland Power targeted architecture moving forward.
- Limited internal skill set with respect to UNIX environment

This alternative is supported by experienced leading IT industry migration vendors who specialize in technical migration efforts. Sector7 stated that, based on their experience, the UNIX platform would be the least risk and keeping Powerhouse AD tools would be the least cost alternative for Newfoundland Power.

Cost estimation: $2,000,000 to $3,000,000
Intertech $500,000/ HP $800,000/ Sector7 $1,250,000 ~300 day or 1 year duration
Sector7 Tools/Software $100,000
Hardware/OS $500,000
Internal Labour $750,000

Effort: 12 Months

2.2 #2 OpenVMS Re-platform – Windows

Description:
Migrate off of the OpenVMS platform but keep all major applications development components (Axiant, Powerhouse and COBOL). Maintain Oracle DBMS but migrate to Windows platform. This would involve:

CSS Online to Windows

- Axiant migrates to Axiant on Windows server.
- Online COBOL back-ends convert to Microfocus COBOL

CSS Batch to Windows

- Batch COBOL migrates to Microfocus Cobol on Windows.
- Batch Powerhouse QTP and QUIZ migrates to Windows.
- DCL converts to Windows (.BAT / .CMD)

Strengths

- Get some native windows GUI improvements from AXIANT on Windows (navigation, integration to EXCEL, Outlook, VB scripts)
- Least impact on end user from a change perspective
- Least impact on end user resources during migration
- Overall the least amount of technical effort (coding and testing)
- Ease of testing (limited to batch environment)
- Most inexpensive migration path to get off of OpenVMS
- Axiant license transfer to Windows
- Cost of Powerhouse (QTP/QUIZ) for Windows
- Move code and compile for windows environment.

Weaknesses

- Niche AD toolset
    - Concerns regarding future of application development tools from COGNOS whose key revenue stream and R&D is in the BI reporting suite.
    - The install base for Powerhouse on Windows platform is very low. This would be a concern for overall support (patches, upgrades) and future de-support (See Appendix A)
    - Skill set shortage and lack of local training
- Extensive programming effort required to convert Batch architecture to Windows (1500 DCL procedures with 150,000 lines of code converted to Windows .BAT or .CMD code).
- Overall the greatest risk with respect to availability and scalability based on the current architecture of CSS. CSS was designed for the mainframe (mini) computing platform, OpenVMS, which is a 64 bit, multi-user platform. Windows recently released its first 64bit operating system Windows 2003 (May, 2003) and therefore is still immature.
- The Windows operating system is not a true multi-user system. CSS would have to be deployed via thick client/server and/or terminal services. Thick client/server would experience bandwidth issues for area offices running CSS. Terminal services would require ‘server farms’

and load balancing and therefore there would be extensive costs for hardware and resources. This was supported by SECTOR7 .

- Extensive new investment in new hardware required for production, disaster recovery, and development environments

Cost estimation: $2,500,000 to $3,500,000
HP $800,000
Tools/Software $150,000
Hardware/OS $750,000
Internal Labour $1,250,000

Effort: 12 - 18 Months

2.3 #3 OpenVMS Re-platform – Windows; AD Language Retooling

Description:

Migrate off of OpenVMS. There will be a technical migration of Axiant, Powerhouse and COBOL Application Development Components while maintaining the Oracle DBMS but with migration to another platform. This would involve:

Online to Windows

- Axiant converts to MS .NET ASP/VB.
- Online COBOL back-ends convert to Microfocus COBOL

Batch to Windows

- Batch COBOL converts to Microfocus COBOL
- Batch Powerhouse QTP and QUIZ (all non-reporting versions) migrates to PL/SQL within the Oracle DBMS complement with Impromptu for reporting purposes
- DCL converts to Windows (.BAT / .CMD)

Strengths

- Market leading AD toolset (eliminates reliance on niche Cognos AD toolset) with growing local skill set expertise
- Improved data integration with MS Suite (Outlook, Excel).

Weaknesses

- Currently only one vendor offering automating code conversion tools for Powerhouse to MS ASP conversion (CORE Software Ottawa)
- Migrating from the AD toolset (AXIANT) would constitute a substantial change to the CSS architecture, as well as the user interface and would require a substantial overall effort of a technical migration project requiring comprehensive testing.
- Overall technical effort is substantial.
- MS .NET technology is still rather immature (bleeding edge technology) and the adoption rates are still rather slow.

Cost estimation: $4,500,000 to $6,000,000

Core 2,250,000
Software $100,000
Hardware/OS $750,000
Internal Labour $1,500,000
COBOL/DCL/DBMS $1,000,000+

Effort: 18 - 24 Months

2.4 #4 OpenVMS Re-platform –Windows/UNIX; AD Language Retooling

Description:

Migrate off OpenVMS. There will be a technical migration of Axiant, Powerhouse and COBOL Application Development Components maintaining Oracle DBMS but with migration to another platform. This would involve:

Online to Windows

- Axiant converts to MS .NET ASP/VB.
- Online COBOL back-ends convert to Microfocus COBOL

Batch to Unix

- Batch Powerhouse QTP and QUIZ (all non-reporting versions) migrates to PL/SQL within the Oracle DBMS were possible otherwise to Impromptu.

Strengths

- Market leading AD toolset (eliminates reliance on niche Cognos AD toolset) with growing local skill set expertise
- Improved data integration with MS suite (Outlook, Excel).
- Utilizing UNIX platform for DBMS and batch processing would be prudent from a staging perspective and help mitigate risk with availability and scalability issues with a windows environment as identified in option 3.

Weaknesses

- Currently only one vendor offering automating code conversion tools for Powerhouse to MS ASP conversion (CORE Software Ottawa)
- Migrating from the AD toolset (AXIANT) would constitute a substantial change to the CSS architecture and as well as the user interface and would require a substantial overall effort to a technical migration project requiring comprehensive testing.
- MS .NET technology is still rather immature (bleeding edge technology) and the adoption rates are still rather slow.

Cost estimation: $4,000,000 to $5,000,000

Core 2,250,000
Software $100,000
Hardware/OS $500,000
Internal Labour $1,250,000

Effort: 15 - 24 Months

2.5 #5 OpenVMS Re-platform – Windows; AD Language Retooling; DBMS Conversion

Description:

A re-platform off of OpenVMS, technical migration of Axiant, Powerhouse 4GL with a database conversion to MS Sql Server. This would involve:

Online Windows

- Axiant converts to MS .NET ASP/VB.
- Online COBOL back-ends convert to Microfocus COBOL

Batch to Windows

- Batch Powerhouse QTP and QUIZ (all non-reporting versions) migrates to Trans-SQL within the MS Sql Server DBMS.
- DCL converts to Windows (.BAT / .CMD)

DBMS Conversion

- Migration of all existing Oracle stored procedures and triggers to MS SQL Server Trans-SQL procedures
- Removal of all embedded SQL in COBOL code to SQL Server API ODBC call interfaces
- Procedural code to perform data extraction from Oracle and loading of MS SQL Server
- Extensive testing for data integrity purposes and performance related testing

Strengths

- Market leading AD toolset (eliminates reliance on niche Cognos AD toolset) with growing local skill set expertise
- Improved data integration with MS Suite (Outlook, Excel).

Weaknesses

- Currently only one vendor offering automating code conversion tools for Powerhouse to MS ASP conversion (CORE Software Ottawa)
- Migrating from the AD toolset (AXIANT) would constitute a substantial change to the CSS architecture, as well as the user interface and would require a substantial overall effort of a technical migration project requiring comprehensive testing.
- Overall technical effort is substantial.
- MS .NET technology is still rather immature (bleeding edge technology) and the adoption rates are still rather slow.
- To convert the Oracle DBMS to MS Sql Server this involves extensive technical data conversion/testing effort.
- Technical differences in ANSI SQL from Oracle and MS Sql Server standard SQL (doesn't perform with COBOL imbedded SQL)
- Extensive level of stress testing required to ensure overall performance and locking is at acceptable level.

- Increased level of functional testing required to ensure data integrity associated with data conversion, locking strategy, concurrency model and coding changes
- The DBMS would no longer be open from the perspective of OS independent.
- MS Sql Server is not as robust as Oracle from the perspective of performance, reliability, scalability and security.
- SQL Server has no multi-version consistency model, which means that "writers block readers and readers block writers" to ensure data integrity therefore locking issues would be highly likely

Cost estimation: $5,000,000 to $7,000,000

Core 2,250,000
Software $100,000
Hardware/OS $750,000
Internal Labour $1,750,000
COBOL/DCL/DBMS $1,500,000+

Duration: 18 - 24 Months

3. Recommendation

Given the estimated cost and effort and the present overall IT industry concern with respect to the Windows environment to support an enterprise class application, the maturity of .NET and 64-bit architecture and the need to extensively re-architect CSS for this environment it would be wise to phase in the technical re-platforming and retooling migration of CSS. This can be achieved by implementing these changes in several phases over a 2 to 3 year time period;

Phase 1: re-platforming while retaining the COGNOS AD toolset to a UNIX platform as in depicted option 1

Phase 2: re-tool the online AD technical component by migrating the online portion of CSS to the MS tool set while retaining the batch component on UNIX as depicted in option 4.

Phase 3: re-tool the batch technical component of CSS to the Windows platform by utilizing stored procedures and automated batch software with the end result being option #3.

Appendix A – Cognos Response

Newfoundland Power Answers April 3, 2003

Cognos future direction

- Axiant – Road map
  - Platforms (OpenVMS, Windows, Unix)
  - Products
  - Support
- Powerhouse – Road map
  - Platforms (OpenVMS, Windows, Unix)
  - Products
  - Support

We are just about to release (April or May) a major new product suite, PowerHouse 8.4, Axiant 3.4 and PowerHouse Web 2.4. Along with a major conformance update and other new features , we have introduced DB2 for UNIX and Windows, and DISAM for Windows, to our suite of supported file systems. As well, QUICK will now be available on Windows, making the PowerHouse product a full development product on Windows, just like it is on other platforms. The current suite of products, being readied for release, involved a very major conformance upgrade that brought us in line with the same data access layer that is used by the Series 7 products.

In a release that will come a few months after this major product suite release, we will also feature support for Eloquence on HPUX and Windows.

Our current largest base is the Hpe3000. With the announced demise of this platform, our customers are now making plans to protect their investment by moving to another Cognos supported platform. This is a key objective for us, our VARS and our Partners. Many customers are still evaluating this requirement.

Roadmap: Our plan going forward is to put out a new base release about once a year or year and a half, with maintenance releases in between. Our focus will be customer driven enhancements and database and operating system conformance.

Note:

VAX: PH830 was last release.
Tru64: PH840 will be last release.

How strong are the commitments?

- Guarantees in writing Axiant and Powerhouse (OpenVMS)
- Guarantees in writing Axiant and Powerhouse (Windows/Unix)

ADT tools are most certainly still a significant contributor to our company's bottom line. As such, we will continue to plan and execute product release strategies as long as there is customer demand and business viability. We do not have any end of life timelines other than for Hpe3000. In the case of the Hpe3000, HP has announced that they will support that platform until 2006. We will follow their support timeline here.

New sales Application Development (Axiant / Powerhouse) statistics:

Significant sales, types of customers buying, Operating System Install Base/Trend. Supported by trending information to illustrate renewed interest or re-entrenchment into Powerhouse and/or Axiant.

We do not do detailed market analysis on the ADT customers as to their line of business, but we do know that our VARS develop all sorts of applications: inventory, hospital, manufacturing, etc.

Are third-party software vendors developing systems in Powerhouse/Axiant?

Yes, Marianne can give some very good examples.
Stargarden Software – develop an HR/Payroll application
Cyframe International – develop a Health Care application
Vantagepoint – develop an ERP application for Pulp & Paper Industry
Infotech – develop a Customer Care application
I have only listed a few that I know have developed packages with Axiant. Our Website should list our partners that have developed both Axiant and PowerHouse applications.

4. Migration

Cognos Platform migration services:

Type of services available from Cognos in this area

Powerhouse Quiz/QTP & Axiant from OpenVMS to Windows/Unix
Powerhouse Quiz/QTP to Impromtu/Powerplay

As Marianne indicated, Cognos will do application reviews, however we do not do migration services. Cognos has developed a Migration Course (called Migrating Applications with Axiant 4GL). This course shows how to use Axiant to migrate your PowerHouse 4GL from one environment to another and from indexed file systems to relational. We do however have partners who do this type of work. As discussed, Newfoundland Power has been in touch with several of our partners already.

Recommended Migration Partners:

Powerhouse Quiz/QTP & Axiant from OpenVMS to Windows/Unix
Powerhouse Quiz/QTP to Impromtu/Powerplay

As discussed, plus we list most of them on our web page http://powerhouse.cognos.com)

Installed Base

We have approximately 2900 supported PowerHouse, PowerHouse Web and Axiant customers worldwide. These customers run the gamut from small shops with one or two licenses, to very large installations with 1000 or more concurrent PowerHouse users.

The order of installed base from high to low, is as follows:
HPe3000
VMS Alpha
HPUX
VMS VAX
IBM AS400
RS6000 (AIX)
NT
Solaris
Tru64

Appendix T – Summary of Bolt-on Vendor Responses External

Customer Service and Support Applications RFI

Summary of Vendor Responses

March 2003

xwave
AN ALIANT COMPANY

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

Newfoundland Power's current Customer Service System (CSS) is a legacy application which has been in production for over 10 years. The company is currently examining several options with regards to the future of the CSS; rather than pursuing a full system replacement – which has major cost implications - the company is investigating possibilities for extending the life of the CSS. Newfoundland Power's desired approach to achieving this is, where appropriate and economical, to identify and implement commercial applications which can be interfaced with, or "bolted" to, the current CSS system.

Enhancements/changes to the CSS are required for two main reasons:

1. There are some types of functionality which are either not delivered at all by the current CSS or which have the potential to be delivered more efficiently and/or effectively. Newfoundland Power may be interested in integrating suitable commercial applications with the current CSS, if such applications can be identified.

2. The current CSS application is running on an OpenVMS operating system. OpenVMS is not the platform of choice for future corporate applications and, as a result, Newfoundland Power is evaluating the merits of re-platforming its CSS. If the company chooses to re-platform, certain pieces of CSS functionality may be purchased rather than re-coded in-house.

1.2 Purpose of RFI

Newfoundland Power asked **xwave** to conduct research on CSS vendors in the marketplace who might be considered when looking for bolt-ons to the CSS. **xwave** found a significant amount of information was available on Customer Information System (CIS) package vendors. This information was examined to discover that the information available did not indicate whether vendors' solutions could be broken up and sold by specific functional area. Given that Newfoundland Power is not interested in purchasing and implementing a full CIS application, the ability of vendors to sell products in a modular fashion was essential information. In addition, most of the information available profiled large CIS package vendors but left out smaller, niche vendors which Newfoundland Power was interested in learning about.

xwave recommended issuing a Request for Information (RFI) to appropriate vendors to uncover the desired information. On February 28, 2003, **xwave** issued an RFI for Customer Service and Support Applications on behalf of Newfoundland Power.

1.3 RFI Methodology

1.3.1 Development of RFI Document

In conjunction with Newfoundland Power, an RFI document was developed. Among other things, the document included the following information about Newfoundland power and its Customer Service System:

- Functionality provided by Newfoundland Power's current Customer Service System;
- Functionality of interest to Newfoundland Power for the future of its CSS;
- Technical architecture of the current CSS;
- Target architecture for any CSS enhancements; and,
- Overview of Newfoundland Power's technical environment.

The RFI also provided instructions to vendors with respect to information required in RFI responses.

1.3.2 Identification of Vendors

The next phase of the RFI process was to develop a list of vendors who should receive the RFI. A preliminary list of vendors was compiled using the following sources:

- Skipping Stone Fall 2002 CIS/CRM Software Report
- Warren B. Causey 2002 Energy/Utility CIS/CRM Report
- TMG Consulting Presentation to Newfoundland Power (Fall 2002)
- List of CIS Providers on CISWorld[1] web site (http://www.cisworld.com)
- List of exhibitors from 2002 CIS Conference

With assistance from Newfoundland Power, this list was refined. Any vendors who stated clearly that their products were "package only" applications were removed. Vendors who focus on CIS for non-electric utilities (e.g. water utilities) were removed. Finally, some vendors/products were already known by Newfoundland Power and were not of interest and were also ruled out.

Once the initial list was refined, Newfoundland Power provided names of a number of niche vendors who were not referenced by any of the original sources used. These niche vendors fell mostly into the functional areas of Cash Receipt, Credit and Collections, and Field Services. The final list consisted of 45 CIS and related vendors.

1.3.3 Dissemination of RFI

Once the vendor list was finalized the RFI was emailed directly to vendor contacts on February 28th, 2003. Vendors were given until March 14th to review the RFI and submit responses.

To enhance the coverage of the RFI, it was also posted on the tender section of the CISWorld web site. By doing so, the RFI was received by nine additional CIS vendors.

[1] CISWorld is a web site, managed by TMG Consulting, dedicated to customer system solutions within the utility and emerging energy industry.

1.4 Purpose of Summary Document

The purpose of this document is to summarize the information presented in vendor responses and provide Newfoundland Power with a guide for reviewing/referencing these responses.

2 Summary of Responses

2.1 Vendors Meeting Some/All Functional Requirements

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
CGI	SAPHIR	√	√	√	√	√	√	√	√	√	√	Yes	Founded in 1976, CGI is the fourth largest independent information technology services firm in North America, based on its headcount. SAPHIR has yet to be implemented in North America. CGI has stated to **xwave** analyst that they might be willing to negotiate an attractive deal with Newfoundland Power, in terms of pricing, in order to achieve a North American installation. Office location with respect to this RFI: Montreal. Subject Matter Expertise resides in Paris. Very high-level RFI response - difficult to determine from response if SAPHIR really meets Newfoundland Power's stated functional

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													requirements.
Clicksoftware	ClickSchedule									√		Yes	Clicksoftware's business is Field Service Optimization. ClickSchedule is installed at the following Canadian companies: ▪ BC Hydro ▪ AT&T Canada ▪ Bell Canada ▪ Direct Energy (formerly Enbridge) RFI response provided a good description of the solution but did not comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements. In particular, no cost information was provided. No information provided on office locations. The RFI response does not state that the product is modular. However, Clicksoftware responded only to the Field Services functionality requirement which suggests that Field Services can be implemented on a standalone basis.

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
Cogsdale Corporation	Customer Service Management (CSM)	√	√	√	√	√		√	√	√	√	In part	Cogsdale has been delivering CSM systems to the utility marketplace since 1997. The current version, which is now on release 7.0, is one of the most comprehensive complex billing and customer service solutions available today. CSM offers seamless integration with Microsoft Great Plains. Cogsdale is one of only six companies in the world to have earned the designation of Certified Development Organization from Microsoft Business Solutions. Cogsdale has recently been chosen as the utility solution vendor for the Central Services Association, which provide applications for their 120 utility memberships across 7 southeast US states. After full implementation, over 1500 system users, with 1.5 million end customers will be utilizing the CSM software for their utility customer service. The following functionality can be purchased modularly (all others are sold bundled as Cogsdale CSM):

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													▪ Cash receipt/POS ▪ Field Services Cogsdale's RFI response was good, followed the desired format and addressed all information requirements. Head office and majority of team located in Atlantic Canada (Charlottetown).
Conversant	Customer Watch ™	√		√	√	√	√		√			No	Conversant is a "new vendor in this space". Customer Watch ™ is not a component-based system. The response states that the solution's architecture allows it to be integrated into virtually any environment, regardless of hardware or software. Offices are located in Texas and Missouri. RFI response provided an overview of the solution but did not fully comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements.

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
CORE Business Technologies	One-Step	√										Yes	CORE has been in business for 15 years and is a provider if payment processing solutions for utilities, cities, counties and universities across the United States. CORE provides cash receipt software and hardware. Based in East Providence, Rhode Island. RFI response provided a good description of the solution but did not comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements. In particular, no cost information was provided.
Docucorp	Docuflex		√									Yes	Docucorp is a leading bill print software provider for the utility marketplace in North America. Nearest sales location: Toronto . Nearest support location: Bedford, New Hampshire. Key customers include: Toronto Hydro, Niagara Mohawk, Southern Company, Exelon Corp,

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													Ameren, MidAmerican, Orange & Rockland, Atco Itek. A sample utility invoice was included with response. Docucorp's RFI response was good, followed the desired format and addressed all information requirements.
Group 1	DOC 1 Suite		√	√					√		√	Yes	Group 1 was founded over 20 years ago and counts over 75% of the Fortune 500 as customers. Nearest service/support location: Toronto. Primary technology partners: Siebel, Informatica. Group 1 responded to Specialized Billing and CRM functionality requirements, however, the information in the response regarding these functionalities is somewhat weak in terms of DOC 1's fit with Newfoundland Power's needs in these areas. Group 1's response followed the desired format

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													but was disjointed and disorganized. Information provided did not meet with requirements in some cases.
Hansen Technologies	HUB Unified		√	√	√	√		√	√	√	√	Yes	Hansen has been in the IT industry for 30 years and the billing market for over 20 years. Hansen has over 100 major CIS clients; approximately 60 of these are HUB Unified clients. Does not provide Cash Receipt functionality but recommends *Cashier for Windows* by Systems Innovators for this purpose. Nearest service/support location: San Diego, California. Primary technology partners: Oracle, IBM, Microsoft, BRIO, Tele-works, System Innovators, Sprint. RFI response did not comply with the prescribed format and provided an excess of information. No meaningful cost information was provided.
Itron	Service-Link									√			Itron is the world's leading technology provider to the energy and water industries for collecting,

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													analyzing, and applying critical data about electric, gas, and water usage. RFI response provided a good description of the solution but did not comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements. In particular, no cost information was provided.
Kinetiq	PV2		√	√			√					Yes	Kinetiq has nine years' experience in international energy markets. PV2 is currently deployed in 36 companies operating in Canada. Kinetiq's Print Bill functionality appears weak. Primary technology partners: Oracle, Microsoft. RFI response provided a good description of the solution but did not comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements. In particular, no cost information was provided.
Nexus Energy Software	ENERGYprism			√				√			√	Yes	Nexus was founded in 1997 and has approximately 50 employees. Nexus currently works with over 40 of the largest utilities in North America.

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													Nearest service support locations: Boston, MA and southern Vermont. Primary technology partners: Microsoft, edocs. Supplied a demo with RFI response. RFI response provided a good description of the solution but did not comply with the prescribed format. As a result, the response did not address all of Newfoundland Power's information requirements.
Open-c Solutions	Open-CIS	√	P	√	√	√		√	√	√	√	Yes	Open-c was founded in 1998 and has been chosen by Accenture as the most advanced best-of-breed billing solution available in the market today. Open-CIS performs some of Newfoundland Power's desired Print Bill functionality, but not all. Primary technology partners: Microsoft, Seagate Software (Crystal Reports), SyncSort (file sort and merge), Computer Associates (AutoSys Batch Scheduler), Melissa Data

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													(address Hygiene), and others. In addition, Open-c's integration partner, Accenture, has strong relationships with several technology vendors. Nearest service/support location: Open-cIS is supported out a Development Center in Minneapolis, MN and out of the corporate headquarters in Santa Ana, CA. Open-c's RFI response was good, followed the desired format and addressed all information requirements. In particular, an excellent cost assessment was provided.
SPL Worldgroup	CorDaptix	√	√	√	√	√		P	√	√	√	In part	SPL is the premier international provider of customer management solutions for the energy and services industries. Modular nature of functionality is questionable. Nearest service/support location: Morristown, New Jersey. Primary technology partners: BEA Systems Inc., BearingPoint Inc., Docucorp, Group1, HP, IBM, Logica, Micro Focus, Oracle, PeopleSoft,

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
													SAGA Software, Siebel. SPL's RFI response was good, followed the desired format and addressed all information requirements.
Talgentra	Gentrack	√	P	√	√	√		√	√	√	√	Yes	Gentrack has been in operation for more than 14 years and has more than 30 customers around the world. Sister product: Tallyman (credit & collections). Billing engine can perform bill design /formatting but all desired Print Bill functionality is not resident in Gentrack – third party vendor would be required (for inserts, envelopes, etc.). Primary technology partners: Microsoft, Oracle and IBM. Nearest service/support location: Baltimore, Maryland. Talgentra provided an excellent RFI response, following the desired format and clearly addressing all information requirements.

Vendor	Solution	Cash Receipt/ POS	Print Bill	Specialized Billing	Area Lights/ Special Products	Credit and Collections	Load management	CIS Specific Analysis / Decision Support Tools	Basic CRM	Field Services	Bill Inquiry / Analysis	Modular Sales / Implementation	Commentary
Wishbone Systems	Wishbone Service Suite								√	√		Yes	Wishbone Systems has been in business for almost 10 years. The future direction of Wishbone Systems is to expand its presence as the leading worldwide provider of real-time field service management and optimization systems that leverage clients' existing business systems infrastructure. The Service Suite is built with Microsoft components. Nearest service support location: Englewood Cliffs, New Jersey. Primary technology partners: Wishbone Systems' primary technology partner is Microsoft. Integration alliances in place with Remedy, Peregrine, Tivoli, and CA – several others are pending. SPL's RFI response was good, followed the desired format and addressed all information requirements.

Key
√ – denotes that vendor response indicates functionality is present in solution
P – denotes that vendor response indicates functionality is present, *in part*, in solution.

2.2 Other Respondents

Caselle

Caselle did not formally respond to the Request for Information. Instead, a company representative forwarded a product information package to **xwave**, stating clearly that Caselle is not interested in bolting to Newfoundland Power's current CSS.

Caselle is a leader in local government software solutions. Based on the information package submitted, Caselle's product does not appear to meet Newfoundland Power's requirements

eCredit

eCredit also did not formally respond to the RFI. After reading the RFI document, eCredit noted that its solution may not meet Newfoundland Power's needs. The company forwarded a solution profile to **xwave**, including the following high-level description:

> In short, eCredit has 9 years of experience in delivering credit and collections solutions to commercial organizations. These are non- utilities, non regulated commercial entities who assess the risks associated with extending credit (terms) to other commercial entities. I noticed that consumers represent a portion of the Utilities' customer base. If there is an interest in commercial risk assessment, then perhaps eCredit would be a closer fit.

Project Title: **Network Infrastructure**

Location: **Various**

Classification: **Information Services**

Project Cost: **$393,000**

Description: This is the second year of a two year project that will see the obsolete components of the Company's Network Infrastructure replaced.

Operating Experience: The Network Infrastructure is comprised of technical components such as routers and switches that interconnect computers and applications across the Company. These components all work together to enable the transport and sharing of SCADA data, VHF radio, and corporate data between the Company's computers across the province. For example, serving customers in Corner Brook requires Customer Service System information to be transmitted from St. John's over the Network Infrastructure to a cashier's personal computer in Corner Brook.

The network components that will be replaced in 2003 and 2004 are considered obsolete, either for technical or functional reasons. Technical obsolescence occurs when a technology component becomes either outdated or unreliable, or when the vendor that developed the component no longer supports it. Functional obsolescence occurs when the business requirements of a system change to the point where the component is incapable of providing the required functionality. BearingPoint (formerly known as KPMG Consulting Inc.) states, "Computer and network hardware (e.g., computers, printers, routers, and bridges) typically have a life cycle of two to five years."[1] The average age of all network components being replaced in year two of this project is seven years.

Justification: The corporate network is the foundation for the operation of such critical applications as the Customer Service System and the Problem Call Logging System. The Company's Network Infrastructure across the province contains components that are no longer manufactured. Vendor support for these components is also in decline. The Company's continued use of technically obsolete network components exposes these applications to an unacceptable risk of disruption. The replacement of the obsolete network components will

[1] BearingPoint (formerly known as KPMG Consulting .) provides business consulting and systems integration to companies and government organizations. They have approximately 16,000 professionals in 39 countries with an average of 12 years of industry-specific experience. They access the latest technology information through nearly 50 alliances with leading software and hardware companies.

ensure the continued stability of the corporate network, thereby avoiding disruptions to customer service and the interruption of critical communications. As well, network components that are no longer adequate due to functional obsolescence will be replaced, allowing for growth in the infrastructure.

The components to be replaced in year two of this project include:

- Seven Motorola 6520 routers that are currently seven years old. These routers are no longer manufactured and vendor support is diminished.

- Two Nortel phone switches and a Redcom radio switch currently thirteen years old which are no longer supported by the manufacturer.

- Seven (7) DECHubs purchased from Digital Equipment Corporation (DEC) prior to 1996. DEC sold off the entire Networking division prior to their acquisition by Compaq. These devices are no longer supported by any vendors.

The Company considered two alternatives when assessing options for moving forward with this initiative:

1) Continue to operate the existing components in the corporate network thus saving the cost of investment at this time. Failure to make the investment at this time would put the normal operation of the Company's Network Infrastructure at an unacceptable level of risk. Should the Network Infrastructure fail the Company's ability to serve customers and to monitor and control the electrical distribution system would be diminished. Vendors no longer manufacture many of these components and technical support for them is decreasing. If one of these components failed due to age, we would not be able to call on the manufacturer for help or get a replacement. Instead we would have to purchase the new equipment at that time causing significant delays that would hinder the Company's ability to function in that area. For example, the DecHUBs have been the cause of several network interruptions in the area offices due to their inability to communicate with newer laptop technology. This problem could not be resolved until the offending laptop was found and disconnected from the network. The vendor has no fix for this problem other than replace the component.

   Many of the components no longer have sufficient capacity to meet the requirements of the Company's applications. Replacing the network components with vendor-supported components will eliminate reliance on obsolete technology and provide capacity to connect shared servers in the future. The new equipment will be supported by the vendor for upgrades, troubleshooting and parts. Also, the new equipment will allow for growth as they can support increased requirements.

   For these reasons, continuing to operate the existing components is not an acceptable risk.

2) Replace the network components with vendor-supported components with increased capacity for future growth.

The benefits of replacing these network components include:

- Eliminating the Company's dependence on technology that is no longer manufactured.
- Reducing the risk of a network failure associated with components for which vendor support is in decline.
- Increasing our ability to remotely monitor and administer network components across the province from a central location.
- Reducing the number of spare parts needed to support the corporate network.
- Reducing the risk of future obsolescence by aligning with a market-leading vendor.

Project Title: **Shared Server Infrastructure**

Location: **Various**

Classification: **Information Services**

Project Cost: **$644,000**

Description: The project involves the addition, upgrade and replacement of computer hardware components and related technology associated with the Company's shared server infrastructure to ensure that the Company continues to provide effective customer service and to operate efficiently.

Operating Experience: The Shared Server Infrastructure project includes the procurement, implementation and management of the hardware and software relating to the operation of shared servers. Shared servers are computers that support applications used by multiple employees. Management of these shared servers, and their components, is critical to ensuring that these applications operate effectively at all times.

Technology components such as servers and disks require on-going investment to ensure that they continue to operate effectively. To maintain this effectiveness, investment in additions, upgrades, monitoring and security is essential.

An upgrade is a modification that extends the useful life of a technology component by fixing known problems, improving usability, and providing additional features and functionality. Hardware upgrades are also necessary to accommodate software enhancements, and include such things as adding extra disk storage or tape backup units.

In order to ensure high availability of applications and minimize the vulnerability of its computer systems to external interference, the Company invests in availability monitoring and proactive security monitoring tools. These tools allow the Company to monitor and respond to problems that could impede the normal operation of applications or damage or destroy Company information.

Eventually the individual components of technology (servers, disk drives, tape drives, processors and memory chips, etc) will require complete replacement as they become obsolete; the challenge is to make appropriate judgments as to when it is more cost effective to add or replace technology components rather than invest in further upgrades.

Factors considered in determining when to upgrade, replace or add server components include the current performance of the components, the level of support provided by the vendor, the criticality of the applications running on the shared server components, the

ability of the components to meet future growth, the cost of maintaining and operating the components using internal staff and the business or customer impact if the component fails. Gartner states that computer servers have a useful life of approximately 5 years.[1] However, Newfoundland Power has extended the useful life of many of its servers, with approximately 30% of servers currently 5 years or older.

Justification: The Shared Server Infrastructure is vital to the provision of low cost, efficient and reliable service to customers. The need to replace and modernize information technology infrastructure is fundamentally the same as the need to replace and modernize the components of the Company's electrical system infrastructure as it deteriorates or becomes obsolete. Instability within the Shared Server Infrastructure has the potential to impact high numbers of employees and customers and therefore is critical to the Company's overall operations and to the provision of overall customer service. The purchase of the components for this project will be tendered in order to ensure they are obtained at least cost. The benefits of the shared server infrastructure project include:

- Ensuring that corporate applications, such as the Customer Service System and the Problem Call Logging System, are available for employees to serve customers.
- Allowing proactive monitoring of the Shared Server Infrastructure to help predict component failure, thus reducing application downtimes that can disrupt the Company's ability to operate and serve its customers.
- Eliminating the Company's dependence on technology that is either no longer manufactured, is obsolete or for which vendor support is in decline.
- Improving security management to ensure that corporate applications and data are adequately protected from external risks.
- Providing additional processing capacity to meet the needs of new or enhanced applications.
- Providing backup for Company data and critical computer components in the event of a serious failure within the Shared Server Infrastructure.

[1] Gartner Group is a research and advisory firm that helps more than 10,000 businesses understand technology and drive business growth. Founded in 1979, Gartner is headquartered in Stamford, Connecticut and consists of 4,600 associates, including 1,400 research analysts and consultants, in more than 80 locations worldwide.