Q. ***Re: Personal Computer Infrastructure, Schedule B, Pages 83, 84 and 85 of 93***

Newfoundland Power states that it is currently able to achieve a 5 year life cycle for its PCs. Is there an industry practice for the replacement of PCs and if so, what is the industry practice?

A. Yes. According to Gartner, Inc. the industry best practice for the expected life of PCs is 3 to 4 years for a laptop PC and 4 to 5 years for a desktop PC.[1] A copy of a 2009 report from Gartner, Inc. titled *Cost Optimization: Re-evaluating Your PC hardware Replacement Strategies* is provided in Attachment A.

In 2013, Newfoundland Power plans to replace 44 laptop PCs that are 5 years old and 52 desktop PCs that are 6 years old.

[1] Gartner, Inc. is the world's leading information technology research and advisory company with over 12,000 clients worldwide. Founded in 1979, Gartner is headquartered in Stamford, Connecticut, U.S.A., and has 5,200 associates, including 1,280 research analysts and consultants.

Cost Optimization: Re-evaluating your PC Hardware Replacement Strategies

Gartner, Inc.

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Cost Optimization: Re-evaluating Your PC Hardware Replacement Strategies

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If four-year-old desktop PCs can support current operating system (OS), software and peripheral device requirements, then they can, in most cases, be held for an additional year. The high failure rate of notebooks makes it impractical to extend them past the traditional three-year life, except in the case of day extenders, who usually only remove their notebooks from the docking station a few evenings a week and/or on weekends.

Key Findings

- Notebook replacements are largely driven by the high failure rate.
- Desktop PC replacements are largely driven by the business requirement to support particular levels of OS, application software and peripheral connections.
- Different types of users or applications may warrant different replacement cycles.

Recommendations

- Do not extend the life of a traveling worker's notebook past three years.
- Consider a four-year life for day-extender notebooks as a short-term capital expenditure (capex) preservation move.
- Consider a five-year life for mainstream-worker desktop PCs as a short-term capex preservation move if all business requirements and OS migration goals can be met.
- Extend the life of fixed-function or task-based worker desktop PCs to a six-year replacement cycle, unless an earlier software application upgrade is planned.

Table of Contents

List of Figures

Analysis

This document was revised on 30 March 2009. For more information, see the Corrections page on gartner.com.

For nearly a decade, it was considered a best practice to replace notebooks every three years, and desktop PCs every four years. The rapid advance of OS and software performance required continuous hardware upgrades. Currently, PC hardware performance is more than adequate to handle OS and software demands. At the same time, economic pressures are causing organizations to ask whether delaying PC hardware replacements is a viable way of conserving capital.

In many cases, the answer is yes. It is possible, under some circumstances, to extend PC hardware life times and postpone capex. However, these extensions must be made in response to immediate economic pressures, and the long-standing best practices for PC hardware replacement — notebooks every three years and desktop PCs every four years — should not change for long-range budget planning.

In reality, it is always possible to extend the life of a current installed base of systems. But if the planned replacement life cycle is extended too far, then there will be no budget in place should systems need to be replaced prior to their target replacement date (due to higher-than-expected failure rates, insufficient performance or any other unexpected factor).

IT planners need to review all the factors that impact PC replacement cycles to make the optimum decision for their organizations.

1.0 Trade-offs

Not surprisingly, there are trade-offs to extending the life of PC hardware:

- **Higher total cost of ownership (TCO):** There are higher maintenance and support costs, especially with notebooks. The longer a fleet of PC hardware is maintained, the greater the number of models, OSs and system images supported. This greater complexity requires more IT staff training and often results in longer call resolution times. Organizations with hardware self-maintenance programs can be hit especially hard on the training and parts depot costs.
- **Limited flexibility and market responsiveness:** Adoption of a new application could be delayed if the PC installed base can't support it.
- **Limited OS migration options:** If a PC hardware fleet is too old, then it might be impossible to manage an orderly OS migration if the system's end of life is not synchronized with the migration project timelines. Extending the PC hardware life may also result in the need to support three OSs: (1) the organization's current mainstream OS; (2) the previous OS — which might be required by systems running a legacy application; and (3) the latest OS in the earliest phases of migration.
- **Reduced or negative residual asset value:** Organizations that are accustomed to selling their used PC hardware into the secondary market will find that aged equipment has a lower secondary market value; or worse, it is not saleable and turns into a disposal expense.
- **Unfavorable lease extension terms:** Lessors do not want to get caught in the reduced trap themselves, and will urge negotiating an entirely new lease or will charge exorbitantly high fees for the lease extension. In most cases, for any extensions beyond six months, the terms are usually more favorable to buy the asset outright. The cost is considerably higher to the lessee than a straight purchase would have been at the beginning, and the organization is still stuck with an aging asset and future disposal costs.
- **Greater likelihood of users buying and using their own unsanctioned equipment for business use:** A recent (not yet published) Gartner survey and client engagements have shown that, in many large enterprises, at least 15% of end users use their own, unsanctioned devices to run business applications on the enterprise network. The number goes up to 20% in more technologically sophisticated companies (especially those with developers and engineers). Many end users feel compelled to supply their own PCs, because they feel that the company-provided systems no longer let them do their jobs. Allowing a PC fleet to age even further is likely to raise the number of discontented users who feel compelled to use their own "rogue" systems instead of the ones provided by the company. This may reduce some of the hardware support costs, but raises tremendous network and security risks.

2.0 Technological vs. Useful Business Life

Many organizations believe that if a system is still running, then there is no need to replace it. However, just because some models of PC hardware (especially desktop PCs) can run reliably for many years, that doesn't mean that they necessarily can perform their desired business functions

for all that time. To make a realistic assessment of how long to extend a PC's lifetime, it is necessary to separate the technological life from the useful business life. The latter is defined by:

- Ability to support the current OS(s)
- Ability to run the enterprise software load
  - Have new applications been added to the software load?
  - Have ad hoc software changes over time led to reduced configuration stability?
- Ability to connect to all standard enterprise networks and peripherals
- Impact on ability to support the next planned OS migration

3.0 Types of Workers

Different types of users have different requirements from their PC hardware. Some need greater performance levels to work with large data sets or graphics. Others only require a limited range of applications and have low performance requirements. Some will have higher mobility requirements and, by virtue of frequent travel, expose their systems to more extreme conditions that result in higher failure rates. Because of the differences in hardware use patterns and the requirements of these types of workers, different PC life extension decisions may have to be considered for each:

- **High-performance workers (power users):** Users with compute-intensive or graphics-intensive applications and/or those that use large data sets in spreadsheets and/or databases. Software developers, graphics designers, hardware engineers and traders are among the types of workers who fall into this category.
- **Traveling workers:** Notebook users who work outside the traditional office environment as much as 80% of the time. They tend to carry their notebooks most of the day and will often work in many diverse locations, including airports, hotels, customer offices and their cars.
- **Day-extenders:** Notebook users whose systems tend to stay docked in the office the majority of the time. These workers typically take their notebooks home in the evening or over the weekend to do extra work.
- **Fixed-function or task-based workers:** Workers who focus on very limited, specialized tasks, such as claims processing or back-office billing. The performance demands of these applications are usually not very demanding, and the applications tend to stay in place longer than mainstream office productivity applications.

4.0 Hardware Upgrades — Not a Panacea

Carefully considered hardware upgrades can help extend PC hardware lifetimes under certain circumstances. However, upgrades are not free. There is the cost of the hardware components and the labor to open the system and replace the part. As a result, consideration needs to be given to the cost of the upgrade versus the benefit in terms of extended life. Careful planning and staging can reduce some of the costs. A few of the simpler upgrades or stop-gap measures to consider are:

- **Memory:** In general, adding memory will be the most cost-effective upgrade. Many older systems have only 512MB of dynamic random-access memory (DRAM). Bringing the memory up to 1GB (if not more) has the greatest performance impact. This can be especially true for notebooks, which tend to lag desktops in terms of processor and hard drive speeds. (Note: Memory for older systems can be difficult to find and/or expensive. However, it can often be cannibalized from systems that are due for replacement.)
- **System tune-up**: There are a number of simple tools that can improve performance efficiency of older PC hardware:
  - Run diagnostics to check system integrity.
  - Check that all drivers and software versions are up to date.
  - Run system clean-up utilities, such as disk defragmentation.
- **System reimaging:** Many PCs, as they get older, have Windows performance problems due to corrupt registries or dynamic-link libraries (DLLs). Reimaging can be a way of "cleaning up" the Windows environment. The cost and complexity of reimaging will depend on the level of the organization's system manageability tools (to locate users, inventory OS levels and do network updates).

5.0 Repair vs. Replace

The cost of adding an additional year's warranty late in a system's life is costlier than buying it at the time of purchase. Given the low failure rate of desktop PCs, paying a premium for the additional year of warranty coverage is not recommended in most cases. For notebooks, paying an uplift fee of more than $50 per system is not recommended.

If the systems are not under warranty, then the question arises about whether it is worth doing repairs on them. For older notebooks not under warranty, the cost of replacing a failed motherboard can be as much as $1,000 in parts and labor, exclusive of the administrative overhead (motherboards can account for 25% to 45% of all notebook hardware failures in a given year). If the system is not under warranty, then paying this much for the repair is highly impractical, because the cost of a new notebook can be only a few hundred dollars more.

As a general rule, never pay a repair cost that is more than 50% of the replacement cost. This means that even when the decision is made to extend PC hardware lifetimes, there will be a certain level of fallout. Budget will be required for replacements. Plan for approximately a 10% system fallout for desktop PC systems, and a 15% fallout for notebooks.

Another item to budget for with notebooks is batteries. These are disposable items that usually have a one- to two-year life, depending on the use pattern.

6.0 Reassigning Systems Available From Employee Layoffs

Although it is unfortunate that many companies will experience layoffs in 2009 (or already did in 2008), this does create a pool of systems that can be used for replacements, loaners and spares.

Systems of the most recent vintage can be reassigned to remaining employees in lieu of new purchases. Loaners will be particularly important to supplement extended-life notebooks, which are prone to significant failure rates.

7.0 Notebook Replacement Strategies

One of the key drivers for notebook replacement is the failure rate, which is considerably higher than for desktops. For notebooks, the small form factor reduces the amount of structural rigidity that can be designed in, making the systems highly vulnerable to breakage through dropping. All the system components that are spread out over a large desktop PC motherboard are compressed into a much smaller space, thus creating heat buildup, which is highly damaging to sensitive electronic parts. Most importantly, users transport their notebooks by hand, car, bus, train or airplanes, exposing the systems to destructive levels of heat, vibration, dust and humidity.

Notebooks that are now three or four years old were bought in 2005 or 2006. Failure rates for systems bought at that time were 15% to 17% in the first year. (Reliability has improved in notebooks of more-recent vintage.) By the third year, the annual failure rate for those systems is likely to have risen to 22% to 24%, or nearly one in four systems. By the fourth year, the failure rate is likely to be close to 30%. That means that, among all four-year-old notebooks of that vintage, nearly one in three are likely to experience a PC hardware failure. (Hardware failures are defined as repair incidents where a hardware component must be replaced to restore operation; see "Benchmarking PC Hardware Reliability").

These failure rates are impacted by use patterns, for example:

- Notebooks of traveling workers that are used extensively outside the traditional office, such as in airplanes, hotel rooms, moving vehicles or at customer sites, are likely to have higher failure rates.
- Notebooks of day-extenders that are used mostly while sitting in a dock/port replicator in a traditional office environment are likely to experience slightly lower failure rates.
- Notebooks used in "hostile" environments (with extreme vibration, hot/cold, high humidity or a high likelihood of dropping) will experience the highest levels of failure rates. However, in most cases, these extreme conditions will be met only in specific vertical applications, in which case, ruggedized notebooks are specified.

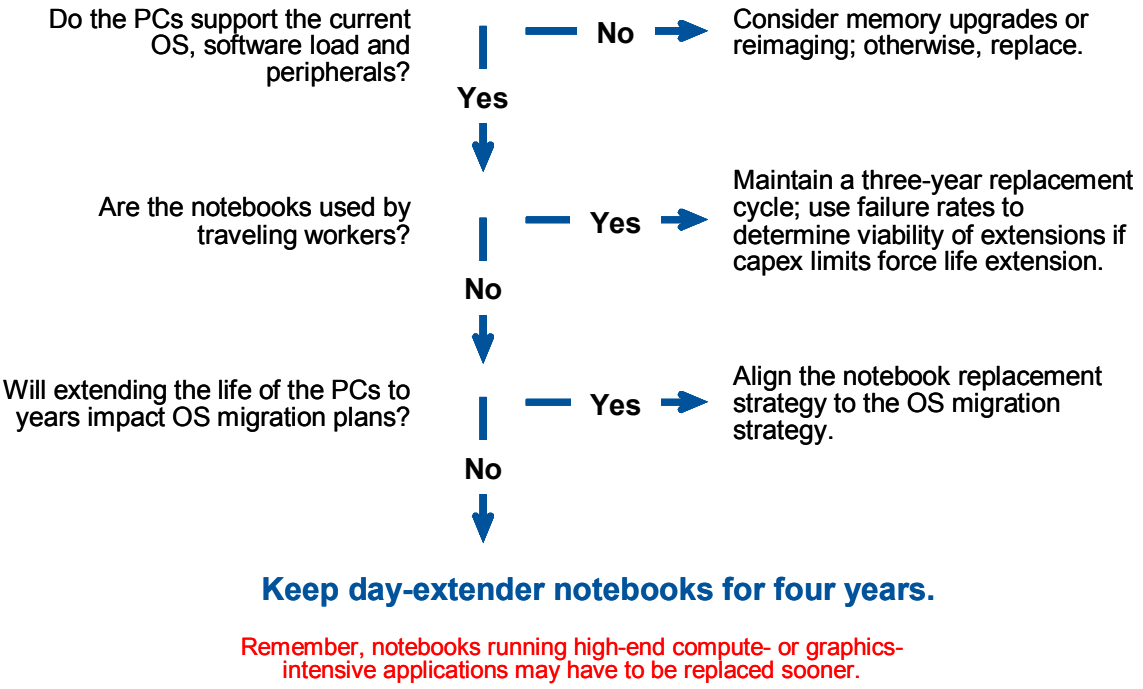
It is easy to disregard the impact of notebook failures, because repairs are usually covered by warranty for the first three years. However, the downtime that results from notebook failures is also a huge issue. Notebook repair time turnaround usually averages three to five days. Although some companies do self maintenance or have on-site warranty service and get one- to two-day turnaround, the absolute minimum for depot service is three days. This entails one day to ship to a depot, one day for depot repair and one day for return shipping. In reality, however, the turnaround can be closer to five days, with one day to do diagnosis and/or find a shipping box, one day to ship, up to two days for depot repair and then another day for return shipping. Seven-day turnaround is not unusual.

This repair turnaround leads to considerable downtime for people who were deemed valuable enough to be given notebooks in the first place. Multiply this amount of downtime by the increasingly high failure rate of older systems (nearly one in three notebooks for four-year-old systems), and the downtime cost becomes considerable.

For all these reasons, it doesn't make sense to extend traveling worker notebook lifetimes. These systems take more abuse than day-extender notebooks and are more likely to fail outside the traditional office environment. Because on-site support usually is only available from the office, in most cases, traveling workers are left with the option of mailing in their PCs for depot repair.

However, since day-extender notebooks rarely leave the office and have lower failure rates than traveling worker notebooks, there is less impact if their lifetime is extended to a fourth year. Although some Gartner clients have had success with this strategy, others have complained that the reduction in capex was offset by the increase in operating expenditure (opex) and user dissatisfaction (see Figure 1).

Figure 1. Notebook Replacement Decision Tree



Source: Gartner (March 2009)

Adopting a four-year replacement cycle for a portion of the notebook population also introduces issues regarding depreciation and leasing, which need to be discussed with the finance department.

7.1 Notebook Recommendations

Consider three-year life cycles for all notebooks as a best practice. However, in times of economic stress:

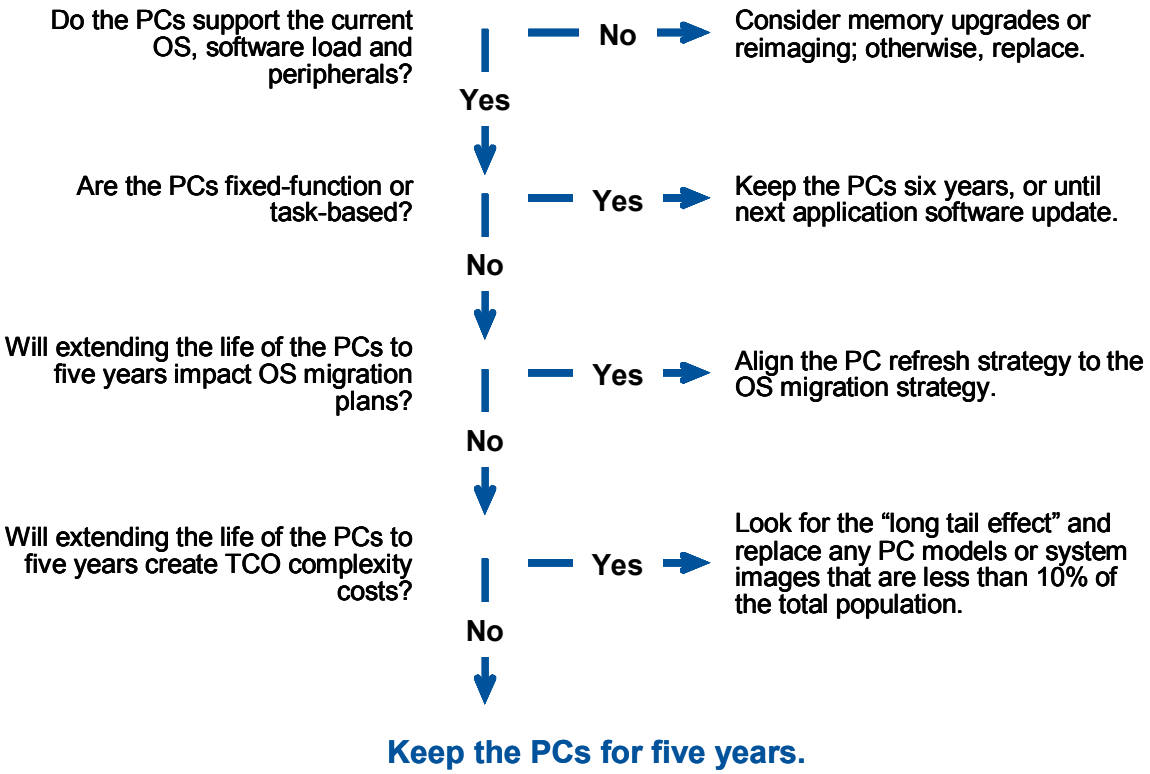
- Maintain a three-year life cycle for traveling workers and field salespeople — any workers who are likely to use notebooks outside the traditional office more than 50% of the time.
- Plan on a four-year life cycle as a means of capex reduction for day extenders whose notebooks spend most of the time in a traditional office environment, and only travel between home and office one or two nights a week and/or on weekends.
- Buy an extended warranty for day-extender notebooks if it's available for under $50.
- Keep "hot spares" (fully configured notebooks) available to use as loaners for users who are waiting for their notebooks to be repaired. The hot spares should number about 1% of a three-year-old fleet. Add additional hot spares for fleets with a significant number of four-year-old notebooks.
- Budget for a 15% fall out of day-extender notebooks if they are held for a fourth year. Also budget for additional replacement batteries.

8.0 Desktop PC Replacement Strategies

The considerations for desktop PC replacements are different from notebooks. Desktop PC failure rates are much lower, and increase at a lower rate as the machines get older. Thus, failure rates are not a factor in replacement cycle decisions. The assets can be held longer with less risk. On average, failure rates for desktop PCs bought from 2005 through 2006 were between 5% to 7%. By the fourth year, the annual failure rate is 12% to 14%. Repairs on these systems also tend to be much easier than for notebooks. The large system boxes are generally easy to disassemble, making replacement parts easy to swap in and out. Also, desktop PCs tend to be clustered in an office or a campus, where it is easy to provide on-site service.

Historically, during the past decade, the desktop PC replacement cycle has been based on a four-year useful life. Many organizations are considering extending the life of PCs from five and even six years. The first question to ask is whether the PCs in question meet all the business requirements outlined above. If the systems do not meet the business requirements and are four years old or more, then hardware upgrades may not make sense; the systems would need to be replaced (see Figure 2).

Figure 2. Desktop PC Replacement Decision Tree



Source: Gartner (March 2009)

If the systems do meet the business requirements, then determine whether the PCs are being used for fixed functions or a restricted numbers of tasks (such as platform automation in a bank, data entry or back-office order processing). In these situations, the application environment is highly stable and unchanging, so software upgrade pressures do not occur as quickly. Many of these systems are already on a five-year life cycle and are candidates for extending to six years — or until the next application software update is due.

Although extending PC lifetimes to five years has resulted in capital spending reductions, it can also lead to higher TCO costs due to complexity. As a greater number of hardware models, OSs and system images are added to the installed base, additional costs are incurred in support and maintenance. Support staff must remain current on a broader array of configurations, which requires more training. Maintenance staff must stay current on a broader range of hardware, which requires more training and greater investment in replacement parts. This cost could be born internally or by the service provider, who will charge back the additional costs. Some of these costs are direct, due to more technical support calls for hardware and software fixes. Others are hidden, unbudgeted costs related to end-user operations and downtime that result in lost productivity and poor user experience. Notebooks are subject to the complexity issues as well. However, the longer

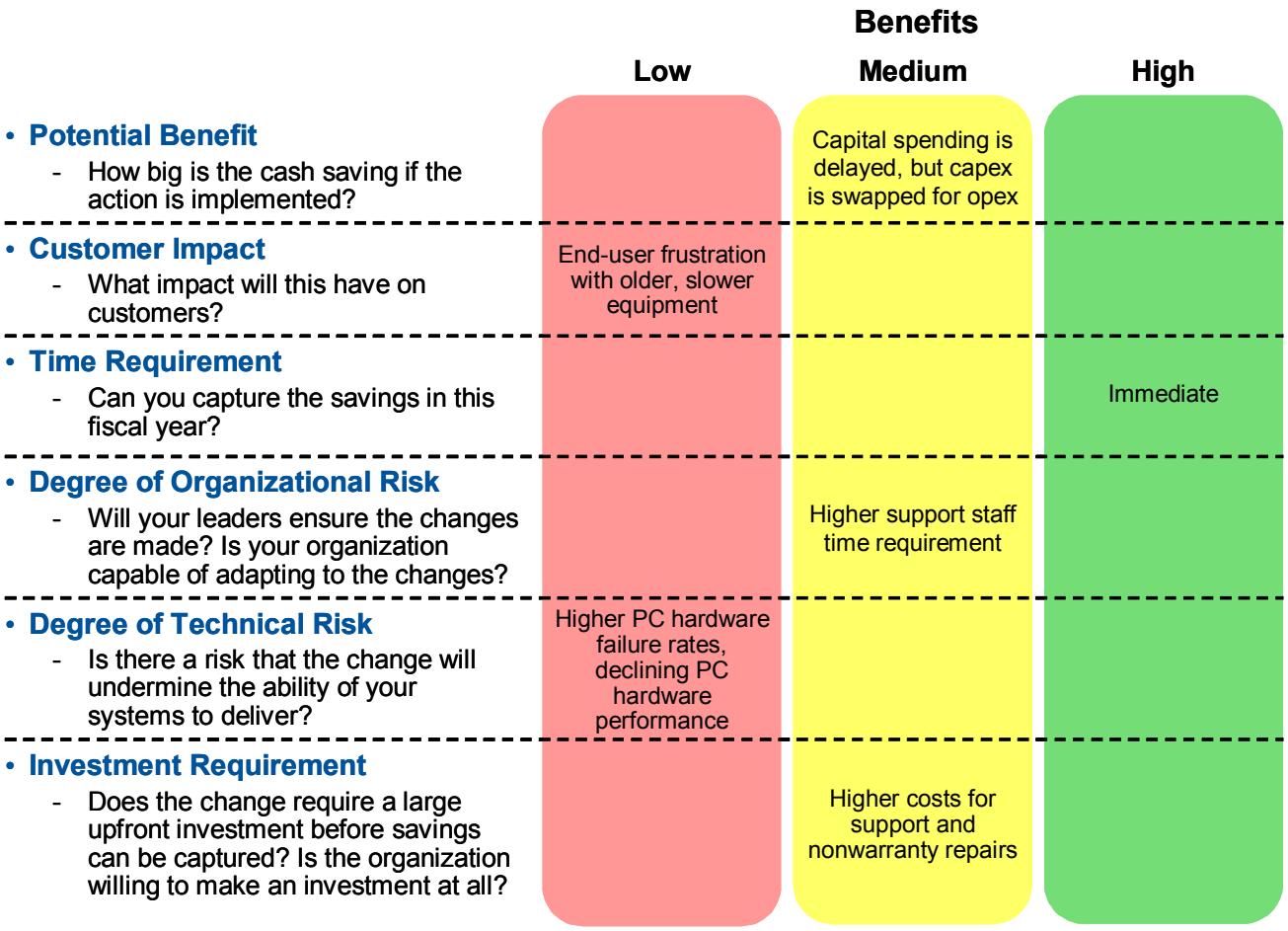
life of desktop PCs exacerbates the problem (see "Toolkit: Age Matters When Considering PC TCO").

Adopting a five-year desktop PC replacement cycle also introduces issues about depreciation and leasing that need to be discussed with the finance department, as well as questions about extending hardware warranty coverage that need to be discussed with the hardware provider.

8.1 Desktop PC Recommendations

- If current four-year-old PCs are meeting all the business requirements for supporting OSs, software and peripherals, then extend their life to five years as a means of capex reduction.
- If current fixed-function or task-based PCs are meeting all the business requirements, then extend their life to six years, or until the next scheduled application upgrade.
- Ensure that extended PC replacement cycles coincide with your OS migration strategy.
- Identify sources of additional complexity due to extended PC replacement cycles, and quantify the TCO impact.
- Look for examples of the long-tail effect — very small, older populations of a particular OS, PC hardware model or system image. If the population is less than 10% of the total, then replace it to reduce complexity costs.
- Budget for a 10% fall out of desktop PCs if they are held for a fifth year (see Figure 3).

Figure 3. Decision Framework: PC Hardware Life Extension



Source: Gartner (March 2009)

Recommended Reading

"Toolkit: Age Matters When Considering PC TCO"

"Benchmarking PC Hardware Reliability"

"Financing the Asset Life Cycle to Achieve Hardware as a Service"

"Operational Considerations in Determining PC Replacement Life Cycle"

This research is part of a set of related research pieces. See ATV: Cost Optimization Opportunities Abound in Client Computing for an overview.

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