

White Paper:

When Upgrading Makes Sense

A study examining the case for CPU upgrades

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Executive Summary

This white paper addresses the challenges that businesses, corporations, governments, schools, and non-profit organizations face with a generation of desktop and server systems that are beginning to under-perform in today's more demanding computing environment. Information Technology (IT) budgets are smaller and IT professionals must justify not only ROI, but also other intricate cost-benefit analyses for every IT investment.

The Challenge

IT professionals and consumers are looking for ways to make their budget dollars go further. The general practice of replacing desktop computers every two to three years is no longer the universal norm. Organizations realize that stretching the computer lifecycle into a fourth or even fifth year means huge savings when calculated over the entire installed base.

However, the retention of older systems for an extended period can have a negative impact on the organization due to the loss of productivity gains associated with higher-performance hardware.

With these challenges in front of them, IT professionals and consumers need to consider a new option: **System Enhancement with Processor Upgrades.**

The Solution

To help alleviate some of these challenges, PowerLeap LLC designs and manufactures CPU processor upgrade solutions that allow an organization to use their existing systems in much the same way as a new system – for a fraction of the cost. A CPU processor upgrade can:

- Add another 12 to 24 months of useful life to a desktop system (or a workstation)
- Substantially increase system performance
- Enhance your return on investment (ROI)
- Increase end-user productivity
- Save the cost of a replacement system
- Take very little time to upgrade in place
- Prevent costly interruption to end-users
- Avoid the hassle and red tape of purchasing new capital assets
- Use existing operating system licenses
- Be environmentally friendly

PowerLeap™ CPU upgrades are an excellent solution for revitalizing the installed base of computer systems. Organizations and individuals should consider this cost-effective method to bring these systems up to current standards.

Introduction

Many companies have an installed base of computing infrastructure with untapped potential. PowerLeap™ upgrade products offer an alternative solution to complete PC replacements in order to take advantage of the latest technology. PowerLeap brand CPU upgrade solutions allow older systems and motherboards to support current CPUs by using PowerLeap's patented Independent Powering System (IPS™). With a PowerLeap upgrade solution, top performance can be restored to legacy machines, preserving the original investment in hardware and software while achieving significant productivity and cost benefits. PowerLeap upgrade solutions are applicable for most desktop PC's, servers and workstations, and selected laptops.

Several factors should be considered to determine whether or not processor upgrades are a viable option for a particular organization:

1. Target system
2. Cost of a new system
3. Cost of doing nothing
4. Benefits of a CPU upgrade

Analyzing these four areas will help determine if upgrading makes sense and what benefits would be realized.

1. Target System

Except for advancements in speed, basic computer hardware design has changed very little over the last three to four years. Organizations still use networks, printers, scanners, and video hardware much the same way as they have in the past. For a networked desktop system, the main improvements over the last four years have been the CPU processor and memory speed.

1-1. Processor Evolution

Desktop, Server and Mobile Processors have several common, important attributes. The most notable factor affecting performance is the clock speed (MHz) that the processor operates in conjunction with the L2 cache (K). While clock speed is the raw horsepower behind executing instructions, L2 cache is the key to faster internet page loads, multiple windows operations, large spreadsheet files manipulations, and intense graphic applications.

The **Table 1** below presents a quick comparison of all of Intel's mainstream CPU processors since the Pentium®. Take note of the "Top Upgrade" column that shows the maximum speed that a class of system can currently reach with a PowerLeap upgrade solution.

CPU Class	Speed Range	L2 Cache Size	Memory Speed	Top Upgrade
Pentium®	66-233MHz	0; 16K	60; 66MHz	400MHz
Pentium II	233-450MHz	256K; 512K (1/2 speed)	66; 100MHz	766; 1.4GHz
Celeron®	233-533MHz	0; 128K	66MHz	766MHz
Celeron II	300-766MHz	128K	66MHz	766MHz
Pentium III	400-1200MHz	512K (1/2 speed); 256K	100; 133MHz	1.4GHz
Celeron III	800-1400MHz	256K	100MHz	1.4GHz
Pentium IIIB	1133-1400MHz	512K	133MHz	1.4GHz
Pentium 4	1200-2000MHz	256K	200MHz	2.8GHz
Pentium 4A	1600-2800MHz	512K	200; 266MHz	3.06GHz

Table 1 - CPU Processor Comparison Chart

Please note that CPU processor speeds have reached levels far faster than the typical business computer needs. In most cases, the newest operating system with the standard mix of business software runs very well at the 1.0/1.x GHz level with 256K L2 cache.

1-2. The Ideal Target System

The ideal target system for a CPU processor upgrade is one that no longer meets the performance needs and/or expectations of the user or organization, BUT can be enhanced to a level that meets these needs. Practically speaking, the ideal target system is one that can be upgraded to the 733MHz to 1400MHz level. At this level, standard operating systems and business applications perform very well.

1-3. Compatibility

Although most systems are upgradeable, because of differences between manufacturers, compatibility is sometimes an issue. There are a few systems that cannot be upgraded either because of unconventional engineering in their original design or the manufacturer has prevented an upgrade by programming the BIOS to refuse anything but the original configuration.

Check with your PowerLeap sales representatives or the web-based Upgrade Finder compatibility database at www.powerleap.com to find which systems have been tested. Systems such as the Dell Optiplex and Compaq Presario are among the most popular compatible upgrade targets.

Users may also run the PowerLeap CPU Upgrade Finder software and submit the details of their specific system to PowerLeap's technical support department for additional help determining compatibility.

2. Cost of a New System

System costs can vary widely depending on configuration and installed software features. Many new systems are required to ship with a new operating system installed.

This trend causes many small and medium businesses to accumulate a variety of operating systems as the result of purchasing new systems at various times. In addition, larger businesses may have a site license agreement for operating systems. Purchasing a new system with a new O/S installed can lead to duplicate charges.

In contrast, PowerLeap upgrades allow the user to retain the current desktop image and do not affect operating systems and software licensing, thereby reducing significant replacement costs. In addition, businesses with disparate configurations may be able to “standardize” their infrastructure with PowerLeap solutions. This makes computer equipment more manageable and achieves a measurable productivity standard across the entire employee base.

2.1. Cost of Equipment

The purchase price of a new PC ranges between \$800 and \$2200 depending on the configurations. For comparison purposes, a moderately-priced system from Dell Online Store was examined:¹

Dell Optiplex GX270

Intel Pentium® 4 Processor 2.60GHz CPU,
800FSB, 512K Cache, Intel Gigabit NIC
256MB DDR Non-ECC SDRAM, 300MHz
40GB Hard Drive
48X CD-ROM, 1.44MB 3.5 Inch Floppy Drive,
64MB, nVidia, GeForce 4MX, DVI w/VGA adapter
Keyboard, mouse
Integrated sound, graphic and network
Integrated Network Adapter (NIC)
No monitor, no speakers, no modem
Microsoft Windows XP Professional, SP1, with Media and NTFS
Total \$1172.00 +shipping

¹ Information from www.dell.com on November 2, 2003

2.2. Cost of Installation

Installation of a new system involves a number of apparent as well as potentially hidden costs:

- Unpacking and setting up
- Software installation
- Network configuration
- Moving individual settings and files from old PC
- General troubleshooting
- Bar coding and inventory cataloging

Depending upon the organization's needs, this process can take 2-4 hours per computer. If an in-house technician completes the installation, the hourly cost can be computed at about \$35 per hour or \$105 for a three hour installation.²

If an outside Solution Provider performs the installation, this cost can range from \$50 to \$200 per hour.

2.3. Employee Downtime

The typical end-user will take some time to scout around their new system, get used to the new "desktop", keyboard and mouse, and configure menus, colors, and sounds to their liking. If these things are done during the working day, there is a measurable cost to the organization. Two hours at \$35 per hour would be \$70 or four hours at \$140.³

If employees have real technical problems following the installation, (e.g., lost files, network shares, etc.) the cost goes up as help desks, IT support, or co-workers become involved. Two more hours at \$35 per hour would be an additional \$70.

2.4. Disposal Costs

Getting rid of displaced computers has become more difficult and costly over the last few years. Increasingly, Environmental Protection Agency (EPA) regulations and state and local environmental laws require that computer hardware be recycled rather than dumped into landfills. In addition, charities and schools have been flooded with donated computers and many no longer accept corporate cast-offs.

Disposal costs are usually between \$25 and \$50 for typical PC systems. These costs can vary by state and can rise significantly higher as more regulations take affect.

² Based on an employee's total benefits package of \$70,000, working 50 weeks, 40 hours per week.

³ *ibid*

If an organization deals with sensitive information, destroying hard drives might be necessary. This can easily double, even triple the disposal costs.

2.5. Total Cost of a New System

To summarize, the **Table 2** below shows the total cost of purchasing a new system:

Description	Cost	
	Low-side	High-side
New System (as described)	\$1172	\$1172
Installation	105	200
Employee down time	70	140
Other employees/helpdesk	70	70
Disposal costs	35	50
Total	\$1452	\$1632

Table 2 - Total Cost of a New System

On top of the actual cost, an organization must also consider its cost of capital or, if leasing, the interest rate. There is also the issue of cash flow and what other projects might be competing for the same funds (i.e., missed opportunity costs).

3. Cost of Doing Nothing

Another alternative is doing nothing with the aging systems. On the surface, this might seem like a good idea or at the very least, the most cost effective way to go. If the productivity of employees using these aging systems is considered, then there is a cost to doing nothing.

Take the example of the employee that makes \$70,000 per year (including benefits). *At \$35 per hour, even a one hour per week loss in productivity due to slow booting, slow graphics, and slow overall performance will result in a cost of \$1750 per year.*

4. Benefits of a CPU Upgrade

There are several direct and indirect benefits to upgrading with PowerLeap CPU upgrade solutions:

1. Cost
2. Time
3. Performance
4. Productivity
5. The Environment

4-1. Cost

As companies continue to trim and manage costs to maximize profits, IT budgets will continue to remain small and/or shrink. IT budgets usually are not viewed as a necessary expenditure unless the infrastructure or productivity demand is justified. However, for the cost of an average market price PC, you can upgrade between 7 to 10 existing systems, keeping your departments on the same page and up to date.

PowerLeap CPU upgrade solutions range in price from \$85 for a Pentium® 400MHz upgrade to \$270 for a Pentium® 4 2.4GHz upgrade. The most popular upgrade is the PL-iP3/T 1400C that can upgrade most Pentium® II and Pentium® III systems to 1.4GHz. The PL-iP3/T 1400C upgrade solution sells for \$119⁴.

4.2. Time

A CPU upgrade takes under five minutes to install for technical staff or a bit longer for non technical staff. Since there are no changes to the rest of the system, there is really very little downtime for the system. The following time advantages are achieved:

- No software configuration – any proprietary software or software not normally installed at the factory must be configured on each new PC.
- No network configuration – new proprietary software on each new PC must be integrated via proper networking protocol by the IT department.
- No time taken for user acclimation/customization.
- No time spent on troubleshooting a completely new installation.
- No time spent on asset management (bar coding and other controls).
- No learning curve for employees to re-learn how to perform mundane daily tasks.
- No down time and productivity loss for employees.
- No time on disposing of the old systems.
- No end-user downtime (if performed after hours).

CPU upgrades are typically classified as repairs and not capital purchases. This means less red tape and no RFQs. The difference between a repair budget and a capital purchase can often mean months in larger businesses, schools, and government organizations.

4.3. Performance

Increasing performance is the ultimate goal to be achieved when upgrading a system. CPU upgrades provide this performance increase simply by substituting a newer, faster, and more advanced CPU for the older and slower CPU.

⁴ Suggested Retail Price in USD\$, November 2003.

While actual performance increases will vary from system to system, internal testing, media testing, and customer feedback confirm benchmarked performance increases from 30% to 300%. When system memory is upgraded, these numbers can get even higher.

Figure 1 shows the benchmarks of a typical business system, the Dell Optiplex™ GX1 before and after a CPU upgrade⁵. The original system is as it came from Dell – a Pentium II 400MHz CPU with 256MB memory upgraded to Microsoft Windows XP™. The only change made was the removal of the old CPU and the installation of PowerLeap's **PL-iP3/T 1400C** (with an Intel Celeron® 1.4GHz CPU).

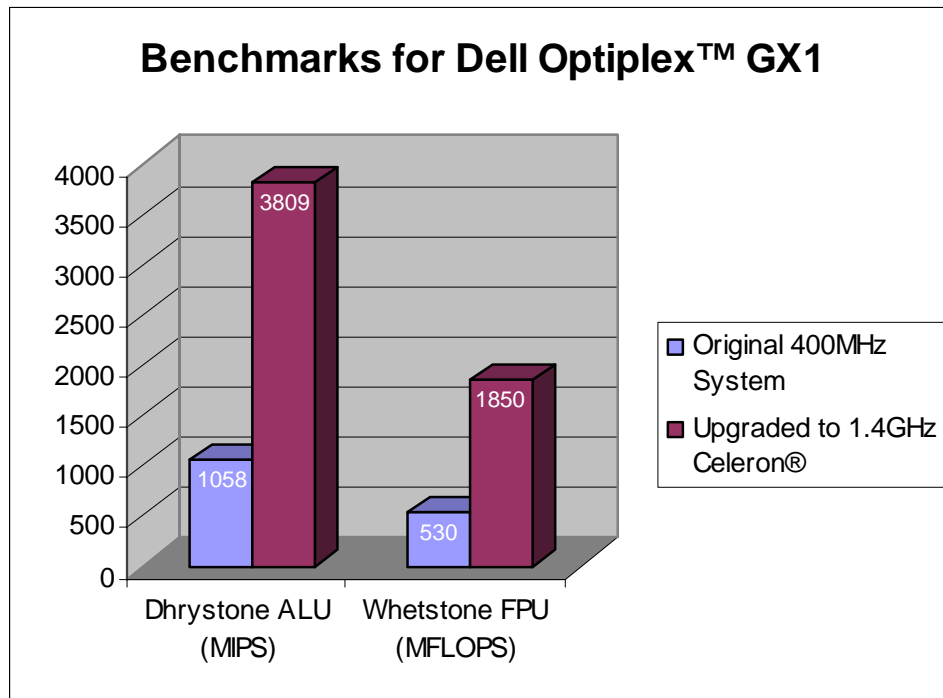


Figure 1 – Benchmark for Common Business System

The increase in the Dhrystone ALU score was 260% and the Whetstone FPU was 249%. Real world use shows significant increases in speed while doing common end-user tasks such as booting, software launching, graphics speed, and general responsiveness.

4.4. Productivity

Since faster systems mean faster booting, faster applications, and faster graphics, end-user productivity goes up.

⁵ Benchmarks as computed by SiSoftware Sandra Standard, version 2002.1.8.59

To quantify this, consider **Table 3** to illustrate these examples:

Hours saved per Week	Annual Salary*	Hourly Savings	Annual Savings
2	\$70,000	\$33	\$3432
2	35,000	17	1768
1	70,000	33	1716
1	35,000	17	884
½	70,000	33	858
½	35,000	17	442
¼	70,000	33	429
¼	35,000	17	221

*including benefits

Table 3 - Productivity Gains in \$

If an organization saves even fifteen minutes per week (3 minutes per day), a CPU upgrade will pay for itself in productivity gains. On top of that, end-users' satisfaction is increased by the extra speed and responsiveness of their newly upgraded system.

4.5. The Environment

Consumers and organizations are disposing systems at an alarming rate. The US EPA has classified computer systems as "hazardous waste" for businesses and government.

Michael Dell recently told Money Magazine that he estimates there are over 180 million systems in the world that are over three years old (with 50 million of those in the USA).⁶ The impact of all of these systems arriving at landfills would be quite a serious problem.

Upgrading a system rather than replacing it with new hardware is not only cost effective, it also makes environmental sense. Adding another 12 to 24 months of useful life to a system delays its arrival at the landfill and the total amount of computer-related material in the waste stream. Organizations that choose to upgrade their systems instead of disposing them make a direct contribution to the health of the environment by doing so.

Conclusion

PowerLeap's upgrade solutions can benefit you and your business tremendously. Please contact us now and let us help your organization increase the performance of your installed base of desktops, servers, workstations, and selected laptop systems.

⁶ *Muscling into New Markets*, by Nick Pachetti, Money Magazine, November 2002.

About PowerLeap

PowerLeap has been designing and manufacturing CPU upgrade solutions since 1996. With seven US, Japanese, and Taiwan patents and seven new products in 2003, PowerLeap is committed to develop innovative upgrade solutions that define the industry standards in quality, reliability, and compatibility.

PowerLeap LLC is a US company headquartered in Millstone, New Jersey, USA. PowerLeap's R&D labs and manufacturing facilities are located in Taipei, Taiwan under its FriendTech Ltd. subsidiary. All manufacturing facilities are state-of-the-art and ISO 9002 certified. PowerLeap maintains distribution hubs in Millstone, New Jersey, USA and Taipei, Taiwan.

Customers include American Online/Time Warner, Amherst Computer Products, Canadian Government, Columbia University, CDWG, Dow Jones, EDS, Evergreen Technologies, Global Computer Supplies, Harvard University, ING Canada, Intel, Intrust Bank, John Hopkins Hospital, Memory Plus, Metropolitan Museum of Art, Princeton University, Purdue University, SAIC, SBC/SNET, Sony, Sony Ericsson Mobile Communications, State of California, Total Memory and Media, US Army, US District Court offices, US EDA, US Geological Survey, Veritas Software, and Yale University. Thousands of other businesses, government offices, educational institutions, and non-profit organizations all over the world have upgraded their computers using PowerLeap CPU upgrades solutions.

PowerLeap upgrade solutions can be purchased online at www.powerleap.com or through a network of distribution partners and solution providers. Please reference the International Sources page on our website for a local supplier if you are located outside of the USA.

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