

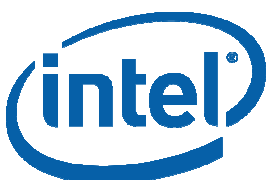


Solution Brief:

**Go Green with IBM System x
Servers and Intel Xeon
Processors**

*Amelia Frost
Mark T. Chapman
IBM Systems and Technology Group*

*Raechel Beiler
Intel Corporation*



Overview

Do you remember how much your last server cost you overall? With energy prices on a steep climb, soon the cost to power and cool a server over its life span could equal its purchase price. According to IDC, over the next two years you'll spend 70 cents in power and cooling for every dollar you spend on hardware.¹ Unless you expect energy costs to drop in the near future, it's quite likely that over the next five years your energy costs could end up exceeding your hardware costs.

By "going green" with energy-efficient IBM® System x™ servers featuring Intel® Xeon® processors, you can win back control of your IT budget—and win the battle with data center power constraints. Go green to:

- Potentially cut your energy costs in half or better—or achieve greater performance within the same energy envelope²
- Expand IT without exceeding data center power limits
- Save floor space for future growth
- Leave your competitors to struggle with the energy crunch

Figure 1 demonstrates the major performance-per-watt improvements over time, progressing from single- to dual- to quad-core processors:

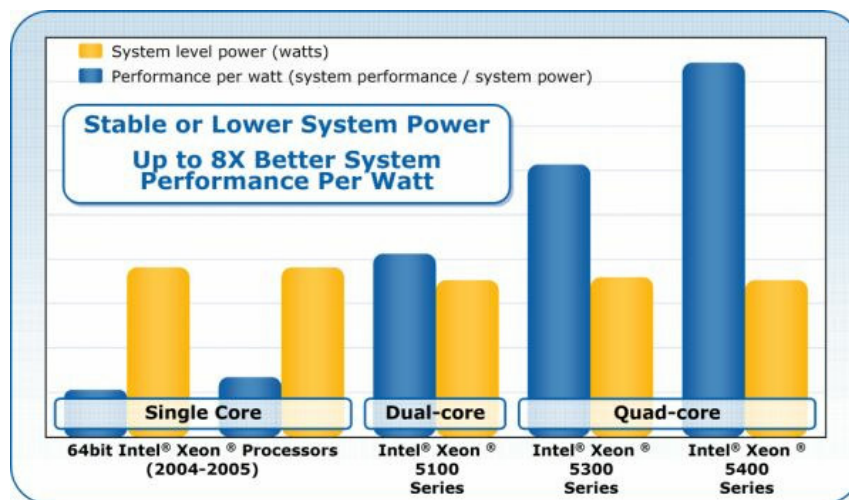


Figure 1. 8X performance enhancement

The energy cost-savings of going green with System x servers and Xeon processors can be tremendous. IBM economic analysts estimate that the typical 25,000 sq. ft. data center, spending \$2.6M on energy each year, can cut costs in half by using green technologies and consolidating servers. With a return of that size you can invest in more strategic IT projects while your competitors continue to struggle with their power bills.

¹ IDC "Worldwide Server Power and Cooling Expense 2006–2010 Forecast".

² The performance of today's quad-core Xeon processors can be up to 8X that of yesterday's single-core Xeon processors, depending on the workload. Performance comparison using SPECjbb2005 bops between (2004) single-core Intel Xeon processor (3.6GHz) and (2008) quad-core Intel Xeon processor E5450 (3.0GHz), measured 8/22/07. Source: Intel Corp.

Going green can also help you increase IT capacity. The pivotal question is: Can you expand within your current floor space safely, without overextending the power and cooling thresholds of your facilities?

The answer? Go green for a denser infrastructure. Consolidate your infrastructure on the latest high-performance, energy-efficient System x servers and Xeon processors that place minimal demands on power and cooling. You can simultaneously increase IT capacity, free up floor space and stay within the power and cooling limits of your data center.

Ultimately, going green with IBM System x servers and Intel Xeon processors translates into minimizing your company's carbon footprint and much more: the cost savings and room for IT growth that sustain a competitive business edge.

More Performance Per Watt

The story of System x energy efficiency starts with the IBM-designed power supply. Typical industry-standard power supplies are only 60-70% efficient. This means *300-400 watts of every kilowatt consumed is expended as waste heat, rather than used productively*. By contrast, some System x rack servers are as much as **91%** energy-efficient. Therefore, only **90** watts are wasted out of each kilowatt.

To fully exploit this efficiency and help you maximize computing performance per watt, IBM gives you the option of equipping your servers with leading performance and performance-per-watt quad-core Intel Xeon processors—including a new 50W processor option (available on selected models).

With enhanced Intel Core™ microarchitecture technologies, the Xeon processors give you substantial performance gains over previous-generation processors without increasing energy consumption. Key microarchitecture innovations, incorporated into the latest System x models, include:

- New **45nm** process technology to deliver higher levels of performance and density with fewer cooling challenges
- Up to **12MB** of L2 cache that stores large data sets close to the processor for immediate computing availability and greatly reduced cache misses
- The power-saving capability to turn the cache devices on when necessary, off when they're not required.
- Advanced logic that reduces processor energy consumption to a mere **16W** when the server is idle



Leadership Benchmark Results

New benchmark results prove that these efficiencies deliver high performance per watt. Running quad-core Xeon processors, both the single-socket System x3350 and x3250 M2 1U servers beat competitive Dell and HP servers in a SPECpower™ benchmark test.³ (Test scores are a combination of system performance and power consumption measurements.)

³ http://www.spec.org/power_ssj2008/results/power_ssj2008.html.

The x3350 achieved SPECpower scores that were:

- 37% better than the HP DL360 results
- 28% better than Dell PE 1950
- 13% better than Dell PowerEdge R300



With advanced cooling and power management and half as many power-consuming processors, the x3350 was dubbed “lean and green” by Network World.⁴ It handles with ease heavy single-application workloads that you previously would have trusted only to dual-socket servers. The x3350 helps you maintain a lean, green data center.

Reliable, Energy-efficient Consolidation

For compute-intensive applications (such as business intelligence) and server consolidation, rely on the energy-efficient dual-socket 2U x3650. Its fast memory and efficient I/O add to the low latency technologies of the Xeon chipset—so that it scales to impressive capacity while maintaining high performance. In fact, the x3650 delivered leadership two-socket benchmark results in a SPEC test scenario that assessed enterprise computing performance.⁵



Of course these results mean nothing without reliability, particularly for systems that can consolidate the work of many servers. Based on the IBM X-Architecture™ blueprint (as are all System x rack servers), the x3650 incorporates proven, mainframe-inspired high-availability features and reliable components. And, like the x3350, it features advanced cooling and power management technologies.

A Portfolio of Green Technologies

Besides super-efficient power supplies and low-voltage quad-core Xeon processors, IBM offers many more green technologies for System x servers:

- Select systems are available with new **low-power 1Gb technology DDR II DIMMs**, rather than power-hungry Fully Buffered DIMMs. The cost-savings can be substantial, considering that memory consumes 25-40% of data center power.
- **2.5” hard disk drives**, available in many System x models, conserve 40% or more (6-10 watts per drive) of the energy used by 3.5” drives.
- **IBM Calibrated Vectored Cooling™** minimizes the amount of energy that a server’s fan system consumes. It triggers only those fans in a critical “cooling zone” of the server to switch to full speed when temperatures rise in that zone—thus cooling hotspots without requiring all fans to spin at full speed. This means less energy consumed, less wear on the fans, and reduced noise.
- **IBM Rear Door Heat eXchanger** is a rack-level solution to the problem of data-center cooling. Using a sealed-coil chilled-water line to absorb heat before it exits the rack and pump it out of the data center, it can



⁴ <http://www.networkworld.com/research/2008/060908-green-windows-linux.html?page=1>.

⁵ SPECjbb2005: <http://spec.org/jbb2005/results/res2008q1/jbb2005-20080311-00460.html>, results posted as of March 11, 2008.

eliminate up to 55% of the heat from a fully populated rack (**15 KVa/ 50,000 BTUs**), dramatically cutting your cooling costs. (And it adds only 4" to the depth of the rack.)

- **IBM Systems Director Active Energy Manager™** provisioning software (available on selected servers), allows you to monitor power usage hourly, daily, weekly or monthly, and use the data to cap power and thermal limits at the system or rack level. For more information about this and other technologies in the IBM Cool Blue™ portfolio, go to <http://ibm.com/systems/x/advantages/energy/overview.html>

In addition, IBM offers multiple one-stop-shopping virtualization solutions for System x rack servers. Virtualization software enables the consolidation of multiple servers into one, thus raising CPU utilization from the typical 5-15% to as much as 85%. When you purchase Red Hat or Novell SUSE distributions of Linux® with a server, you receive that vendor's version of open-source Xen virtualization software. You can also purchase various IBM and VMware virtualization software products with System x rack servers.

The Right Green Solutions

Incorporating quad-core Intel Xeon processors and many other energy-saving technologies, IBM System x rack servers deliver deep, continuous cost-savings. They are the building blocks of the flexible, green infrastructure that you need to retain a competitive business edge.

Visit <http://ibm.com/systems/x/hardware/rack/index.html> to view the complete portfolio of System x rack servers.

To learn more about Intel Xeon processors, visit <http://www.intel.com/xeon>.



For More Information

IBM System x Servers

IBM System x and BladeCenter Power Configurator

IBM ServerProven Program

IBM Technical Support

IBM Configuration and Options Guide

ibm.com/systems/x

ibm.com/systems/bladecenter/powerconfig

ibm.com/servers/eserver/serverproven/compat/us

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ibm.com/servers/eserver/xseries/cog

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Dept. U2SA
3039 Cornwallis Road
Research Triangle Park, NC 27709

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Some machines are designed with a power management capability to provide customers with the maximum uptime possible for their systems. In extended thermal conditions, rather than shutdown completely, or fail, these machines automatically reduce the processor frequency to maintain acceptable thermal levels.

MB, GB and TB = 1,000,000, 1,000,000,000 and 1,000,000,000,000 bytes, respectively, when referring to storage capacity. Accessible capacity is less; up to 3GB is used in service partition. Actual storage capacity will vary based upon many factors and may be less than stated.

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will depend on considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.

Maximum internal hard disk and memory capacities may require the replacement of any standard hard drives and/or memory and the population of all hard disk bays and memory slots with the largest currently supported drives available. When referring to variable speed CD-ROMs, CD-Rs, CD-RWs and DVDs, actual playback speed will vary and is often less than the maximum possible.

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