Driving data center efficiency

A new wave of storage solutions is emerging that offer greener, more energy efficient approaches to IT. *Business Management* spoke to **Bruce Shaw**, Director of Server and Workstation Marketing at AMD, **Ian Seaton**, Technology Marketing Manager for Chatsworth Products, and **Lorie Wigle**, Director of Server Technology and Initiatives Marketing for Intel, to find out how companies can reduce their energy costs and improve data center efficiencies.

BM. Why is it important for companies to address efficiency concerns as well as performance and reliability considerations? Is there any conflict between energy efficiency and energy reliability? And how can the two be reconciled?

IS. Data center energy efficiency is not the counterpoint to energy reliability; however, what we are seeing recently is that the cost of powering the machine is increasing at a much higher rate than the computational output efficiencies we are getting. If that trend continues at its present pace, we will be facing a period where businesses will no longer be able to cost-justify the hardware required to implement new applications. There are also more tangible, closer-to-home reasons why companies should be concerned about addressing data center energy efficiency. It's a matter of competitive advantage. When the costs for powering technology finally exceed the costs for acquiring the technology and a data center can account for anywhere from 50-90 percent of a business' energy operating costs, the guy who figures out how to shave millions of dollars from those costs is going to have a competitive advantage in his area of business.

LW. In this age of global warming, everyone is scrambling to reduce their carbon footprint and no company can ignore the need to be mindful of energy efficiency. Many companies' data centers have actually reached the limits of their designed power capacity. In 2006, Gartner reported that 50 percent of data centers will have insufficient power and cooling capacity by 2008. The business choice facing such customers is to build additional data centers or make current ones more efficient. Energy reliability is just as critical, particularly when you consider that system failures can cost millions of dollars in lost business. But energy reliability is more a factor of good siting – avoiding areas with great potential for power failures – and installing adequate power backup systems. I see synergy rather than conflict between energy efficiency and energy reliability. Energy efficiency can support reliability by helping reduce the amount of overall power that must be supported by the grid.

BS. In the data center today, performance and reliability are no longer the only concerns on the mind of the typical IT manager. It is vital they consider these factors in concert with the need for more energy efficient systems. Due to rising energy costs and shrinking IT budgets, data center managers must review the entire picture, balancing their performance needs with available financial resources through newer solutions such as server consolidation and virtualization. By optimizing server density in data centers and utilization of the processor, servers are continuing to do more with less, coming close to achieving true balance of performance and reliability for high productivity, while maintaining or minimizing lowering energy usage.

Lorie Wigle is the Director of Server Technology and Initiatives Marketing for Intel. She and her team are responsible for taking to market the Intel Virtualization Technology offerings, as well as Intel Active Management Technology and other advanced platform capabilities.

BM. A recent EPA study suggests that energy efficient technologies and practices could improve efficiency of servers and datacenters considerably (somewhere between 20-55 percent). Do you think these figures are realistic, and what are the technologies and best practices that will get us there?

IS. The figures are realistic and solutions to achieve them are available. An Intel "Eco-Rack" recently demonstrated how server-level configuration changes – such as converting to DC power delivery, activating Enhanced Intel SpeedStep Technology, and using larger memory modules – deliver up to 18 percent total power savings at the rack-level. An Intel collaboration with Lawrence Berkeley National Laboratory showed how using high efficiency components and eliminating multiple power conversions improves power conversion efficiency 50 to 75 percent. Then there's consolidation through virtualization. Consider this: through Intel processor improvements, 53 blade servers drawing 21kW provide the same 3.7Tflops of performance that in 2002 would have required Intel Architecture-based HPC clusters using 512 servers arranged in 25 racks using 128kW of power. Just 17 percent of the power required in 2002 provides the equivalent performance today.

BS. Dependent upon the data center solution implemented, the EPA figures are not unrealistic. Servers can spend a lot of time in an idle state, while power to the systems remains constant. By simply optimizing the power management instructions within the processor and through software today, IT managers may significantly improve energy efficiency. New processor technologies from AMD are being introduced to aid in increasing energy efficiency with Enhanced AMD PowerNow! and limiting heat output with Dual Dynamic Power Management. Within the industry in general, due to the economics of energy in our daily headlines, more and more companies are quickly getting into the business of providing energy efficient technology solutions. We will see the market determine which are the strongest and most effective in the coming months and years.

IS. The two biggest energy hogs in a data center are the IT equipment itself and cooling that IT equipment. In large enterprises, there is significant waste in running servers that are either not doing any real work or are doing work that nobody needs or uses. Cooling the data center, according to a study by the Lawrence Berkeley National Laboratory, consumes anywhere from 25-50 percent of the total energy bill for data centers. Those cooling costs can be reduced by anywhere from 50-90 percent by raising supply temperatures and taking advantage of more hours of economizer cooling. The most important requirement for being able to significantly raise AC supply temperatures is to isolate the data center supply air from the return air – this means there is only cool air on the intake side of technology equipment and there is only hot air on the exhaust side (i.e. the server or other piece of IT hardware divides the data center between supply and return). This approach can reduce data center cooling costs by 90 percent for 4000 hours a year in places like Houston, and for 100 percent of the year in places like Denver. Separation strategies can range from building a containment room around a hot aisle to ducting heated exhaust air into a ceiling plenum from where it can be returned to the HVAC return air in-take.

BM. How can an energy reduced data center solution impact on overall business performance? How are your clients benefiting from work in this area?

IT holds scope for improvement

Despite the current sense that little progress is being made, the IT function is well placed when it comes to reducing its environmental impact. By adopting existing energy efficiency methodologies and technologies, corporate servers and data centers could cut power use from current efficiency trends by 56 percent by 2011, according to the EPA. For the US alone, this would reduce projected electricity costs from some $31 billion to $17 billion, providing an obvious cost saving incentive – and also delivering a huge reduction in future CO_2 emissions. Beyond the data center, simple initiatives such as switching off PCs when not in use and minimizing unnecessary printing, can improve an organization's green credentials and save money at the same time.

BS. The key here is not to think only of servers, processors, power supplies and cooling scenarios in a vacuum when building a data center solution. The overall infrastructure needs to bridge the separate interests of the IT and operations departments. Companies are thinking about energy efficiency holistically with consideration for the overall physical structure where server farms are housed. This foundation strategy ultimately requires long-term vision for business success. The initial (sometimes costly) investment can enable businesses to grow exponentially while decreasing a potential need for capital-intensive data center expansion on a case-by-case or near-term basis. AMD continues to develop processor cores and technologies based on achieving greater energy efficiency without sacrificing performance. By optimizing performance-per-watt, we are able to provide IT decision-makers with that critical starting point for building an efficient data center solution.

IS. An energy-reduced data center contributes to the bottom line. Intel has published a white paper that shows a positive ROI payback for water-side economizers in less than one year. The Kyoto Cooling Technology ROI is off the charts, since the capital investment is actually less than legacy energy hogging design models. We proposed an alternative design for a medium-sized hotel casino data center of about 600kW with supply air and return air segregated by cabinets ducting exhaust air into a suspended ceiling return plenum; it resulted in a 700,000kW hours per year savings on their electric bill, entirely from increased HVAC efficiency due to higher ΔT between the supply air and return air.

$4.5 billion

Amount spent on electricity for US servers and data centers in 2006

LW. Energy-efficient solutions provide a positive impact to data center performance by enabling more to be done within the same power budget. When you consider the way data center power consumption has steadily risen, avoiding any increase in one's current power budget yields a good-sized cost savings, and on a larger scale is a big contribution to slowing global warming. Purchasers of Intel processor-based servers have many ways to profit from our work as Intel's 'tick-tock' cadence continues to deliver a new process technology with enhanced micro-architecture or entirely new micro-architecture every year. These innovations can result in major efficiency gains for constrained power envelopes. For instance, in March 2007, Intel introduced two energy-efficient 50W server processors, the Quad-Core Intel Xeon processors L5320 and L5310, delivering a 35-60 percent decrease in power from Intel's 80-120-watt Quad-Core server products. Requiring just 12.5W of power per core, these processors represent a nearly 10-fold improvement in power consumption per core in just one-and-a-half years.

BM. Energy costs are generally increasing. Do you think that managing your data center in a more efficient way is an effective foundation for a risk management strategy to address concerns over energy costs, security and supply?

IS. Definitely. Merely de-commissioning unneeded servers and optimizing data center cooling by providing access to greater economizer hours through better hot air containment can reduce data center energy costs by 25-50 percent. Issues of security and supply tend to get a little more complicated. Improved energy efficiency can prolong the life of an existing facility; therefore, reactive strategies to supply and security concerns can at least be delayed somewhat. On a more macro level, supply and security concerns will be mitigated to the degree that more businesses add efficiency objectives to both their operating plans and their strategies.

BS. Any risk management strategy based on thorough and efficient data center management should have efficiency at its core but should not be the sole component for measuring its effectiveness. The smart IT manager will take a close look at energy consumption in parallel with per-

As Director of Server and Workstation Marketing at AMD, **Bruce Shaw** is responsible for the Global Brand, Product Marketing and Business Development of the AMD Opteron processor family, including the introduction of the next generation of AMD processors codenamed Barcelona.

formance gains overall to determine what deployment of servers and blades (or even power efficient client systems) is optimal for business success. I strongly believe that as IT managers continually strive for greater energy efficiency in their data centers in planning for current and future needs, we have quickly reached the tipping point where the issue becomes the standard rather than the exception. Striking the optimal balance between factors of performance, space and available power all within the same thermal envelope is the primary and constant challenge data center managers are facing today.

LW. Certainly having every company do its share in reducing energy consumption or achieving greater performance within the same power budget helps reduce competition for energy supply and thus holds down energy costs by reducing or slowing demand. But in general, power costs per watt are going to increase while the world moves to cleaner power sources because these sources are generally more expensive, at least until we get better at producing them. Thus any company would be wise to find ways to increase their energy efficiency to help hold down energy costs and ensure supply. This would also apply to any new data centers a company is considering building as well. It would obviously pay to be as green as possible in everything you select from servers and cooling technologies to power distribution and conversion to lighting. Security comes from making the right selection in every element of your design.

Ian Seaton has over 30 years of experience in electromechanical systems. He serves on the BICSI standards committee responsible for the new data center design manual, teaches BICSI accredited data center thermal management courses and is currently Technology Marketing Manager for Chatsworth Products, Inc.

BM. How have you seen energy efficiency rise up the corporate agenda in recent years? Is enough being done, and what areas need to be addressed in order to ensure efficiency and energy reduction strategies remain top of mind?

LW. If I look at our own company, energy efficiency has definitely risen to the top, both because of Intel's position as the world's largest semiconductor chip maker (based on revenue) and our emphasis on corporate responsibility. I think the EPA's report to Congress on Data Center Efficiency, the formation of industry groups like The Green Grid and the Climate Savers Computing Initiative, and the growing press about the energy crunch in data centers have all helped to raise awareness. But there are still some major hurdles. We need the energy efficiency standards these groups are working on to help data center operators make more informed purchases. We need to get those responsible for paying the energy bills of data centers to have more influence on those who do the purchasing of the IT equipment. We need to provide proof and assurance to data center operators – who are naturally risk-adverse – that new trends like virtualization and consolidation can be implemented to achieve high availability and that the new energy-efficient technologies are just as reliable as the ones they're using now. And finally we need to feed off the momentum we now have going and bring more companies aboard.

IS. We have seen a small handful of major corporations be serious enough about their energy conservation initiatives for it to impact on day-to-day actions and decisions. However, for the most part, the person responsible for paying the electric bill and the person responsible for driving up the electric bill are so far removed from each other that they typically don't know who the other is or what they do. Bringing these two parties together (typically IT and facilities or plant engineering) so there is some viable reward and punishment structure associated with data center energy use is required before significant progress can be expected. Conventional wisdom on this subject points to the need for a C-level executive to take ownership over both areas. However, in actual practice, it seems that the best progress occurs when one functional manager reaches out to the other to initiate a dialogue intended to surface costs and share credit for reducing them. As long as IT management is rewarded more or less exclusively for implementing applications, the transition to energy efficiency initiatives will be difficult and slow.

1.5 percent

Share of total US electricity consumption attributed to data centers

BS. Internal AMD studies and external industry research have shown that power consumption and the efficient use of it has fast become a mission-critical challenge that the majority of companies face. Performance has always been top-of-mind but this is now combined with a performance-per-watt metric, and for more and more companies, simply the right thing to do in today's world of ongoing climate challenges. Additionally, businesses are looking at the whole package of energy efficiency from the deployment of the data center down to the types of power (oil, gas, wind, solar) used to keep it up and running. Organizations like The Green Grid and the Climate Savers Computing Initiative are representative of the importance of energy efficiency that leading companies (hardware, software, utilities and customers) are supporting and leveraging to help determine best practices, industry standards and measurements for power consumption across the IT landscape. ■