



“Greening” the Data Center

By Tom Bishop
Chief Technology Officer, BMC Software

A variety of factors are driving the emerging industry trend of “greening” the data center. A “green” data center is one that is designed to be energy efficient and minimize its impact on the environment. One problem is that many IT organizations have reached — or are approaching — the power and cooling capacity limits of their data centers. As a result, it is difficult to accommodate or expand the IT infrastructure. However, they still have to respond to continually increasing demands for business services that require more servers, more storage, and more network elements. Another concern is that energy costs are high and rising to the point where power and cooling now account for a significant portion of IT operations costs. In addition, organizations are coming under increasing pressure to become good corporate citizens by reducing their power consumption to conserve energy.

A major contributor to excessive power consumption in the data center is over-provisioning. Organizations have created dedicated, siloed environments for individual application loads, resulting in extremely low utilization rates. The result is that data centers are spending a lot of money powering and cooling many machines that individually aren’t doing much useful work. Some are even sitting idle.

INNOVATION

Processor vendors, hardware vendors, software vendors, and IT organizations are all working to address the problem. Processor vendors are developing more energy-efficient technologies, such as dual-core processors and CPUs that are automatically throttled based on workload. Hardware vendors are



developing energy conservation technologies, such as energy-efficient fans. Software vendors are providing server and storage virtualization technologies that enable IT to lower the number of physical devices that need to be powered and cooled. The primary approach that IT organizations are taking to reduce power consumption in their data centers is to consolidate and virtualize their data center environments.

RESULTING COMPLICATION

This consolidation and virtualization is a complicated undertaking that requires deploying not only the right number of physical devices, but also the right types of physical devices. Determining the right number of servers means including the right number of physical servers and virtual servers that can be accommodated in each physical server host. What’s more, IT has to ensure that the resulting server configuration reduces power

consumption and can handle current workloads at agreed-upon service levels and provide sufficient room for growth.

Power consumption and cooling must be considered in consolidation and virtualization. Newer processor chips consume more power and generate more heat than their predecessors. In addition, newer chips have lower maximum operating temperatures than their predecessors, so they may require more cooling.

Moreover, as a result of the higher power consumption and greater cooling requirements of the new processors, usable rack density (the number of servers a rack can accommodate) is decreasing. That places a limit on the number of new servers that a data center can accommodate based on available rack space. It is important to note, however, that although the new servers

consume more power, they can perform more useful work than their predecessors. So, when choosing servers, it's essential to consider both performance characteristics and power and cooling requirements. It's like choosing an automobile based not only on how fast it can go, but also on how many miles per gallon it can achieve.

IMPLICATION AND ACTION

It's important for BSM solution providers to offer solutions that enable organizations to identify underutilized servers, consolidate and virtualize their data centers, and to effectively manage the resulting dynamic, virtualized environments. The "greening" of the data center introduces a new dimension into server consolidation and virtualization; that is, the need to factor in server power consumption and cooling requirements when planning, implementing, and managing the consolidated, virtualized environment. What is required is a way to monitor, measure, and report on power consumption.

Hardware vendors are beginning to instrument their servers to monitor such things as voltage, temperatures, airflow, and power at the overall server level. Initially, this real-time monitoring is used to drive illuminated alerts. History is not maintained and monitoring is not available to software. Hardware vendors need to enhance this monitoring capability by making it available to software, permitting solution vendors to enhance their solutions with power consumption awareness. This enables the BSM solutions not only to monitor device power consumption in real time, but also to create a historical database of power consumption by device.

BSM solutions can leverage power information to enhance management of the consolidated/virtualized IT environment. They can use real-time monitoring to provide an early warning of out-of-limits power conditions. They can also use historical power consumption information in a variety of ways, such as in server consolidation and virtualization planning, capacity planning, change planning, and continuous improvement.

Eventually, hardware vendors could increase the granularity of power monitoring, such as by monitoring at the motherboard level. BSM solution vendors could then further enhance their solutions to measure power consumption at the operating system instance level (physical and virtual). In this way, the solutions could correlate power consumption with specific application transactions and workloads, and associate the cost of power with the applications consuming it. With this capability, IT organizations could optimize the ratio of work output to power consumption.

BUSINESS BENEFITS

The overriding business benefit of "greening" the data center through consolidation and virtualization is optimizing power efficiency to gain maximum work output per watt consumed. This will help reduce operations costs. It will also permit organizations to continue to expand services to meet increasing business demands without requiring additional power and cooling, a benefit that is especially important to those organizations that have already reached the power and cooling limits of their data centers.

BMC Software offers solutions that address these issues. For more information, visit www.bmc.com/virtualization.

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About Tom Bishop

Tom Bishop was named one of the top 25 CTOs by InfoWorld Magazine in 2004 and is a well-known industry innovator who holds nine patents in fault-tolerant computing and in leading the development of industry standards, such as the Distributed Management Task Force (DMTF) and POSIX.

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