Data Center Efficiency in the Virtual Era:

Three Key Steps

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The power to do more

Executive summary

Rapid changes in the business environment have put tremendous pressure on IT infrastructures. Tough global competition requires new levels of operational performance and a tight lid on costs. Executives, customers, regulators, and investors are ever more demanding. And the economic roller coaster hasn't made anything easier.

The latest piece of technology is only part of the conversation. Faster processors, new applications and enabling technologies such as virtualization and cloud computing can provide tremendous benefits. But as new components are added – hardware, software, storage, and the like – new complexities are added which can crush an IT department and its budget. Often, these additions create islands of efficiency, but add to a sea of IT inefficiency that will not meet the needs of an organization in this new, faster and resource-constrained world.

The way to address these challenges is with a fundamentally different strategy – one that Dell has been driving, and using it its own IT, for years. Today, a growing number of organizations are reaping benefits from a three-step process: standardize, simplify, automate, which create a platform that can generate even greater efficiencies through cloud computing.

Step 1: Standardization: Job One

Data center efficiency begins with standardization, which is an antidote to the patchwork style of growth in the 1990s and early 2000s. It is no longer an option to provide resources to handle and application's peak workload plus an additional 25 to 50% to guarantee performance.

As these silos were added, data centers became a vast field of under utilized capacity, often with a wide diversity of technologies each requiring its own management infrastructure, tools, dashboards and processes. The cost of housing, power, cooling, and administration took over the IT budget, especially as costs and demands continued to rise and budgets continued to tighten.

Standardization lays the foundation for solving these issues. It begins to remove the complexity of administering and maintaining diverse systems. Staff can work more efficiently, because the need for specialized expertise in different systems diminishes. Purchasing, upgrading, and inventory management also become easier.

According to Camden Associates' Alan Zeichick, "All of the old reasons for standardizing remain," he says. "Better purchasing power, upgrades and patches, easier decision making, simpler stocking of spare parts, especially in terms of specific models." In addition, he says, the ease of decision-making means greater flexibility to react to changing business issues, the ability to consolidate purchases, and the simplification of the whole service environment. As a

result, standardization can lead directly to a lower total cost of ownership (TCO) derived from lower maintenance costs, improved operational efficiency, reduced parts inventories and simplified service contracts.

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A Standard Platform Makes Management Easier

Virtually every maker of computers, regardless of processor type, bus type or intended operating system makes a server. But just because there are a lot of choices doesn't mean that organizations should choose completely freely. Data center expert Jack Gold, principal analyst at J. Gold Associates, explains that it makes the most sense to stick with an industry standard architecture. "The majority of companies today are better off standardizing on a commodity market," Gold says. That's because x86 and x64-based systems are so prevalent that the cost is almost always lower than that of equivalent systems using other architectures.

Standardization allows for a modular design in the data center. "If you have 50 servers and they're all the same," Gold says, "if a couple go down you can swap components if you need to." Swapping out a server needing maintenance with a fresh server is simply a matter of sliding one chassis out of the rack and sliding another in. Everything from cable management to cooling should be unaffected.

Standard Server Form Factors Aid in Upgrades, Power and Cooling

Although it's unlikely that any data center will be made up entirely of identical servers, it makes good economic sense to standardize on one or two basic form factors. Doing so facilitates the process of populating the racks and planning for power distribution, cable management and cooling. In addition, standardizing on a minimal set of allowed form factors means you can swap servers when a different level of capacity is needed or when servers are upgraded.

"The more identical you can make them, the more efficient you can make them," Zeichick explains. "They should all have the same hardware, processor and memory, the same connection, the same number of steps to the router or load balancer. You want to remove anything that makes them different."

Standards in Communications Can lay the Foundation for the Future

The data center communications environment should also be standardized—to the extent that's possible without affecting the ROI of existing systems. At the same time, IT organizations must lay the groundwork for future requirements. For data communications within the data center and the enterprise, the only real option in use today is Ethernet – 10 Gigabit Ethernet is the current data center standard, 40 Gigabit speeds are under development, and research on 100 Gigabit Ethernet is underway. But when it comes to storage communications, data center staff can choose between Ethernet and Fibre Channel.

Storage Standards

The investment in existing SANs is significant, and the process of migrating to a new SAN can be difficult, expensive and disruptive to the operation of the data center. However, data centers can build bridges to the future by implementing new SANs and new storage using iSCSI and Ethernet. In this way, the data center can gradually evolve to an Ethernet-only environment as the Fibre Channel SANs are replaced.

The emerging standard for network communications is Ethernet, using iSCSI for storage traffic. The availability of storage arrays that use iSCSI has boosted the popularity of this storage protocol. iSCSI will work over any Ethernet network, and can work in parallel with other network traffic, as long as the switches handling the traffic are able to assign the appropriate priority to the storage traffic. Fibre Channel still persists in some legacy systems and its infrastructure is very similar to Ethernet's. Combining a legacy Fibre Channel storage network with a new iSCSI Ethernet network can be easy to accomplish and cost-effective for the economic life of the legacy system.

iSCSI storage has the additional benefit of running on the same Ethernet environment as other network traffic. This means that there's no learning curve as there is with Fibre Channel. The same network management software will work with storage traffic and other network traffic, and the same infrastructure, including switches and routers, can handle both types of traffic. (Dell EqualLogic – www.dell.com/equallogic – can help make this transition easy).

The Link Between Standardization and Efficiency

Reducing total cost of ownership is one of the key goals to improving data center efficiency. Although it may be marginally more expensive up front to buy from a standard set of platforms, in the long run, the total cost of ownership is lower.

Consider the complete cost of any machine you plan to put into the data center, including the acquisition cost, the cost to provide power and cooling, the cost of the staff to operate it, and of course maintenance costs. In many cases, Gold says, the costs to operate a server, the electricity it uses and the cost of cooling will far exceed the cost of purchasing it in the first place. A recent study by Intel showed that replacing old, single core servers with new Xeon-based servers can generate a return on investment in as little as eight months. In that same study, Intel showed the compute load that took 184 single core servers in 2005 now can be done with just 21 – a replacement of one server for every nine – while at the same time using 90% less power.

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Standardization can lower the total cost of ownership, reduce energy consumption, and control acquisition costs. Standardization also lowers maintenance costs, reduces parts inventories, and lowers training costs while improving flexibility. With a standardized environment, the data center can more easily grow to meet current and future needs.

But standardization is only the first step toward overall data center efficiency. Once the data center unites on open, standard technologies, simplification can occur. A standardized, simplified data center environment provides the most stable base for the automation, the final layer of the efficiency initiative.

Step 2: Simplification Through Virtualization

Even if an organization manages to standardize everything in its IT arsenal it may still end up with a complicated, convoluted, and expensive mess that fails to deliver sufficient value. When simplifying an IT infrastructure organizations should take the next step – beyond standardization – to address the second layer of efficiency. Simplification includes a systematic approach to address several issues:

- Maximizing capital investment by reducing the number of systems through virtualization and consolidation
- Sprawl control to reduce management, space and costs to lease and maintain
- Power and cooling "right sizing" to available needs and resources
- Eliminating redundant or manual tasks and processes
- Minimizing hardware bloat and unused excess capacity
- Reducing management complexity – tools, dashboards and touch points
- Optimizing and tuning network performance
- Freeing strategic resources from maintenance
- Simplifying migrations

Good economic times can mask the inefficiency of an IT infrastructure and data center. But economic challenges bring the problems to light.

A Comprehensive, Phased Approach

Simplification is the hallmark of intelligent infrastructure because it increases agility and reduces unnecessary expenses. Technically, simplification is a three-phase process: rationalization, consolidation and virtualization.

Rationalization involves determining what the organization needs for its operations and designing an architecture that meets current IT and business requirements while still creating a platform for future needs. According to a June 2009 Gartner press release on data center costs, rationalization and consolidation aid asset and inventory management, lower annual energy costs (typically by $400 per server per year), and yield a 5% to 10% savings in overall hardware costs.[1]

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Consolidation involves reconfiguring servers, networks, storage, and applications to accommodate the rationalized design and eliminate redundant hardware, software, and data centers. Gartner estimates that data center consolidation will typically save from 5% to 15% of an overall data center budget.

Virtualization involves separating physical resources from virtual processes and treating servers, storage, and networks as pools of capacity deployed as necessary. Virtualization can also free additional hardware for further consolidation. According to Gartner, users see net savings of virtualization within two years, reducing server energy use by as much as 82% and floor space requirements by as much as 86%.

When an organization undertakes rationalization, consolidation, and virtualization, IT systems become more effective in a number of ways, answering the problems that standardization alone doesn't address. The benefits enterprises derive from simplification efforts are many,

including more efficient capacity management, reduced facility requirements, right-sized administration and increased flexibility.

Battling Politics

Simplification must transcend technology. Because the organization as a whole drives IT (and often vice versa), true simplification must start with the business processes that drive the need for applications and information. That requires rational determination of what software and hardware the organization actually needs to run its business. "Different IT teams who are using disconnected processes, maybe a mix of manual or automated tools, are each doing their own thing in terms of deploying apps, the database, the OS, security, the network connections, and storage resources," according to Mary Johnston Turner, IDC research director for enterprise systems management, in an April 21, 2010 *InformationWeek* webcast. The result is that getting anything done that requires cooperation is a chore.

Planning IT rationalization and consolidation involves crossing organizational boundaries in technical and operational silos. "The planning and design is the most crucial piece," says Irwin Teodoro, director of engineering and systems integration at IT consultancy Laurus Technologies. In addition, according to The Hackett Group, the recently difficult economic climate has made it easier to move beyond individual objections and restructure infrastructure. "People are saying, 'Forget the cultural issues that kept us from consolidating in the past', because businesses can no longer afford to operate that way.

The challenges that silos of technology pose underscore the need for rationalizing choices of software and hardware, consolidating infrastructure, and, most importantly, virtualizing. By doing so, an organization can effectively wrest control of servers, networks, and storage from individual silos and turn them into pools of assets that can be assigned to specific needs as necessary.

Issues resulting from vendor lock-in

Risk: Can we return to the previous state if it doesn't work?

If the organization faces a problem in moving a silo to the new technology, it may find it impossible to return to the previous state.

Future: Will it be incompatible with emerging standards?

Unless the proprietary vendor embraces the new technologies, companies may find themselves unable to use them. New capabilities that could further simplify IT operations or systems administration would be incompatible with the proprietary infrastructure.

Cost: Will we be locked in to expensive proprietary technology?

Open systems drive down costs because of competition. Closed systems leave an organization at the mercy of the vendor as well as of employees with highly specialized experience, consultants, and third party software firms that provide scarce goods and can charge accordingly.

Incremental Virtualization

Before virtualization, organizations typically only virtualized 36% utilization of their data center, according to information IDC's Turner presented in the *InformationWeek* webinar. Within the next two years, IDC expects utilization to rise to 67%. By the end of 2010, IDC predicted that more than half of all workloads would run on virtual servers. Yet, IDC projects that number will only rise to 69% by 2013.[2]

Once initial virtualization and consolidation efforts (the low-hanging fruit) is complete, companies often hit a virtualization wall; further progress means driving virtualization into proprietary silos, which is a risky undertaking. Eventually, virtualization must be applied more broadly, however the rip-and-replace approach of changing everything within the data center at once is unrealistic. Enterprises must approach virtualization in a pragmatic and phased approach, targeting high-reward and low-risk areas for initial implementations and then continuing into other areas as software and project schedules allow. Instead of rip-and-replace, intelligent enterprises opt for a strategy of expand-and-embrace, incorporating the infrastructure in pieces until everything comes under the virtualization umbrella.

For most organizations, that means an incremental and circular process of standardizing some portion of the infrastructure, virtualizing that part, and then using freed resources to repeat the process in another part of the infrastructure. Not only does this incremental approach allow an organization to work within its budget and resource limits, but it also starts with the most receptive operating silos and, over time, brings pressure to bear on less receptive ones.

Simply Efficient

Enterprises that approach simplification with the rationalization, consolidation, and virtualization approach in mind can free resources and reduce expenses. Even more importantly, building on open, standard technologies allows them to preserve and even expand choices in how to run their business. The built-in scalability and flexibility offered by a standardized, simplified data center infrastructure enables IT to respond quickly to business needs and enables the enterprise to take advantage of changing opportunities. Furthermore, simplification prepares the business to make the most of automation.

Step 3: Automate: Taking Virtualization to the Next Level

The ability to quickly deploy business services and reduce computing costs has pushed virtualization firmly into the mainstream. A recent *InformationWeek* Analytics survey found that more than half of business technology professionals expect that 50% to 100% of their production servers will be virtualized before 2012. As demands on the data center continue to increase, administrators are looking to virtualization with greater automation of processes and deployment, to lower TCO. Forward-looking CIOs will want to deploy flexible data management, self-service workload provisioning, resource pooling and an infrastructure that is more self-aware than ever.

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Until recently, automation technologies for the data center were available only on proprietary platforms that locked organizations into expensive, single-vendor solutions. Today, enterprises are standardizing on open x86 platforms and other standard technologies that equal or exceed the stability, reliability and performance of the best proprietary systems. "IT resources must be deployed in a repeatable and predictable way, so creating and using standardized models is necessary for quality provisioning and successful automation that takes full advantage of virtualization," says Benjamin Woo, program vice president at IDC.

An optimized data center meets user demands by spinning up VMs to deliver business services while recapturing under- or un-utilized resources, including storage and networking, on the fly. With the right technology, workloads running on failing hardware can automatically be shuttled to stable platforms, and computing assets can be quickly deployed or scaled back to match fluctuating demand.

This dynamic workload migration is driven by constantly-changing business and application performance requirements. Each workload needs specific computing resources, and every migration affects a number of network, storage and system configurations, all of which must be updated. Automation can manage and streamline this process across multiple technology environments.

The next-generation data center will respond with lightning speed to users who need to launch business services. No longer will it seem normal—or even acceptable—to wait days or weeks between the time demand is created and the time the solution becomes available. By automating with standard, open x86 platforms, enterprises can avoid the trap of single-vendor lock-in while preparing for growth — without the need to rip and replace existing infrastructure.

Organizational Challenges to Automation

It may be painful for the leadership admit, but the structure and culture of an organization can be an obstacle to attaining the IT efficiencies everyone desires. Politics come into play as each camp has its own ideas about administration, provisioning and system design. Managers of server, storage, desktop and networking fiefdoms can spend a lot of time and money negotiating service-level agreements (SLAs), while delaying deployment of important business services.

"By standardizing on a unit of IT, with a defined amount of compute, storage and networking, you can neutralize many of the political battles that go on," says Woo of IDC. "These turf battles should become irrelevant, since all resources become pooled. As long as each group maintains its level of service and continues to ensure that resources are available, the murkiness that drives time-consuming negotiations will be eliminated."

In the past, it was common for IT administrators to throw people and resources at problems as they arose. But, the old ways of doing business, such as deploying a new physical server for every new application, are no longer viable. IT staff must resist the urge to allocate extra headroom or capacity to applications to meet peak demand. By doing so, they isolate valuable compute, storage and networking resources from other workloads that could share them. This approach is at odds with the concept of supporting variable workloads, whose compute needs ebb and flow over time.

Taking Control of Virtualization

Almost all CIOs want to adopt automation to reap greater benefits from their investment in virtualization. According to a recent IDC survey, 67% of the executives called automation "critical" or "very important." Their key drivers were the speed and volume of changing workloads, the desire to reduce errors and improve staff productivity, the need for real-time workload migration, and the wish to cut operational costs. Yet management practices often don't keep up with the needs of highly complex and dynamic production data centers. IT administrators who want to use automation to improve data center efficiency must first take control of their virtualized infrastructure. A good place to start is with virtual image sprawl.

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Because too many organizations are using rudimentary tools and procedures to manage images, IT staff is often unaware of the workloads and dependencies that sit within a VM. These images are often retained indefinitely without IT groups reassigning the resources or terminating the licenses within the workload. Having the right information to track images allows IT to optimize and match workloads on a physical server to obtain maximum performance of all VMs on that server. "Before we can automate, we need to know what to measure and how to measure it," explains IDC's Woo. "You can't automate something until you know that you need to automate it."

IT groups also need to address how they manage systems. An efficient data center manages physical and virtual networks, storage and servers as a single pool of resources, which can be accessed dynamically to meet varying workload demands. This also includes looking at how they will integrate their physical and virtual resources across functional silos, from servers and desktops to storage and networking. This is the opposite approach to statically allocating extra capacity to applications to meet peak demands.

IT groups burdened by too many VMs and not enough knowledge about what is in them, will not be able to attain the operational improvements and ROI they need. As a result, overall performance will suffer, and IT will find it increasingly difficult to meet growing business demands.

The Benefits of Automation

Perhaps the most important benefit of automating the data center is how it reduces the operational complexity of managing virtual environments. Automation exploits the stateless pool of resources that virtualization creates, enabling workloads to borrow and return these resources on the fly. The monitoring capabilities brought by automation can continuously track the state of underlying physical and virtual platforms, freeing IT staff to focus on strategic activities that support business goals. To deliver services efficiently and consistently, IT groups must understand how all the components — from databases and hypervisors to storage and networking — relate to each other. With this knowledge, IT groups can automate deployment, patching, maintenance and auditing.

Automation and standardization complement each other. When IT resources are deployed in a standardized way, automation can quickly and predictably allocate resources to workloads as required. Enterprise IT groups currently spend a lot of time trying to decode problems and incidents. If processes are tightly integrated and automated, the entire incident-management process can be streamlined. Management consoles can display performance and data analytics that simplify troubleshooting and enable IT groups to be more productive.

Automated monitoring sheds light on the state of VMs, as well as on the workloads they are running. Since workload performance ultimately depends not only on the configuration of the VM, but also on the associated network and storage resources of the physical servers that support it, IT groups need a single view of the entire integrated environment.

Automation and standardization bring consistency to the user experience, reducing unique errors within systems. Together, they simplify IT management and empower IT groups to better meet SLAs.

Spinning up Services on Internal (Private) Clouds

As IT groups automate their virtualized environment, taking advantage of resource pooling and automatic workload allocation, they can start planning to apply these efficiencies to deliver cloud capabilities to their business groups. And many are already heading in that direction. According to an *InformationWeek* Analytics/ Network Computing survey published earlier this year, 71% of IT groups are considering or investigating deploying a private cloud, compared to 53% considering or investigating public cloud services.

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– *InformationWeek*

Like SaaS providers of public cloud services, IT administrators of private clouds can set SLA expectations with business units and define the performance, cost and security metrics they will deliver. They also must to define configurations irrespective of whether an application sits on a physical or virtual server; they must specify the related storage and networking and articulate how all the pieces fit together so that end users receive a consistent, quality experience.

With an internal cloud, enterprises will be able to spin up new business services quickly, scale them dynamically to meet fluctuating demand, and set up standardized, automated processes for all IT groups to use.

Building upon dynamic workload migration, powerful management tools and automation, an internal cloud infrastructure will match resource consumption with service requirements to deliver excellent performance and security at an affordable cost.

Building a Business Case for Automation

Extending automation and virtualization throughout the data center isn't really an option; it's a necessity. If enterprises are to meet the growing demand for scalable, quickly provisioned business services, IT groups will have to make a business case for investing in these areas. These arguments may help:

- Automation does not require ripping out and replacing any of your existing infrastructure (Check out Dell Advanced Infrastructure Manager www.dell.com/AIM and Virtual Integrated System www.dell.com/VIS.)
- Manual, non-integrated tasks — such as patching, inventorying and solving problems — can be automated to reduce costs
- Automation is necessary for supporting a private cloud
- Automation and standardization will open the door to eliminating redundant tools and unnecessary licensing
- IT groups will be able to deliver better ROI with automation
- Automation will also help enterprises apply policies to support regulatory compliance and data retention

As IDC's Woo puts it, "IT is no longer about the speeds and feeds of the physical hardware infrastructure. The focus of IT today is all about delivering a quality experience to the end user, and that depends on using standardization and automation to deliver cloud-based services."

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> – Benjamin Woo IDC

Automation for Agility and Flexibility

If IT organizations use advanced management tools and automation to support their virtualization and cloud road maps, they will ensure that their data centers can easily adapt to meet changing business needs. Delivering flexibility, scalability and the performance to support business objectives is what automation is all about.

Summary

New levels of operational performance and a tight lid on costs have completely changed how IT is purchased, deployed, managed and retired. Faster and more powerful hardware is only part of the conversation. Achieving IT efficiency within the data center and across the organization requires an examination of existing processes, resource management and existing technology assets. And it requires a fundamentally different strategy.

Today, a growing number of organizations are reaping benefits of enabling technologies including cloud services, cloud computing and virtualization through applying a three-step approach: standardize, simplify, automate and eventually move to the cloud. Dell is ready to help you meet the requirements of the virtual era. We'll work with you to assess your current IT environment as well as business and IT requirements and help leverage your current assets as well as new technologies to transition to a more efficient and agile environment. Starting with a Virtualization Workshop and Assessment, Dell provides the experience, tools and solutions that can shorten the path and lower to cost to improve your organization's IT agility. Call your Dell Executive and let's get to work.

Learn more about Dell's Efficient IT strategy by visiting:
www.dell.com/efficiententerprise

Dell IT consulting services
www.dell.com/services

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2. Johnston Turner, Mary. Automation and Integration Vital for Efficient Data Center Operations, IDC White Paper, April 2010.