



Improving TCO with Server Consolidation and Allocation



While many see server consolidation as simply a way to reduce the enterprise server count, in fact it offers a great deal more when it's regarded as a resource optimization strategy.

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Table of Contents

Improving TCO with Server Consolidation and Allocation.....	1
Defying the Averages.....	2
What it Takes to Succeed: 12 Steps.....	3
Approaches to Server Consolidation.....	5
What Role Virtualization?.....	9
What to Look Out For.....	10

When it's thought through, with due consideration given to both business and IT objectives and constraints, server consolidation can help align an organization's IT objectives and processes with its business requirements. It can also contribute to the creation of a more rational and flexible IT infrastructure that can efficiently support an organization's strategic business objectives.

[See Sidebar 1: *Approaches to Server Consolidation*]

Lower total cost of ownership (TCO) matters, of course, and server consolidation delivers. IBM has reported, based on experience through 2006, typical server consolidation savings that are impressive:

- > Hardware costs cut by 33 percent to 70 percent
- > Maintenance cost reductions of up to 50 percent
- > Support costs down by as much as 33 percent
- > Floor space and facility costs decreased by 33 percent to 50 percent.

In addition, fewer servers mean less energy consumed as well as reductions in support, development and administrative staff. "Server power savings of 40 to 60 percent are the norm," notes Chris Wolf, a senior analyst at IT research consultancy Burton Group, "and such savings are noticeable almost immediately following a consolidation."

85%

of the virtualization software acquired by enterprises has been devoted to server hardware consolidation projects. (*Yankee Group, Server Consolidation Creates New Opportunities for Fault-Tolerant Servers, January 22, 2007*)

Server consolidation delivers other benefits as well. Even though workloads are consolidated on a single physical server, system resources can be optimized without compromising application service levels, especially when naturally complementary workloads reside on the same system.

Dynamic resource provisioning can improve the handling of varying transaction volumes, and live migration techniques can ease the moving applications or virtual machines (VMs) [See Sidebar 2: *What Role Virtualization?*] to new physical hosts (for scheduled maintenance, allocation of more memory, etc.) without disrupting clients or applications.

"Despite all of the intangible benefits," observes Jennifer Colasanti, a research consultant at Info-Tech Research Group, "the initial business case can be made solely on hardware acquisition and maintenance savings."

<10%

of computing capacity is utilized in any given 24-hour period by a typical x86/x64 server. (Gartner, Data Center Power and Cooling Scenarios Options for the World Ahead, April 2007)

Defying the Averages

But beware: server consolidation payoffs are highly variable.

Intel has stated that it's trying to achieve server consolidation levels of between 15 and 20 to one. But, Colasanti reports, "Most organizations currently average between five and ten to one."

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Consolidation ratios will be climbing, however, Wolf believes. "Memory latency is significantly reduced with Intel's hardware-assisted memory virtualization support, which allows organizations to run more virtual machines on a single physical system," he says. "So consolidation ratio improvements of 50 to 100 percent are not out of the question."

Yet so many factors affect server consolidation that analyst firm Gartner has found no common average savings, no set length of a project, no common average percentage of staff position reductions and no common average percentage reductions in the number of servers.

What it Takes to Succeed: 12 Steps

"Trying to achieve a predetermined consolidation ratio before ever analyzing an environment is not realistic," says Wolf. "Successful migrations use a bottom-up approach. Server performance, service-level requirements and security restrictions will ultimately determine the consolidation ratio."

Thus, any organization contemplating server consolidation must carefully analyze its own environment to figure out what to expect from the effort. And because any consolidation project will affect an organization on all levels, it's critically important that the project be thoroughly planned. These 12 steps are key:

1. **Get high-level executive sponsorship.** Unless upper management understands and actively supports your server consolidation project, it will fail.



APPROACHES TO SERVER CONSOLIDATION

Centralization: consolidating multiple servers within fewer sites. This is often a first step when the primary goal is cost control or when a realignment requires a rationalization of IT architecture. Centralization lowers data center costs, eases management burdens, improves availability and recovery, and reduces security risks.

Physical consolidation: replacing many servers with fewer, more powerful servers or clustered systems, either within a single architectural framework or across architectures. This approach optimizes server utilization and floor space, boosts performance and application throughput, eases management and raises scalability limits. It also reduces maintenance, hardware, support and software licensing costs.

Data integration: combining data from different sources across the same or disparate data types and architectures into a central resource base, lessening data duplication and data inconsistencies, and enabling more rational use of storage management tools. This can dramatically lower data management costs and can improve data availability, recoverability and security.

Application integration: consolidating multiple applications into fewer servers and guest OSes so that mixed workloads are colocated in a unified infrastructure. This enables applications to communicate and work together seamlessly, reins in complexity, and makes possible business process integration and automation, thereby optimizing performance and resource utilization and generating significant cost savings.

2. **Assign the project to a dedicated team.** Prioritize the project in terms of others vying for the team's time.
3. **Conduct a comprehensive, objective assessment of your existing environment** that considers organizational capabilities, strengths, and weaknesses and that provides a solid foundation for realistic planning. This includes understanding user requirements, business and financial dynamics and constraints, and your current IT infrastructure. As part of this effort, you should inventory your servers to assess which servers are complementary (e.g., resource consumption, workload) and which current configurations and attributes must be preserved in the consolidated environment. You should also inventory all applications running on the servers and their dependencies on other applications and services, as well as server peak and average utilization rates, and IT staff training needs.

"It's often not the hardware that limits consolidation ratios, but nontechnical factors such as department, site or security restrictions," Wolf points out. "Organizations should use tools, such as those from CiRBA, that can collect performance and nontechnical system data, analyze the data against prospective new hardware platforms, and output a consolidation plan."

50%

of the data centers worldwide in 2008 lack the power and cooling capacity needed to support high-density equipment. (Gartner)

3.1. Make identification of inefficient IT processes explicit. Discovering and measuring these inefficient processes are essential for understanding what it will take to improve them.

60-70% of total cost of ownership is devoted in daily data center operations. (various sources)

3.2. Establish a baseline business alignment benchmark. This profiles your organization's current state in terms of application response and utilization. Detailed benchmark reports help establish best practices and enable modeling of future-state scenarios.

- 4. Identify your goals and define your project.** Business and service objectives as well as service delivery plans must be clearly delineated so all involved parties have similar expectations.
- 5. Develop a server consolidation strategy and methodology.** This should address all aspects of your organization's business, application, infrastructure requirements and tool selections, with emphasis on reuse of knowledge and assets, as well as reliance on industry standards for acquiring, building and using IT infrastructure. It should recognize that the network will continue to evolve,

and it should incorporate a change management system. Whenever possible, it should centralize corporate systems and automate processes. This allows your team to follow a common set of policies and practices, which will help ensure that your server consolidations are cost-effective and efficient.

"Robust enterprise-class planning tools are capable of analyzing virtualization candidates and creating consolidation plans based on the specifications of the target hardware and virtualization platform," says Wolf. "Without a tool, administrators are faced with manually compiling the planning data and generating a series of Excel spreadsheets for use in decision-making."

40% of respondents to Goldman Sachs' 2007 survey of 100 IT managers listed server consolidation as a high priority for the next year.

- 6. Evaluate cost benefits** of the consolidated environment in terms of infrastructure, support and maintenance, and administration. These should be weighed against such downsides as performance overhead, effects on service levels, licensing costs, etc.
- 7. Plan and design your server consolidation process,** which should address all consolidation, migration, implementation and project plans in detail. Include acquisition of any consolidation, virtualization, management and migration tools; and specifics about technology relocation, change management, education and training.

8. **Build a development and test environment so applications can be tested for the effects that consolidation may have on them.** Make sure this environment includes rigorous change control so that changes to application code will be regression-tested.
9. **Implement a pilot consolidation project** using applications that will not affect business-critical production servers. This is when you can make sure that existing software and services are compatible with new consolidation technologies.
10. **Evaluate the performance of the pilot**, running it long enough to ensure its stability. Important parameters include system throughput, security, latency and response times.
11. **Use the pilot evaluation to improve planning, design and implementation processes and create consolidation/allocation best practices.**
12. **Implement successively more business-critical consolidations.**

10-80%

of improvements in hardware utilization are attributed to server virtualization. (*Yankee Group, Server Consolidation Creates New Opportunities for Fault-Tolerant Servers, January 22, 2007*)

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WHAT ROLE VIRTUALIZATION?

Decoupling software from hardware — and presenting a logical view of physical hardware to software — is not a new idea. Instances can be found in virtual local area networks (VLANs) and RAID storage, among others.

When the same idea is applied to servers, it's called server virtualization. Enabled by "hypervisor" software — a container presenting a logical hardware interface to a "guest" operating system and any software and data running on the OS — server virtualization makes possible the partitioning and sharing of hardware resources among multiple guest operating systems. Thus, server resources are more fully utilized.

Because the hypervisor's presentation of a logical hardware interface makes a guest OS "think" it's running on an actual physical server, the guest OS, along with any software and data it runs, becomes a virtual machine (VM). VMs can be stored as a large file on a physical server and are easy to transfer from one physical system to another. They can also be saved on shared storage and accessed by multiple other systems, as dictated by business demands.

"Server consolidation and virtualization are better together," states Paul Burns, a senior analyst at consultancy Enterprise Management Associates. "Virtualization is a great way to enable multiple applications to run on the same physical server even if they have different or conflicting patch, middleware or other software requirements. You'll end up with fewer, more powerful servers in a consolidation project, and then you'll be able to dramatically increase their utilization through virtualization."



What to Look Out For

Change always triggers unanticipated consequences, some of which you'll wish to avoid. Here's some advice from the trenches:

- Applications migrated from several servers to one server must be compatible.
- More applications running on a server means the consequences of a single hardware failure will be more severe, as will performance and capacity problems. And while server virtualization technologies have advanced dramatically, network and I/O virtualization technologies still lag. So capacity planning and management is more critical in the virtual environment, where applications on different VMs share or compete for common hardware resources.

"IT managers need to go beyond CPU utilization planning and ensure that network and memory don't become bottlenecks," Paul Burns, a senior analyst at consultancy Enterprise Management Associates (EMA), explains. "This should be done through *up front* capacity planning as well as *ongoing* performance and capacity management that could involve load balancing and live migration of VMs."

29%

of North American companies used server virtualization in 2005. (Forrester Research)



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- Network downtime and latency can have a serious impact on centralized servers.
- A new OS may affect the behavior of custom applications.
- Regulatory mandates, which frequently are based on user location rather than data center location, may apply to operations as well as data access and retention.
- System and support availability may be affected by moving servers to locations in different time zones.
- Unexpected user impacts can come from centralization and from cutting-over services from one system to another.
- System management tools should be re-evaluated from a consolidation/virtualization perspective as vendors begin to provide common platforms and tools for managing Windows, Unix and Linux, as well as VMware, Xen and others.

"Classic system management tools don't help in deploying and patching hypervisors," advises Burns. "IT organizations should evaluate their system management toolset as part of any new virtualization project and may need to set some goals for consolidating and unifying their management tools so their physical and virtual infrastructure can be managed efficiently and seamlessly."

40%

of North American companies used server virtualization in 2005. (Forrester Research)



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