An examination of server consolidation: trends that can drive efficiencies and help businesses gain a competitive edge.

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Introduction

An organization's success and ability to react to market and environmental changes are now more dependent than ever on an effective and efficient IT infrastructure. Yet IT departments have become increasingly complex and costly, making it more difficult and time-consuming to support changing business requirements. In addition, this complexity continues to increase the cost of doing business by making the management and maintenance of these IT environments more expensive. In order to become more efficient and improve their competitive stance, organizations need to find ways to simplify their IT environments — without disrupting their business operations.

Organizations often embrace server consolidation as an ideal path to streamlining the IT environment. Unfortunately, many look at it only as a way to reduce the number of servers and therefore fail to realize all the benefits of such an initiative. IBM is taking a more strategic approach to server consolidation. Viewing it within the context of resource optimization, IBM believes server consolidation can not only address an organization's IT infrastructure but also help to align IT objectives and processes with the organization's business needs. Server consolidation can provide the first step toward designing and implementing a more rational, efficient and flexible IT environment that truly supports an organization's overall strategic business objectives. But taking this first step involves more than just eliminating a few servers here and there — it requires a thoughtful approach, one that takes into consideration both business and IT objectives and constraints.

This white paper provides a starting point for organizations contemplating server consolidation. It includes an overview of server consolidation concepts and techniques and provides guidance on methodologies. It also looks at the potential cost savings associated with server consolidation and offers information on how organizations can sustain the advantage they have gained by consolidating their servers.

Popular server consolidation techniques include centralization, physical consolidation, application integration and data integration.

Server consolidation techniques

There are several ways to approach a server consolidation project. The following are a few of the more commonly used techniques.

Centralization

Centralization involves consolidating multiple servers within fewer sites. Examples might include moving 20 servers dispersed throughout three floors of a building to a single server room, or moving 200 servers originally installed in 20 locations to three. Centralization is often the first step an organization takes when it wishes to use server consolidation to control costs. It also is generally an organization's initial step toward rationalizing the architecture after a realignment of responsibilities.

The primary benefits of centralization are:

- *Lower data center costs associated with elements such as power and floor space*
- *An easier-to-manage IT environment due to more consistent standards, improved tools and specialization*
- *Increased availability and recoverability*
- *Improved disaster-recovery capabilities*
- *Reduced security risk as a result of having fewer locations to protect.*

Physical consolidation

Physical consolidation is often what comes to mind for most people when they think of server consolidation. It is the process of reducing the actual number of servers by replacing many servers with fewer, more powerful servers or clustered systems. This can take place within the same architecture or across architectural boundaries. For example, an organization may replace several

two-way UNIX® servers with one 16-way UNIX server or consolidate hundreds of Intel®-processor-based servers onto a mainframe server running the Linux® operating system (OS).

The primary benefits of physical consolidation are:

- *Optimized utilization of the remaining servers*
- *Improved application throughput and performance*
- *Improved manageability*
- *Greater scalability*
- *Reduced floor space*
- *Lower maintenance, hardware, support and software licensing costs.*

Sometimes referred to as the nirvana of server consolidation techniques, application integration enables the colocation of mixed workloads within a unified infrastructure.

Application integration

Breaking the one application/one server paradigm, application integration is sometimes referred to as the nirvana of server consolidation techniques. This approach involves consolidating multiple applications into fewer servers and OS instances, resulting in not only reduced complexity but also business process integration and automation. It enables the colocation of mixed workloads within a unified infrastructure so that applications can communicate and work together seamlessly.

The primary potential benefits of application integration are:

- *Optimized performance and resource utilization*
- *Substantial cost savings, including reduced administrative costs.*

Highlights

Data integration helps organizations apply storage management tools more consistently, allowing them to significantly lower the total cost of data management.

Before starting a consolidation initiative, an organization should define and communicate its business and service objectives and service delivery plans.

Data integration

Data integration combines data from different sources across the same or disparate data types and architectures into a central resource base. By centralizing data, an organization can apply storage management tools more consistently, greatly lowering the total cost of data management. Also, in the event of a catastrophic failure, centralized data can be restored more quickly than data stored in multiple locations.

The primary benefits of data integration are:

- *Increased data availability*
- *Universal access to data across the enterprise*
- *Enhanced security*
- *Reduced inconsistencies due to fewer instances of data duplication.*

Factors to consider

The success of a server consolidation project depends on several factors: sponsorship, clear project definition, communications, thorough data collection, identification of inefficient IT processes, organizational change and a well-thought-out technology adoption strategy.

Sponsorship

It is critical that upper management both understand the importance of the project and actively support it. This will help ensure that the consolidation team has the support it needs to complete the project according to plan.

Project definition

Before starting a consolidation initiative, an organization should spell out its business and service objectives and service delivery plans clearly to help ensure that all involved parties have similar expectations. Because a dedicated team is required for this type of initiative, it also is critical that the organization take into consideration competing projects that are vying for the team's time so that all plans can be prioritized and adjusted as needed.

An objective assessment that considers organizational capabilities, strengths and weaknesses provides a solid foundation for realistic planning. Figure 1 illustrates how the knowledge gained from a comprehensive assessment forms the foundation on which an optimal consolidation strategy is created.
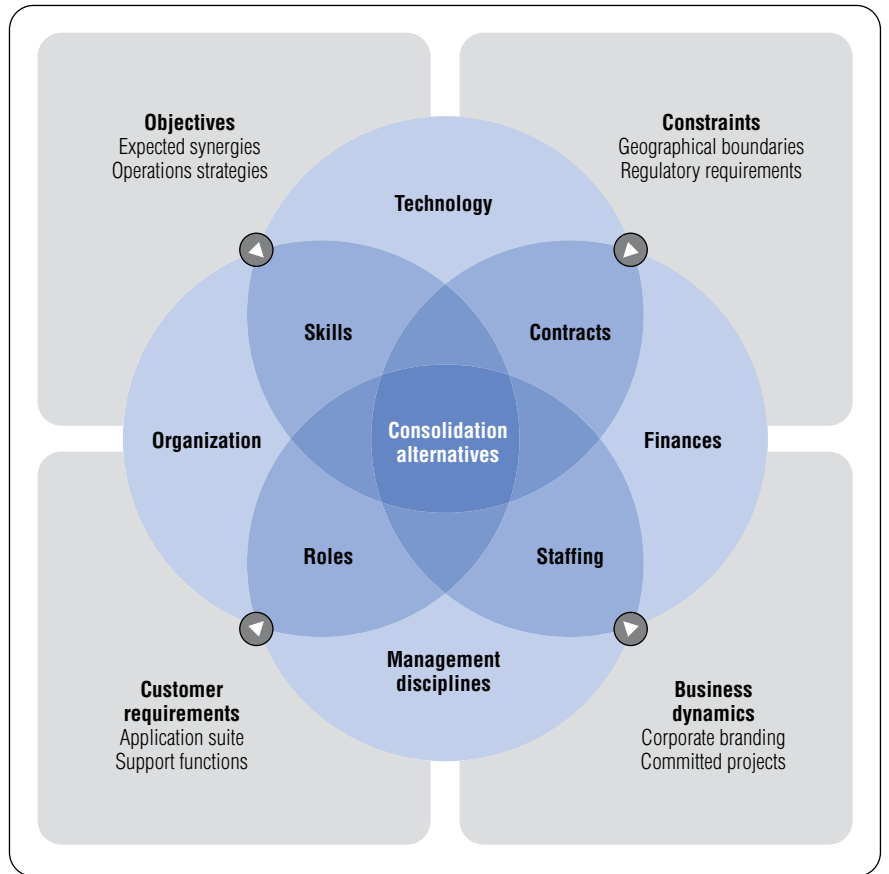

Figure 1. Analyzing the current environment is key to ensuring a successful server consolidation initiative.

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Communications plan

Both operational and IT staff members should be kept abreast of the project and its goals, benefits and successes. Continuing communications with all affected parties can make it easier to unite them in support of the project.

The consolidation team should collect all relevant data pertaining to the current IT infrastructure before embarking on a consolidation initiative.

Data collection

A successful consolidation effort hinges on an organization's ability to gain a clear understanding of its current IT infrastructure. The consolidation team should collect all relevant data, such as:

- *An inventory of the organization's servers and their processor types and memory capacities*
- *The applications running on the servers and their dependencies on other applications and services*
- *Peak and average utilization rates for each of the servers*
- *Training required to bring IT staff members up to speed on the new consolidated environment.*

A well-planned data collection effort can be vital to the success of any consolidation initiative. Yet, without the proper tools to collect the data and a full list of the correct data points to be collected, this phase of the project can become protracted and ultimately fail.

By performing an audit of server metrics and current network performance, team members can gain insight into current systems utilization and develop benchmarks to use in postconsolidation performance testing.

To develop a thorough understanding of the current IT infrastructure, team members also should perform an audit of its existing components and evaluate current processes and application profiles. By performing a baseline on server metrics and current network performance, team members can gain insight into which systems are utilized least effectively. They can also develop benchmarks against which they can measure postconsolidation performance tests.

Highlights

Capacity management and planning processes are vital to ensuring effective and efficient management of servers and their workloads.

Identification of inefficient IT processes

One of the main reasons for the proliferation of servers and storage devices in most IT environments is a lack of efficient processes. Capacity management and planning processes are therefore vital to ensuring that servers and their workloads are being managed effectively and efficiently. It is critical that the consolidation team identify and measure these processes in order to understand the level of effort needed to make them effective.

Organizational change

When developing server consolidation plans, organizations should assess both the degree and scope of required changes. This will help identify stakeholders and determine the audience for communications and training as well as guide further planning.

An organizational impact analysis should document the functions, jobs and number of end users that will be affected by the key changes, as well as the degree of impact. Change managers should work closely with both the infrastructure project teams and subject matter experts within the organization to gather and analyze the information required to assess the organizational impact.

Technology adoption strategy

As data is analyzed and recommendations are developed, it is important to develop a strategy for the implementation of any new recommended technologies. Creating a plan is vital to ensuring that the project's benefits are realized.

Methodology

Any server consolidation effort should follow a tried and proven methodology. Besides allowing all members of the team responsible for leading the server consolidation project to follow a common set of rules and policies,

By following a tried and proven server consolidation methodology that is based on tested industry best practices, organizations have a better chance of achieving favorable results.

a methodology based on industry best practices that have been tested and proven over a large number of projects has a greater chance of producing a successful outcome.

The server consolidation methodology that an organization chooses should take into account all aspects of the IT environment to help ensure that the solution is both cost-effective and efficient. It should allow team members to reuse knowledge and assets and should encompass the breadth of the organization's business, application and infrastructure requirements.

One server consolidation methodology that can be used is the IBM Global Services Method, which is split into three vertical phases that address all aspects of the IT environment. They take into account business needs, organizational effectiveness, IT processes, applications, architecture, IT performance, operations and security.
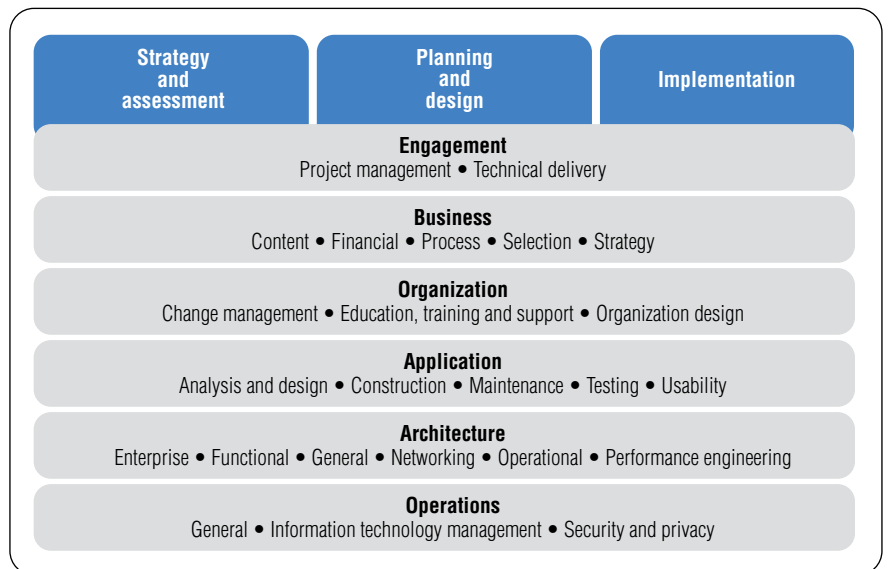

Figure 2. The IBM Global Services Method delivers a structured, reusable and thus cost-effective approach to server consolidation.

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The IBM Global Services Method has three phases: strategy and assessment, planning and design, and implementation.

Strategy and assessment

During the strategy and assessment phase, IBM consultants collect the information necessary not only for developing a strategy for conducting the server consolidation engagement but also for deploying any new technologies. The information gathered includes details about the IT organization's processes, infrastructure, budget and facilities.

Using this information, the consultants assess the environment and develop solutions that they believe will best meet the client's needs. In addition, they define the scope of the project and provide a financial analysis of the current environment compared to the proposed solution environment.

Planning and design

During the planning and design phase, IBM consultants develop the design for the final solution and create detailed consolidation, migration, implementation and project plans. These may include information about technology relocation, education, training and change management.

Implementation

In the implementation phase, the consultants first launch a pilot deployment of the solution and test it. Then they incrementally roll out the solution into production. Once the agreed-upon parameters of the project are met and signed off on, the project is officially closed.

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Server consolidation technologies

*There are several technology strategies from which to choose when imple-
menting a server consolidation initiative. Two of the more popular options
are server virtualization and resource management.*

Server virtualization
*Server virtualization — the process of creating multiple virtual servers out
of one physical server — is becoming a key technology for organizations
looking to reduce the number of servers in their data centers. Organizations
are not only adopting virtualization to aid with consolidation efforts but also
are including it in their server strategies.*

*While virtualization can be used with nearly every server platform, how it is
accomplished depends on the platform.*

*On Intel platforms, virtualization software helps simplify the computing infra-
structure by partitioning and isolating individual physical servers into secure
machines, each of which can run standard Microsoft® Windows®, Linux or
NetWare operating systems and applications. To ensure high performance,
each virtual machine is given direct access to the host machine's resources,
such as the CPU, memory, disks, networks and peripherals. Applications
can be stacked or virtualized — or both.*

*UNIX-based server vendors offer additional strategies for achieving virtual-
ization. For example, dynamic logical partitioning (DLPAR) — offered by
IBM for IBM System p™ products — and similar technologies from Sun
Microsystems and HP employ both hardware and software strategies to
allow organizations to run multiple, independent OS images concurrently on
a single server. With DLPAR, resources also can be moved from one parti-
tion to another without requiring a reboot of the system or affected partitions.
Known to be extremely stable, these types of partitions are often recom-
mended for production environments. And because DLPAR allows for the*

(continued)

creation of several partitions in a single server and the stacking of applications in each of the partitions, this type of technology can greatly increase CPU utilization rates, allowing for the optimization of the servers being used.

Resource management tools
Resource management offers another effective way for organizations to optimize and consolidate their servers. In many IT infrastructures, an all-too-common strategy is to reserve large amounts of CPU and memory resources for applications just in case they may need them. Rather than ensuring consistent performance, this strategy often leads to overprovisioned and underutilized servers. By improving the performance of servers and the applications that run on them, resource management increases the efficiency, manageability and quality of service of the enterprise infrastructure.

Resource management tools are designed to provide IT organizations with control over the allocation and management of CPU and memory resources that are available to applications and processes that are running in any OS instance. They ensure that each resource consumer or application component is automatically allocated an adequate share of available resources or, based on business-policy-defined priorities and entitlements, can be guaranteed additional resources during periods of contention to assure that service levels are consistently met.

If the correct policies are applied to the resource consumption automatically, and entitlements dynamically changed based on business events or system load, policy-based, process-level management of CPU and memory enables enforcement of service performance guarantees, increases utilization and raises service levels through workload prioritization. Solutions such as intelligent orchestrators that will automatically adapt policies at the enforcement layer to enable multiple or different workloads are excellent ancillary tools for optimizing existing resources controlled by resource management practices.

Cost-cutting is a main driver for server consolidation initiatives, but the organization must be able and willing to make the initial investment needed to plan for and execute the project. Therefore, such an initiative must start with a cost-benefit analysis.

Areas of savings

For many businesses, one of the main drivers for server consolidation initiatives is the need to cut costs. And while such an initiative can help reduce the IT organization's operating and management costs, savings can only be realized if the organization is able and willing to make the initial investment needed to plan for and execute the project. Therefore, it is important that any organization undertaking this type of initiative start with a cost-benefit analysis.

Figure 3 illustrates an example of the initial cost tradeoff at the start of a consolidation project. One of the goals of any server consolidation initiative would be to move the break-even point closer to the start of the project in order to realize the benefits sooner. This can be achieved in part with careful initial planning and preparation.
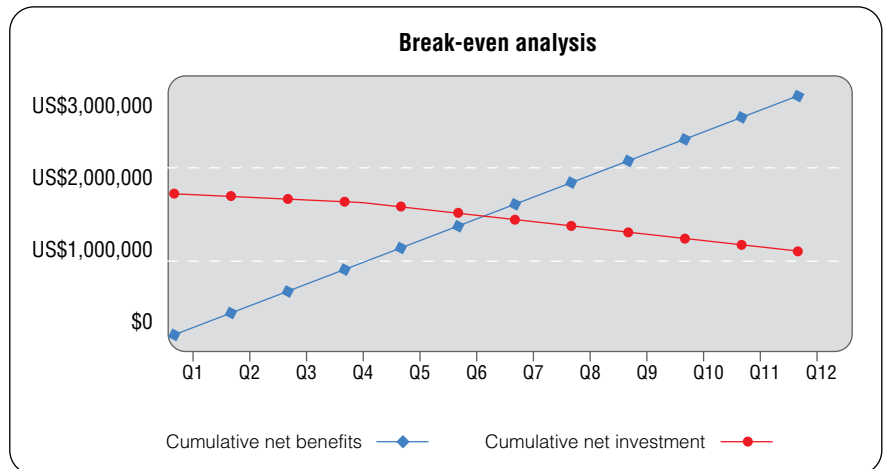

Break-even analysis

Cumulative net benefits ◆   Cumulative net investment ●

Figure 3. An illustration of the break-even analysis for a server consolidation initiative.

Organizations undertaking a server consolidation initiative can experience savings associated with hardware, software, systems administration and support, and facilities, among others.

To develop the break-even analysis, organizations not only need to understand what their costs will be, but they also need to be able to determine their potential savings. These savings aren't always easy to predict, since they can vary depending on the strategy employed, the consolidation team's level of experience and the organization's level of commitment to the project.

Traditional areas of savings include:

- *Hardware—A reduction in the number of servers can decrease the need to refresh funding as well as reduce the maintenance costs associated with the server environment.*
- *Software—This is where the initial savings can be achieved with proper planning. The savings can include costs associated with applications, operating systems and systems management software.*
- *Systems administration and support—As the number of servers and server images are reduced and processes are put in place to improve operational efficiencies, the cost to administer the servers can also be significantly reduced.*
- *Facilities—A reduction in the number of servers will also impact the required floor space, power, cooling, network infrastructure and monitoring needs, all potentially leading to further savings.*

There are other areas in the organization that can experience savings, such as:

- *Help desk—As the server environment becomes more resilient and the availability of the systems increases as a result of the consolidation initiative, the volume of help-desk calls often falls.*
- *Application deployment—The new processes and technology delivered by the initiative can help reduce the amount of the time required to deploy new business functionality.*

Based on IBM's experience, the following represents the typical savings organizations may realize:

- *Hardware costs reduced 33 to 70 percent*
- *Maintenance costs reduced up to 50 percent*
- *Support costs reduced by as much as 33 percent*
- *Floor space and facility costs reduced 33 to 50 percent*

Organizations that do not address the root causes of their initial server proliferation are likely to see the problem reemerge over time.

Sustaining the new environment

Almost every organization has some sort of server consolidation initiative under way, ranging from simple e-mail server consolidations to complex consolidations that are global in scale. And many such initiatives have an underlying goal of cost reduction. However, very few are designed to address the root cause of the server sprawl that has occurred. Instead, they are focused on treating the symptoms. Although a reduction in server count will result in some savings, if the root cause of the initial server proliferation is not identified, the problem can reemerge over time.

To sustain a consolidated environment, it is important to put measures in place as identified throughout this white paper. These include:

- *Efficient implementation of new technology — Technology implemented inefficiently can result in additional costs with no additional benefits.*
- *Optimization of current processes — Inefficient processes often result in inefficient IT environments.*
- *Identification and correction of organizational deficiencies, overlap and inefficiencies — To ensure that they continue to operate efficiently, organizations need to minimize instances of duplicate or ineffective functionality, which are often the result of mergers and acquisitions.*
- *Implementation and use of effective systems management tools — Systems management tools can significantly reduce the cost associated with server management, while increasing the availability of the IT infrastructure.*

Conclusion

Server consolidation can be a daunting task. When done right, it can help IT departments lower costs, improve service levels, provide a faster time to market and improve access to information. When done incorrectly, it can lead to more headaches than benefits. Most consolidation failures are the result of a poor strategy that lacked vision and instead focused mainly on hardware. To unlock the full potential of a server consolidation effort, organizations should adopt a long-term management strategy that addresses all aspects of the IT environment. These strategies would not only look at the technology but also provide guidance on IT process modification to sustain the new infrastructure, organizational change to properly manage it and a plan for hosting the functionality necessary to support the business.

The focus of any server consolidation effort should be on optimizing the entire environment rather than individual assets. Once an organization's technical infrastructure is aligned with its business requirements, the results can include reduced costs and increased infrastructure performance and effectiveness. A simplified server environment also can free up IT personnel to focus on business-critical tasks rather than on IT infrastructure maintenance.

Given the benefits of server consolidation, the question of whether or not to consolidate quickly changes from "Is it a good idea?" to "Who has the expertise to help us address our unique needs, and when do we start?"

For more information

IBM provides a wide variety of server consolidation services that can complement your IT organization's current skill set. With extensive experience ranging from infrastructure design and process reengineering to organizational change management, our consultants have the expertise and knowledge you can depend on to help ensure that your next server consolidation initiative is a success.

For more information, contact your IBM sales representative, or visit:

ibm.com/services