Assessing the Value of Compaq's AlphaServer Consolidation Solutions

An Approach to Measure the Business Value of Server Consolidation

A report by *ITCentrix*

Opinion

Through extensive case studies with Global 2000 and smaller organizations, a detailed technical analysis of Compaq's AlphaServer offerings and business modeling approaches, ITCentrix found that consolidated servers often provide striking business value by simplifying operations, improving IT quality and accelerating time-to-application deployment. ITCentrix believes that for many server workloads, consolidation is a strategic imperative for organizations trying to exploit automation and build the "IT Center of the Future."

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Executive Summary

This study presents a methodology to quantify the business value of IT and specifically consolidated servers. The approach measures value in three areas including: 1) Operational costs; 2) Service levels and 3) Business Flexibility. By applying such a methodology to server and IT strategies overall, companies can maximize the business impact of technology and assess tradeoffs of different approaches.

…. server consolidation is increasingly becoming an imperative within IT organizations.

We believe that server consolidation is increasingly becoming an imperative within IT organizations. While there are many situations where server consolidation is not warranted (e.g. Point-of-sale, process control, communications gateways, etc.), the following factors are driving a consolidation initiative in many commercial environments:

- Cost advantages – The opportunities to reduce the number of processes and procedures related to managing a server infrastructure are significant.

Connecting to external customers and partners is often only possible with a consolidated infrastructure and a "Single View" of key data.

- Business-to-business enablement – Connecting to external customers and partners is often only possible with a consolidated infrastructure and a "Single View" of key data. This will enable applications within the organization and between organizations to be integrated through well defined sets of standards.
- The trend to connect external users/devices/computers is creating greater pressure on service levels that can only be achieved with consolidated infrastructures and a common management framework.
- Increased pressures on achieving "first mover advantage" are forcing companies to rethink the way they design and deploy applications. Direct access to data and applications via a consolidated infrastructure is often the only way to support intense time-to-market requirements.

This study places a particular emphasis on Compaq's server consolidation solutions in the AlphaServer Tru64 UNIX and OpenVMS markets. Compaq's approach to these two platforms can be summarized as follows:

Tru64 UNIX – gains its advantage from enabling Unix with single system image clustering and global file/systems management technologies.

- Tru64 UNIX – gains its advantage by enabling Unix clusters to be managed as a single system using global file/systems management technologies. This allows Unix to achieve a so-called any-to-any topology that, in our view, is a pre-requisite of a global systems management approach. [Note: an any-to-any approach means that, in theory (assuming proper security access), all applications, servers and data have direct access to each other as opposed to access being gained through independent server, application and data "islands"]. Once achieved, an any-to-any topology can be exploited to allow a more dynamic and automated workload management approach.

  Tru64 UNIX is Compaq's answer to improving the suitability of Unix for larger scale mission critical applications. Today, the

platform is very well suited for large scale infrastructure, business intelligence and business critical applications (including asynchronous e-commerce) and we believe over time, will be enabled for more intensive business processing workloads (including end-to-end e-commerce).

[OpenVMS]…is fundamentally suited for medium to large-scale mission critical applications.

- OpenVMS – can be described as an enterprise-class platform, effectively leveraging proprietary, highly available, state-of-the art clustering and global file/system management capabilities. The platform offers some workload balancing attributes along with good recovery and data integrity and is fundamentally suited for medium to large-scale mission critical applications. Future enhancements are expected to extend these capabilities significantly.

Compaq began shipping in mid-2000 a new high-end AlphaServer GS Series targeted at large scale computing environments. This platform is based on Alpha technology and further improves Alpha's availability, performance, scalability and manageability features. The system is expected to have a number of four processor modules, each with its own memory, and all linked via a high-speed back-plane. This NUMA-like architecture approach can be partitioned across the four-way boundaries (physical partitioning) enabling better workload management. The AlphaServer GS Series is expected to be Compaq's platform of the future for both Tru64 UNIX and OpenVMS in medium-to-high end environments.

A key underpinning of Compaq's consolidation story is the company's StorageWorks storage area network (SAN) offerings. The company is rapidly enhancing its storage management software with features like cloning and logical volume management, designed to exploit a consolidated server infrastructure.

It is important to note that a move to server consolidation brings complexities and management challenges. A decision to implement a solution should be based on a number of factors including:

- Suitability of application. Specifically, some applications need to be close to the business process (e.g. factory floor and process control) and may not be good candidates for consolidation.
- Degree of integration of applications – Simply put, the greater the need for integration between applications, the greater the need for consolidation. Frequently, however, consolidating applications presents major challenges due to the diversity of infrastructure (databases, tools, middleware, etc.) seen in many computing environments.

…the more common procedures/ processes in place, the more a consolidated infrastructure can be exploited.

- Maturity and scale of current server infrastructure – Specifically, the more common procedures/processes are in place, the more a consolidated infrastructure can be exploited. Examples include: file naming, backup, client management, security and asset/inventory management. Moreover, a consolidated infrastructure can help customers better manage business barriers in high-growth server environments.

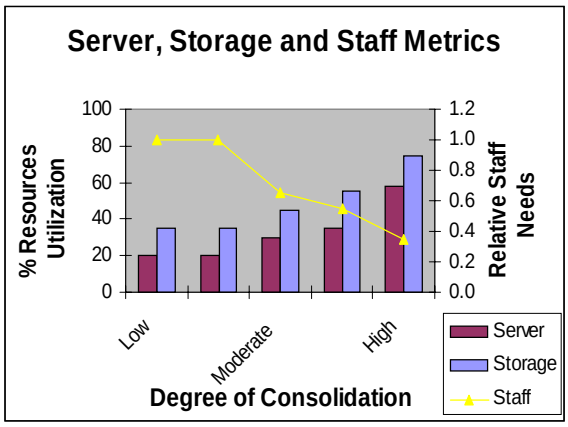


Figure 1 - Server, Storage & Staff Improvements with Consolidation

- A political & management infrastructure that will support shared resources between different lines of business.
- Business value of current and future applications – generally, the higher the application value, the greater the value of a consolidated infrastructure.
- Rate of change of business environment – the higher the rate of change, the greater the need to react and the greater the benefit of consolidation (as an uncoordinated server infrastructure can often inhibit application deployment).

By fully evaluating the business implications of making changes to a server infrastructure, customers can realize significant returns, optimize IT for business value and avoid unnecessary expenditures. The following key points summarize our findings:

- Consolidating servers can have dramatic operational cost savings primarily due to more efficient resource utilization (i.e. server capacity - GHz and GB's - managed per person) but also better server resource utilization (see Figure 1 in margin).
- Consolidation complexities include – Political resistance from lines-of business, platform nuances (if moving to a different platform), network requirements studies (changing traffic patterns, bottlenecks, availability requirements), lack of standards (e.g. different applications need different revisions of OS or database to function properly) and person-power required to exploit a consolidated infrastructure.
- Added consolidation complexities are usually offset by significant value contributions of lower operational costs, increased application availability and improved time-to-application-deployment.
- Approaching consolidation in steps increases chances of success. Building credibility with smaller projects and working to larger scales can have dramatic effects on the credibility of consolidation efforts.

The following section describes an approach to quantify the value of a server consolidation effort. The model used was built with input from several hundred (approximately 200) organizations in North America and Europe and contains industry average data based on these interviews.

The ITCentrix Value Contribution Model

What is it and How Does it Work?

The data and assumptions in the model are derived from real world case studies and calibrated with in-depth interviews of Global 2000 and smaller organizations.

The ITCentrix Value Contribution Model (Figure 2) provides a strategic framework to assess and quantify IT's contribution to business value. It is based on a proprietary and tested methodology that combines cost, technology and business modeling to more accurately predict how changes in IT will impact business. The data and assumptions in the model are derived from real world case studies and calibrated with in-depth interviews of Global 2000 and smaller organizations.

The interviews are conducted by senior ITCentrix professionals and span a range of industries, IT philosophies, applications and server approaches.

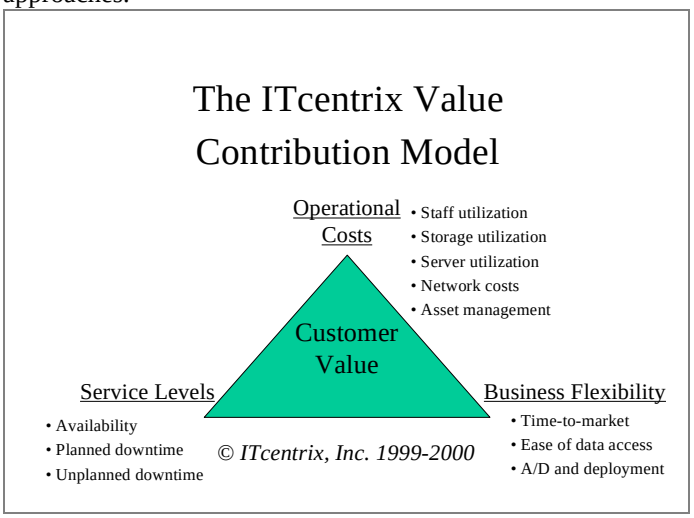


Figure 2 The ITCentrix Value Contribution Model

The model uses data obtained from interviews with large and medium-sized companies and allows users to make changes to reflect specific applications and environments (e.g. application value, levels of availability, planned downtime, server utilization, etc.).

To assess the value contribution of a particular technology approach, the model quantifies and analyzes three high-level ***Business Value Contributors*** including:

- ***Operational Costs*** – [Metric: Cost Savings] - Emphasizing factors such as staff efficiencies, hardware utilization and network costs.
- ***Service Levels*** – [Metric: Incremental Revenue or Productivity Dollars] – Emphasizing the benefits associated with higher ***application*** availability (less planned and unplanned downtime) and response times (held constant between environments for this report).
- ***Flexibility*** – [Metric: Incremental Revenue or Productivity Dollars] - Emphasizing the time to develop and introduce new applications (i.e. time-to-market) and the value

[Flexibility is]……the increased revenue or productivity generated from faster application deployment…

generated from faster deployment times and the associated products and services. Each of these value contributors contains numerous sub-elements and data points solicited from actual customer situations. These factors are assessed to develop an accurate view of current installations (***The Base Case***) and compared to alternative approaches. The explicit intent of the model is to allow customers to assess the business cases of different approaches to the Base Case in business value terms. All components of the model are quantified in value terms and represent real dollars - e.g. cost savings, revenue potential and/or productivity gains.

Applying the Model to Server Consolidation

Server consolidation is an emerging and important technology and management trend combining enterprise server hardware and software function with operational procedures designed to reduce management complexity. In many respects, server consolidation is a misleading term in that often, consolidation efforts are focused on non-server efforts including:

- The reduction in the number of processes and procedures.
- The consolidation of data.
- The consolidation of applications.

To apply the Value Contribution Model to server consolidation, we analyzed results along a commonly accepted spectrum of ***Consolidated Server Topologies*** (see Figure 3) with specific assumptions as follows:

- **Distributed/Logical –** Physically de-centralized servers resident outside of a data or location center. Certain functions (e.g. backup) are done over the corporate network but management is typically handled by non-IT Professionals. Typically only one application is resident per server.
- **Collocated/Physical -** Distributed servers are moved into a centralized data or location center. Management by IT Professionals – backups done over a local data center network. Applications topology remains typically one per server.
- **Server/Data Integration -** Collocated servers are sometimes moved onto larger processors but still partitioned by OS region (i.e. hardware and software resources are not shareable/accessible across partitioned boundaries). Simplification of the overall server infrastructure occurs via a reduction in the overall number of processes and procedures (e.g. backup, recovery, security and general operations). Some application consolidation is possible for homogeneous applications distributed on servers with similar configurations and software infrastructures. Data access is via an any-to-any server to I/O approach where any server (assuming proper security clearance) has access to any I/O devices attached. This can be achieved in a number of ways including large consolidated storage boxes supporting multiple servers, a storage

area network, a cluster that spans multiple partitions or even network attached storage. Re-allocation of hardware and software resources is done manually. The key technologies that contribute to consolidation value in this topology are larger processors, partitioning, clustering, consolidated storage (either through large, monolithic boxes or fibre-based SANs) and logical volume management (manual).

- **Application/Workload –** Support of multiple heterogeneous applications per Server & OS image. Re-allocation of hardware, software and workload balancing is done semi-dynamically with improved utilization of resources. A single system image clustering environment provides many of the workload balancing capabilities that enable value in this topology.
- **IT Center of the Future** (see Figure 3) **–** Any-to-any connectivity between applications, servers and data with a single logical view of server, applications and data resources. Consolidation is fully enabled with dynamic and automated re-allocation of hardware and software resources and workload balancing to meet service level goals. N→1 failover capability where N servers are "backed up" by a single node (as opposed to a "pair and spare" approach where availability is achieved by full redundancy of servers, channels, switches, storage, etc.). This topology achieves high degrees of automation where service level agreements (SLA's) are managed automatically by the system (based on pre-defined customer parameters).

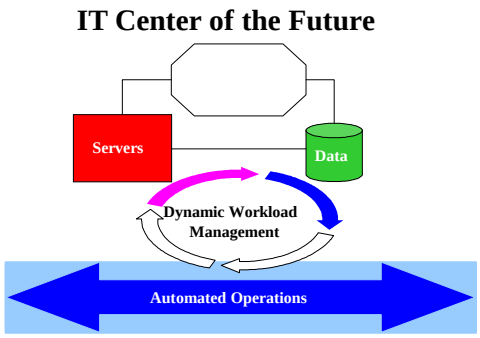


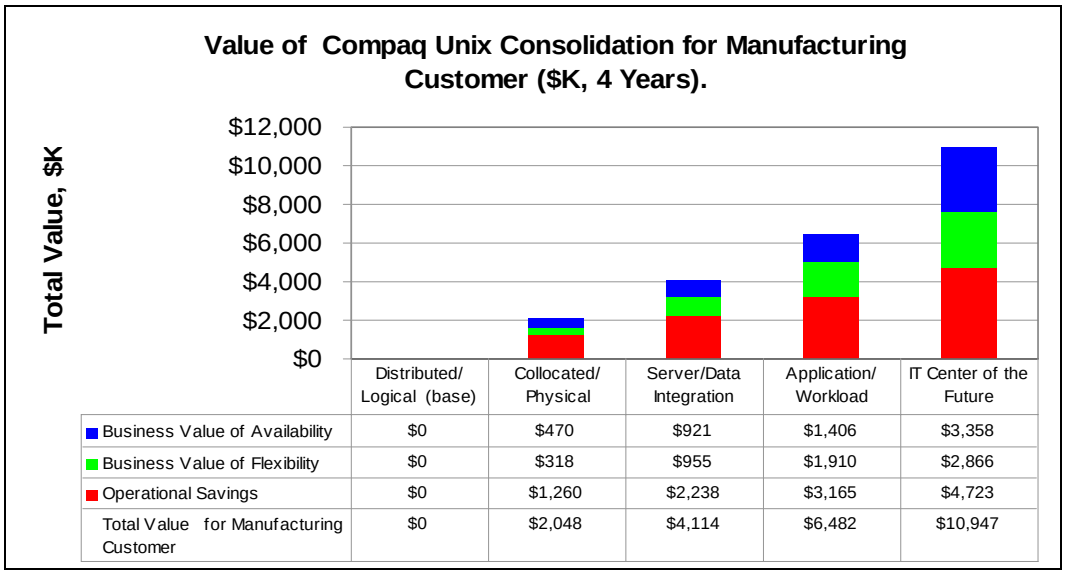
Figure 3 The IT Center of the Future

The model captures data about each type of server topology in terms of its business value contributors (operational costs, availability and flexibility) and assigns ***hard dollar values*** to each attribute. Results are presented in value terms over a four-year period. Comparisons of each business case can then be made, tested and calibrated between environments and actions can be taken to better align IT to desired business objectives.

We specifically focused on Compaq Tru64 UNIX and Open VMS-based server technologies. Our research indicates that relative to NT servers, these technologies offer many of the benefits today that exist on the NT/W2K roadmaps of the future (e.g. partitioning and advanced global file management). Importantly, the model considers the timing of benefits derived from earlier availability of technology.

Key Findings, Assumptions and Scenarios

Figures 4 and 5 summarize the total value contribution model applied to two examples: 1) A 75-server business-critical Tru64 UNIX environment and 2) A 30-server, mission critical OpenVMS environment. The data shown project business cases for each topology and make an apples-to-apples comparison between environments.



	Distributed/ Logical (base)	Collocated/ Physical	Server/Data Integration	Application/ Workload	IT Center of the Future
Business Value of Availability	$0	$470	$921	$1,406	$3,358
Business Value of Flexibility	$0	$318	$955	$1,910	$2,866
Operational Savings	$0	$1,260	$2,238	$3,165	$4,723
Total Value for Manufacturing Customer	$0	$2,048	$4,114	$6,482	$10,947

Figure 4 - Value Contribution for Business Critical Tru64UNIX Servers

An in-depth explanation of this data is available in the following pages (see "The Business Case for Consolidation"). The study provides detail on the factors contributing to server infrastructure value and how they change as server topologies evolve. A key emphasis of value is the contribution from availability and time-to-market improvements as server infrastructures are made more robust yet flexible to business needs.

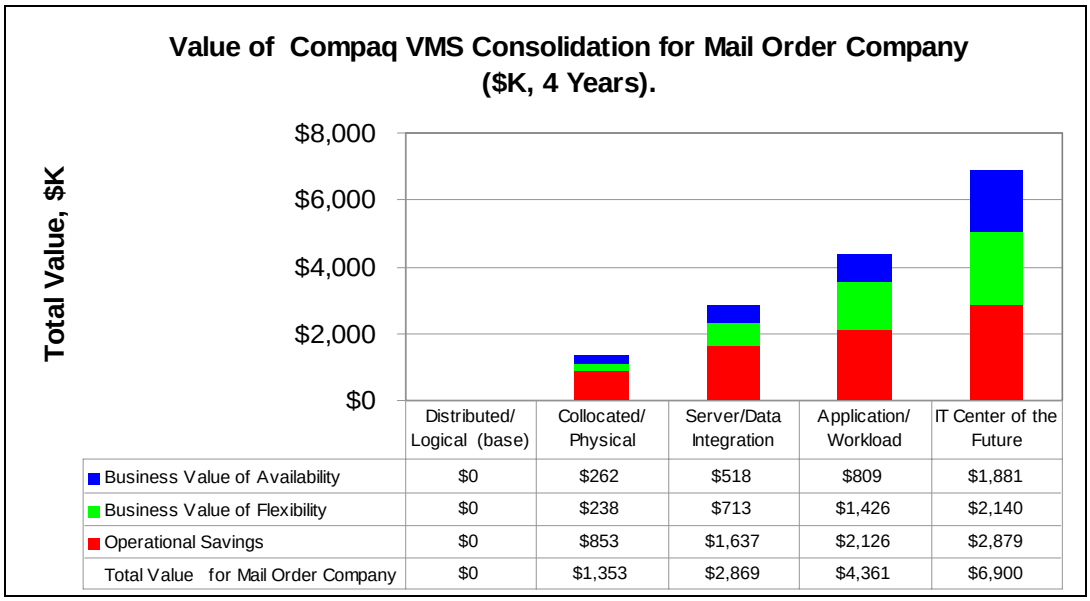


Figure 5 - Value Contribution for Mission Critical OpenVMS

Our analysis of consolidation spans a spectrum of approaches beginning with distributed/logical topologies. Where sensible, most companies are implementing steps to either logically manage distributed resources (e.g. with backups done over a corporate network by IT Professionals) or physically move distributed systems into data or location centers.

Beyond these first two initial steps, consolidation efforts are aimed at making more dramatic impacts on operational costs. Our findings show that other aspects of IT value, namely service levels and time-to-application deployment result from subsequent stages of consolidation. The following high-level findings summarize our initial analysis:

Key Benefits of Consolidation

Stage I – Improved storage capacity utilization and reduced system management costs.

Stage II – Better server resource utilization and further staff reductions due to limited automation.

Stage III – Much improved availability and cost to deliver high availability (due to N→1 fail-over). Significant staff reductions due to greater automation.

- Beyond moving systems into a central location, there are three stages of consolidation: 1) Infrastructure (Server/Data Integration); 2) Application/Workload and 3) Automation (IT Center of the Future).

  In the first stage, physical any-to-any connectivity is established. At this level (in theory), any server can access any data (assuming proper security access). [Note: Clustering and partitioning are prevalent at this level and the primary emphasis is creating common processes and procedures].

  Stage I benefits include improved storage capacity utilization and reduced system management costs (with some modest availability impacts).

- Stage II is further exploitation of that infrastructure through application consolidation and enhanced software functions such as advanced clustering and partitioning. The emphasis at this stage is placing multiple applications per OS and achieving easier (albeit still mainly manual) workload management.

Stage II benefits (which largely stem from easier access to shared data under same OS) include better server utilization and further staff reductions due to limited automation. Fewer OS images are required at this stage and any application can get at any data (assuming proper security access).

- Stage III, in theory, allows any user to have access to any application and/or data on any server. Dynamic workload & file management is the key technical breakthrough at this stage and is a key enabler to automation.

  Stage III benefits include improved availability (due to less human error) and significant cost benefits (in H/A environments) resulting from N→1 fail-over, where N servers are backed up by a single standby server (as opposed to a pair and spare approach). Costs are also reduced as server utilization increases dramatically. Moreover, the impacts on business flexibility at this level are enormous as the ability to accommodate change is enhanced.

Important factors to look for in server products/vendors to support the various stages of consolidation are the ability to deliver a single system image cluster, partitioning, dynamic reconfiguration capabilities, single OS image scalability and high speed interconnect expertise. Additionally, OS prowess is fundamental and includes global file system expertise and monitoring and instrumentation knowledge at many levels including servers, OS, database and applications.

The Business Case for Consolidation

To understand the value contribution of consolidation it is necessary to review the business case. The goals of server consolidation are to:

- Simplify operations.
- Optimize resources.
- Improve the quality and hence the availability of IT.
- Accelerate application development and deployment.

The first two factors (simplified operations and resource optimization) contribute to the greatest portion of business value today and are enabled more by software function than by hardware centralization alone. If these two primary goals cannot be achieved through consolidation then the typically higher hardware and software costs are not likely to warrant the investment.

Despite this caveat, our research indicates if consolidation is possible, then achieving these goals can bring major IT benefits.
Assessing the value of server consolidation must include but also transcend operational costs. This paper will explore three primary scenarios to assess the business impacts of server consolidation.

- A 75-server ***business-critical*** Tru64 UNIX Environment (e.g. Support Systems for a Manufacturing Company)
- A 50-server ***mission-critical*** Tru64 UNIX Environment (e.g. Laboratory Systems in Health Care Services Company)

- A 30-server ***mission-critical*** OpenVMS Environment (e.g. Order Processing in a Mail Order Company)

Through in-depth one-on-one interviews with large and mid-sized corporations, we developed detailed assumptions for each environment and populated the model across the entire spectrum of server topologies to allow comparisons.

Case Study Details for Figure 6

- Manufacturing Company
- 75 Tru64 UNIX Servers
- Business Critical
- Support Application
- Application value = $240 million
- 7,500 GB's
- 7,000 Users
- 15% Active Concurrent

Understanding Operational Costs Associated with Server Consolidation

Through in-depth one-on-one interviews with large and mid-sized corporations, we developed detailed assumptions for each environment and populated the model across the entire spectrum of server topologies to allow comparisons. In general we found that the greater the degree of server consolidation, the greater the business benefit. Generally, the value of operational costs is related to three main factors:

- Server Management Efficiency (GHz and GB's managed per person)
- Server Utilization (%)
- Storage Utilization (%)

As shown in Figure 6, these contributors can be significant and primarily related to server and storage staff efficiency factors. Once again, the case for consolidation is compelling. Figure 6 shows, the four-year operational savings in a business critical Unix situation are significant.

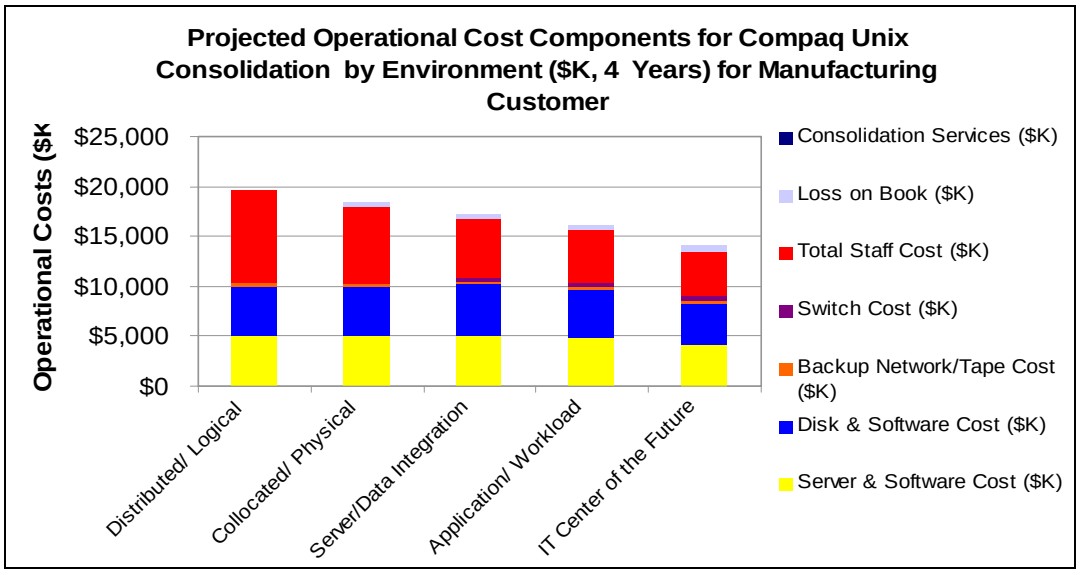


Figure 6 Operational Cost Savings – Tru64 UNIX Consolidation

These cost benefits come from several areas including the following:

- Significant reduction in management complexity
- Easier/faster problem determination and resolution
- Automation of copy procedures
- Simplified backup and restore

- Significant reduction in performance management
- Easier resolution of bottlenecks due to improved I/O pathing
- Faster recovery process for system administrators

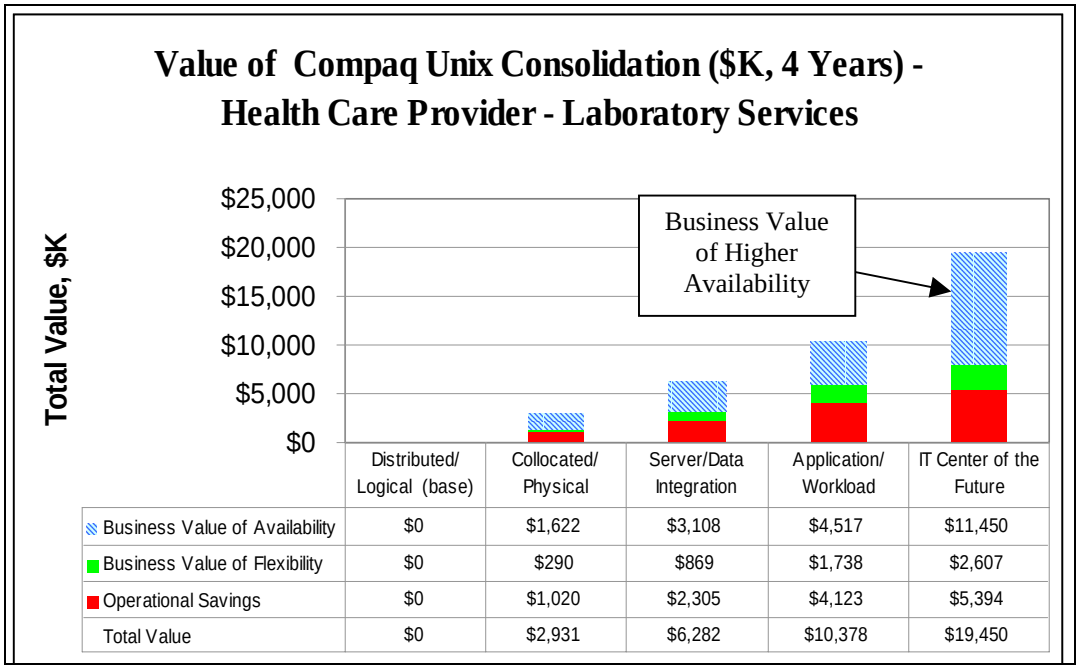
The Impact of Consolidation on Availability

The added value of a server consolidation becomes more obvious when analyzing the availability and flexibility aspects of business value. In assessing the impact of reduced downtimes we make the following observations:

The business impact of reduced downtime is a function of:

- The value of an application to the business (e.g. revenue or productivity generated by the application).
- The percent of this value that is lost during normal operations when an application becomes unavailable (unplanned downtime).

The results of the case study in Figure 7 show the revenue/productivity impacts of increased uptime (both a reduction in planned and unplanned downtimes) as consolidation is enabled. The value of availability is shown in the hashed portion of the bar chart and is based on a laboratory services application valued at about $220M per annum. This example depicts a 50-server environment with 2,500 total users – 25% that are active/concurrent. The application is mission critical with a severe impact (on business flow) from an outage. This emphasizes the importance of availability for this application and naturally increases the value of higher availability.



	Distributed/ Logical (base)	Collocated/ Physical	Server/Data Integration	Application/ Workload	IT Center of the Future
Business Value of Availability	$0	$1,622	$3,108	$4,517	$11,450
Business Value of Flexibility	$0	$290	$869	$1,738	$2,607
Operational Savings	$0	$1,020	$2,305	$4,123	$5,394
Total Value	$0	$2,931	$6,282	$10,378	$19,450

Figure 7 - Value from Higher Availability – Tru64 UNIX Consolidation

The model reflects projected increases in availability as software functional enhancements increase (along the consolidation spectrum). The factors contributing to better availability include:

- Faster recovery times for hardware and software errors.
- Fewer operator errors.
- Better recovery procedures.
- Reduced backup window pressures. (Performance can help here)
- Lower probability of offline procedure overruns.
- Ability to manually balance workloads across more servers and volumes to avoid dangerously high server and storage utilization levels.

How Server Consolidation Impacts Business Flexibility

The ITCentrix Value Contribution Model measures business flexibility in terms of the revenue or productivity from faster application deployment. The value of getting an application deployed sooner, as it relates to servers, is a function of two factors:

- The value of the application to the business.
- The percentage of server-related time that application deployment consumes.

Specifically focusing on the latter, when applications are developed and deployed, the following issues need to be addressed:

- The application has to be designed or modified to work with existing server resources within the organization.
- The data for the application need to be extracted from existing servers.
- The data from the application need to be moved to and exploited by other applications resident on other servers.
- The system configuration requirements are never known until after the application is in production.
- Space for the application needs to be found on a server that is sized appropriately.
- The application needs to be integrated into the current operational procedures so that it does not disrupt existing applications, and all data are secure.

Application development and deployment constraints can severely delay an organization's ability to meet business goals. Techniques that allow data to be directly accessed (not moved over the network) and/or shared sequentially (i.e. "you take it, then I take it, then you take it") can help improve time-to-market.

Depending on the value of the application to the business, this factor can have dramatic impacts on incremental revenue (or value) generated to an organization (see Figure 8).

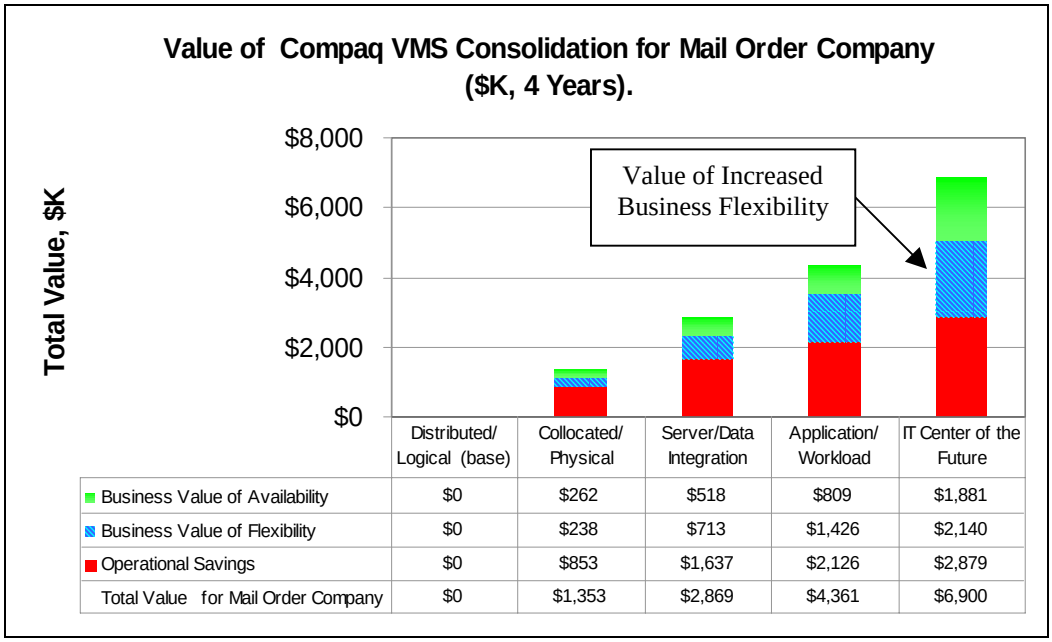


Figure 8 - Case Study for Mission Critical OpenVMS

Case Study Details for Figure 8

- Mail Order Company
- 30 OpenVMS Servers
- Mission Critical
- Order Processing
- Application value = $180 million
- 2,500 GB's
- 3,000 Users
- 30% Active Concurrent

Figure 8 shows the results of our analysis (shown in the middle of the bars – hashed portion). The figure depicts the incremental value (in additional revenue terms) from faster deployment of new applications of similar value to our example. Moving from left to right on the server topology spectrum our estimates for increased application deployment times are as follows:

These figures are derived using actual customer data and, in the case of future topologies, modeling the impacts of future software related to automated workload balancing. The specific contributors to faster application deployment come from software functions enabling the following factors:

- Ability to access data directly
- Ability to share data more effectively
- Ability to avoid constraints on operational access to data
- Ability to supply server services more quickly
- Ability to automate all of the above (Future)

Total Value Contribution of Server Consolidation

By way of summary we have reviewed three value contributors for server consolidation:

- Operational Cost Savings – expressed in fully managed cost improvements.
- Availability – expressed in revenue or productivity gains from reduced downtime.

- Flexibility – expressed in incremental revenue from faster application deployment.

Key Points:

- Assuming appropriate application(s), consolidation supports a pattern of continued value improvements in Tru64 UNIX and OpenVMS services.
- The magnitude of improvement will vary by each situation and should be analyzed accordingly.
- The Value Contribution Model provides a strategic framework by which to make such an assessment.

Conclusions and Recommendations

Our analysis has found that Compaq has many factors in its favor that should enhance the confidence of IT managers in the company's AlphaServer series and add to business value for consolidation. Two factors that deserve specific mention are:

1. Compaq has leveraged its leading global file management technology across all AlphaServer operating systems. This initiative is a pre-requisite for automating and reducing data center management costs and improving availability and flexibility.

2. Compaq has announced that it will build some future Alpha chips using IBM's advanced copper and SOI (Silicon-on-Insulator) chip technology. This effort should ensure that the Alpha Series remains competitive from a technology cost and performance standpoint.

The following points summarize the key conclusions and recommendations of this study relating to business value and consolidation. Importantly, we have analyzed numerous real world situations beyond the ones noted in this report:

Consolidate Now! – Where the application permits, consolidation of server infrastructure gives customers meaningful benefits in terms of the cost of service delivery.

Include Availability and Flexibility in Business Cases – While consolidation benefits are often dramatic in terms of operational cost savings, significant value relative to reduced downtime and faster application deployment should be considered when making a business case.

Identify Processes/Procedures that are Candidates for Consolidation Exploiting a server infrastructure demands the identification of processes and procedures that can be consolidated in a common framework. Examples include backup, security, client management, asset tracking, etc.

Prioritize High Value Projects for Consolidation – By using a common analysis framework to assess the value contribution of a server infrastructure, priorities can be managed to emphasize high-value projects ahead of marginal efforts.

Plan for Staff Re-deployment – a major cost benefit of server consolidation will often be staff costs savings. Because most IT departments are stretched thin, re-assigning staff, rather than eliminating staff is the key consideration. Specifying the business impacts of staff re-deployment can support business cases.

Don't Assume all the Benefits up Front – Our models delay the recognition of benefits based on a normal experience curve. Assuming such "negative" factors in an analysis framework is important for credibility. Other examples include greater capital costs (frequently the case of a consolidation), loss on the books for existing servers and the cost of external services.

About ITCentrix

ITCentrix is a software company that develops a suite of sophisticated decision support tools designed to help IT and Business Professionals quantify the impacts of technology change. Its customers include Global 2000 and smaller organizations around the world that use the company's software and services to predict the effects of improved IT on business results. Based in Framingham, MA, the company leverages its proprietary software, methods and industry comparative databases to successfully assist clients in using IT to avoid costs, improve customer service levels and accelerate time-to application deployment.

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