



# IT Consolidation Solutions from Hewlett-Packard

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Within the information technology environment, the concept of consolidation has evolved from a focus on downsizing the number of boxes in the datacenter to a strategic effort to streamline the entire IT infrastructure. More organizations are realizing that projects initially designed to reduce acquisition costs are delivering longer-term benefits by increasing operational efficiency and allowing for greater levels of business flexibility.

Organizations of all sizes have begun to see these benefits, as the necessary technology and processes have become much more widely accessible. For many companies, consolidation has become a continuing effort rather than a discrete project. They continually look for ways to realign their business processes as they reorganize or deploy new technology.

Becoming mainstream does not mean, however, that consolidation should be viewed lightly. It remains a significant investment in both time and capital expense and presents a certain element of risk. Organizations considering consolidation must carefully assess their business requirements, the business value, risk, and total cost of ownership (TCO) associated with a consolidation effort. An important development in the consolidation space has been the emergence of tools and methodologies to assess and quantify these elements. The availability of these tools is spurring interest in consolidation, as organizations are able to directly connect the money they spend with the results they achieve.

As Hewlett-Packard integrates offerings from across its business units, it is renewing its emphasis on IT consolidation by employing a pragmatic, forward-looking, service-driven approach. HP recognizes that a desire to reduce cost drives most consolidation projects and helps its customers identify the areas where consolidation will provide the greatest return. Its approach to consolidation, however, goes well beyond initial cost savings. HP believes that reducing the complexity of the infrastructure is an essential step toward achieving the vision of a utility-driven computing environment. In such an environment, the focus is on providing the services that deliver business value, not on managing the infrastructure. The concept of utility computing is neither new nor completely realizable today. Still, HP's approach to consolidation is an important part of bringing together the solutions, services, business practices, and partnerships that allow organizations to move toward such a reality.

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This white paper examines the new role consolidation is playing as IT infrastructures evolve. It looks at the business value of consolidation and the steps organizations must take to plan and implement a successful consolidation effort. HP's IT consolidation alternatives are profiled, along with the experiences of several of its customers.

## **MARKET AND TECHNOLOGY SHIFTS LEAD TO NEW OPPORTUNITIES FOR CONSOLIDATION**

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At its most basic level, consolidation is about doing more with less. At this level, most organizations consolidate as a matter of course, replacing older technology with newer, more powerful solutions. Just about any vendor can deliver a consolidation solution that meets these criteria. To take real advantage of consolidation, however, organizations must look beyond the cost savings realized in initial hardware procurement and consider the effect on TCO as well as the longer-term benefits of improved operating efficiency and business flexibility.

Some of the major business and technology drivers for consolidation are as follows:

- Faced with flat or declining IT budgets, many organizations have reevaluated their business priorities and supporting technology infrastructures. Through this process, they have identified ways to streamline their IT operations while providing the best possible support for strategic applications and processes.
- Improvements in network connectivity and bandwidth, as well as the emergence of the Internet, have increased the opportunity and necessity for organizations to do business globally. Many organizations are reducing their total number of datacenters to a few strategic locations. Through consolidation, they are able to serve a growing and diverse base of customers and partners with a network that is more efficiently managed.
- The ability to consolidate has come along just when many organizations need it most. Organizations are being challenged to provide higher levels of service to their internal and external users when the complexity of the technology is increasing and budgets are often constrained.
- Deployment of new architectures, such as Windows 2000, allows companies to look at how they used servers to host applications under the previous architecture and consolidate as they deploy the new operating system. Compaq eliminated more than 2,000 Windows servers during its deployment of Windows 2000.

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- With the availability of faster and more capable server and storage hardware, smaller systems can be eliminated and storage moved away from the hard-to-upgrade direct attached storage (DAS) storage area networks (SANs).
- The desire for better disaster tolerance and recovery.
- The need to manage security risks and attacks from hackers and viruses.

Overall, consolidation has the potential to benefit many different types of organizations with a variety of different IT environments. At the very least, organizations should assess their environments to determine their potential. Those companies that choose to pursue a consolidation strategy should work with a vendor that offers a solid methodology that ranges from requirements identification through implementation, contingency planning, and a strategy for addressing changing requirements. They should choose vendors that currently offer a good foundation of products and services, have a track record of successful implementations, and present a consistent road map for the future.

## **THE BUSINESS VALUE OF CONSOLIDATION**

Reducing initial hardware costs is usually the impetus for consolidation. Experience has shown that the impact goes far beyond initial costs and the initial implementation. Many organizations find that the money they save through consolidation can be used to fund other technology initiatives. It is important during the assessment process to identify the projects that will deliver the greatest return — in both cost savings and strategic value. IDC recently surveyed organizations on their plans and experiences with consolidation. Their top reasons for consolidation are shown in Figure 1.

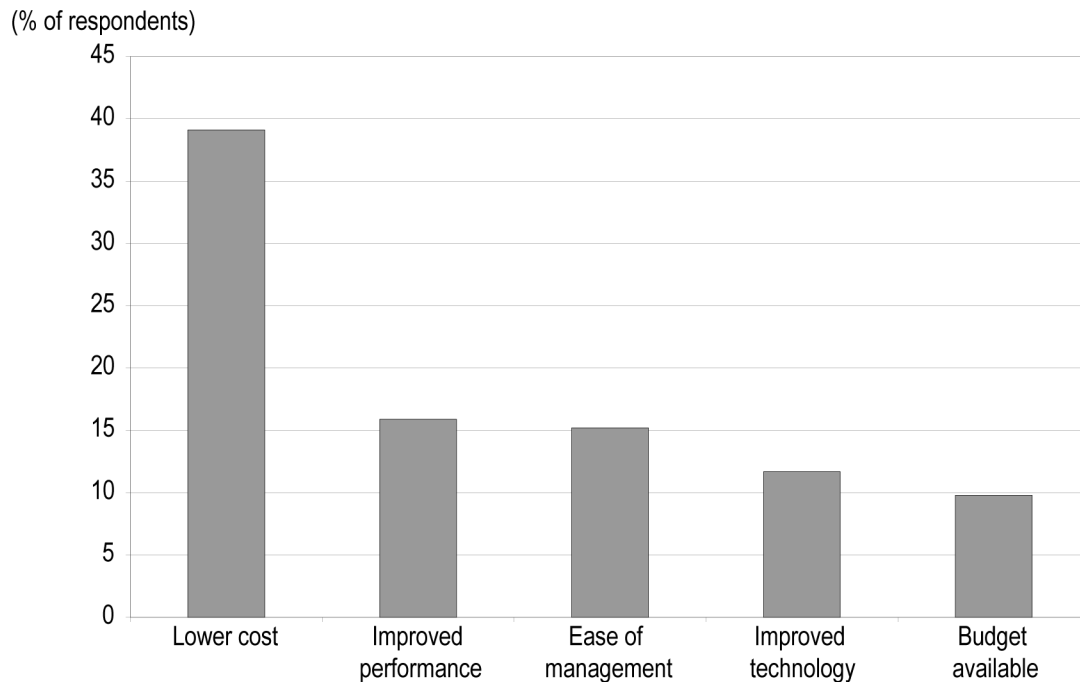
Most organizations find value in all the elements cited in Figure 1, thus leading to an overall value proposition of improved business processing. Consolidation delivers these benefits in the following ways.

### **Maximizing Efficiency**

Cost is always an important consideration, especially in a time of limited IT spending. Replacing older hardware with newer platforms presents obvious cost savings in terms of floor space, power consumption, cooling, and maintenance. There are also potential savings in licensing due to the need for fewer software licenses on a reduced number of machines.

Simply reducing the overall number of things that must be managed may make it possible to reduce the number of administration personnel. It also allows for better use of the available staff resources. High-cost people resources are often poorly utilized in IT environments because their skills are stretched over multiple technologies and locations. Consolidation allows organizations to establish consistent processes and procedures and reduce the number of technologies present across the environment. IDC studies have shown a 7:1 cost savings in people management resources when processes and resources are consolidated.

**Figure 1: Top Reasons for Consolidation**



Source: IDC, 2002

Efficiency gains can also be found in better utilization of available system resources. Many datacenters are sized to support peak application loads, and processors often sit idle a good deal of the time. They also have many DAS devices that are underutilized. Traditional server and storage deployments use 20–40% of available resources. By consolidating multiple applications on the same server with workload balancing capabilities, organizations can reduce the total number of servers they need. The DAS can be consolidated into a highly available SAN-based architecture to maximize utilization, ease of management, and flexibility in deployment. The consolidated system can manage peak workloads to take advantage of available processor and storage capacity, reducing the amount of excess capacity that must be maintained.

One HP customer had 85 district offices, each with its own VAX server running OpenVMS and feeding information into a central IT organization. It hoped to gain efficiency and business flexibility through a standardized, centralized environment. "To simplify management, reduce costs, and make rapid changes across the 85 districts," says the manager of systems support, "it would make sense to consolidate the VAXs into one physical location."

The organization replaced the 85 servers with one AlphaServer cluster running a single version of the operating system and the applications. As a result, it has seen cost savings in some expected and unexpected places. One obvious area is in maintenance costs, which are significantly lower for one new cluster than for 85 older systems. The organization has seen its annual maintenance budget drop from \$5 million to less than \$2 million.

Another area of significant savings is in field support and management. Prior to consolidation, local field personnel were required to do backups, respond to outages, and perform local system maintenance. Every patch to the operating system, for example, had to be installed 85 separate times. As a result of consolidation, the organization is saving several thousand hours per year in local administrative time. It is also saving in person-hours at its central location. "We used to have three teams of four people doing remote management," says the manager of systems support. "We now have two people managing the system. We have saved five full-time positions."

This organization was also surprised at the reduction in telecommunications costs. With 85 distributed servers, it had modems and phone lines dedicated to each for communication back to a central system. By consolidating, it was able to eliminate between 8 and 16 phone lines associated with each distributed server. It now leases a bank of modems and phone lines from its service provider, paying a flat fee. As a result, its telephone costs were reduced by more than half. It is not unusual for a consolidation project to result in unanticipated, and often surprising, cost savings.

### **Providing the Best Possible Service Levels**

Increasingly, IT organizations are looking to change their image from being part of overhead to being perceived as a strategic service provider. To do so, they often must operate within service level agreements (SLAs), which spell out the level of service the organization must provide. Consolidation can help improve service levels by increasing the availability of systems and applications and, potentially, the total number of users the organization can serve. At a physical level, the consolidated environment allows organizations to boost the availability of their systems by having redundancy and failover capabilities in place.

At a procedural level, consolidation can lead to a more effective, overall management scheme that supports higher availability. Consolidation involves not only physical assets but also the processes and procedures that run the datacenter. Streamlining these elements allows the implementation of a consistent set of best practices that runs across the entire IT environment, which greatly reduces the possibility of downtime associated with operator error.

Consistency can also enhance the ability of the IT organization to respond to its customers' requests for services. By reducing the backlog of requests, the IT organization can become a much more strategic and valuable operation.

One HP customer, a multisite hospital organization, initiated a consolidation project as part of replacing its outdated hardware. The organization realized it had no focus within its IT structure on availability of systems or applications. To address the perception that IT was ineffective, it made improved service levels a major goal. "We were trying to change the persona of the IT department," says the CIO. "We were perceived as unreliable and would overcome that through higher service levels and ability to be proactive."

That change in perception is based on very impressive improvements in system and application availability. As part of the consolidation project, the organization set minimizing unscheduled downtime as a major goal. The entire organization tracks it down to the minute. Before the consolidation, as much as 3% of total downtime was unscheduled. Now, the figure is at .00043%.

Consolidation can also lead to higher levels of security by making the environment less vulnerable to intrusion. The organization with 85 VAX servers found, prior to consolidation, that it had little control over the security of its distributed systems. "These systems were out of our control. We never knew who had access to them," says the manager of systems support. "By bringing it all together, we are better able to control access security."

### **Maximizing Business Flexibility**

For many organizations, the ability to anticipate changes in the business environment and even be out in front of them is the greatest benefit to consolidation. The IT center sees not only a growing number of applications but also increasing interdependence among them. In a distributed environment, applications are spread among departments and often do not offer the necessary levels of interoperability. Data may be shared synchronously (e.g., through a remote procedure call [RPC]) or asynchronously (batch updates from various applications). IT centers are constrained by their ability to make and extend these relationships and do so in an ever-shrinking business window.

A distributed environment also presents inherent problems in deploying new applications. Consolidating the server environment may involve creating a consistent naming scheme across the new environment, which greatly facilitates the process of rolling out new applications from a single location. Once the IT center has completed the consolidation process and achieved the desired environment, users can expect more rapid deployment of new applications and features and greater flexibility to respond to changing business demands.

Ultimately, consolidation can lead to a utility computing paradigm, where all resources and data are universally available. Such an environment removes the barriers to innovation and productivity that technology can present. It allows an IT infrastructure that supports highly flexible business models that are not constrained by technology.

Many consolidation projects have proven that they can effectively combine cost efficiency with improved business value and flexibility. The healthcare organization went from an IT structure that was plagued by downtime and inefficiency to an organization that can focus on deploying technology to the best business advantage. The CIO says his organization has turned IT from a cost into an investment. "Our admin people have an opportunity to be more proactive, rather than reactive," he says. "We no longer worry about keeping the system up; it's what can we do next?"

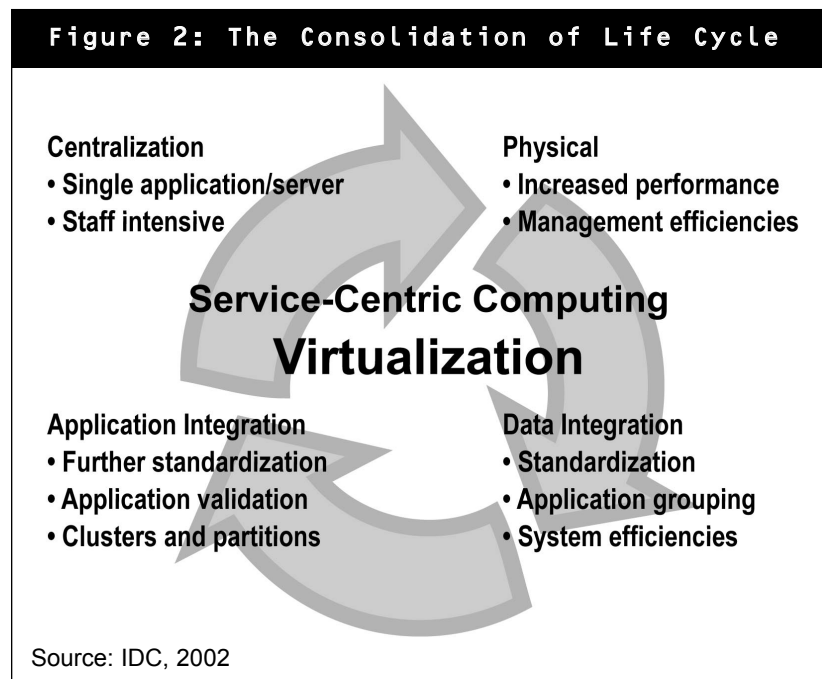


Organizations considering consolidation often face an internal battle from those who argue that centralization leaves the organization more vulnerable to unforeseen events. Many organizations find, however, that consolidation provides the groundwork for implementing greater redundancy and disaster tolerance.

The HP customer that consolidated 85 VAX servers down to one AlphaServer cluster found that the greater control it had in one central system allowed it to mirror that system more effectively. "The new site was built for disaster tolerance," says the manager of systems support. "[Prior to consolidation], we had two disaster recovery systems that took 24 hours to deploy. Now it is a matter of hours."

## DEFINING CONSOLIDATION

Consolidation takes a number of forms, which are best thought of as steps along a continuum that range from fairly simple undertakings to highly complex initiatives. Figure 2 shows the steps involved in consolidation, along with their associated benefits.

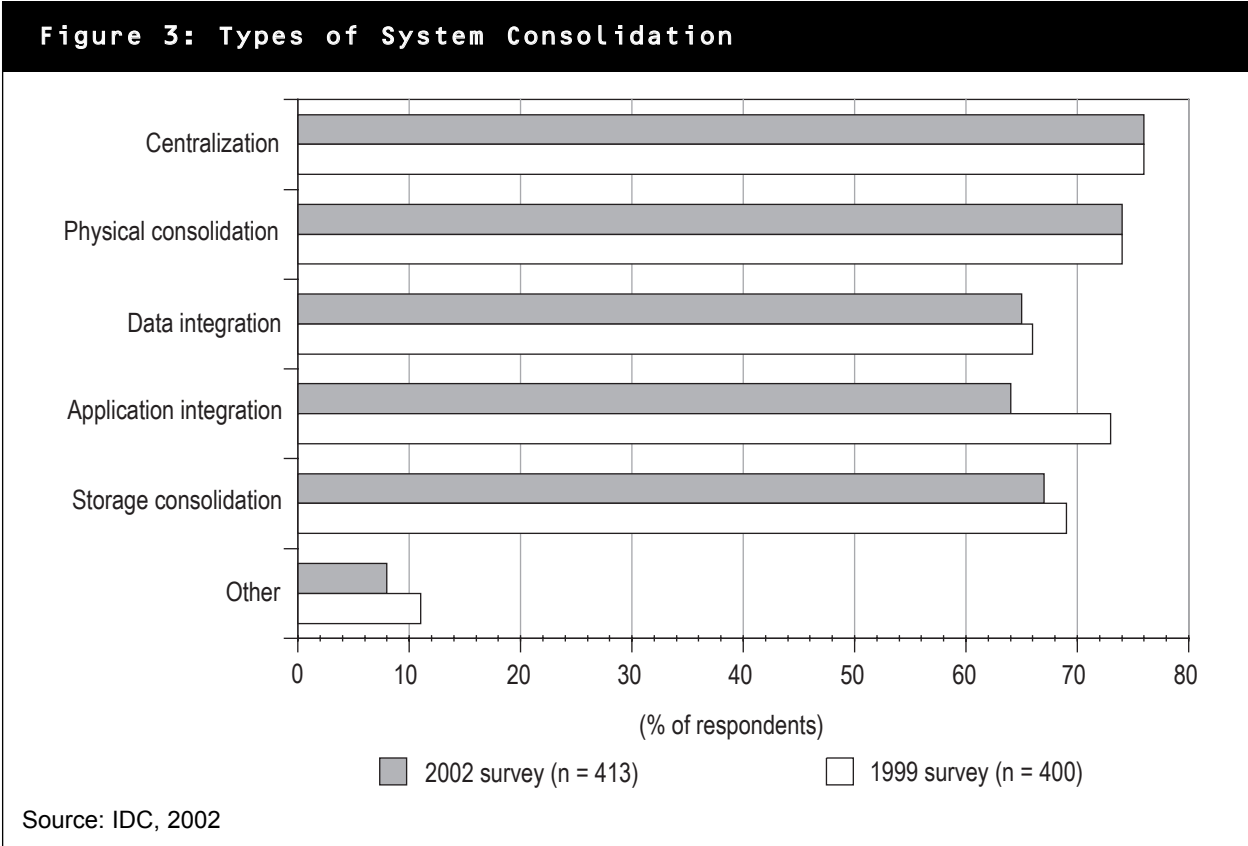


Not all organizations move through the phases at the same pace or in the same order, and most employ a combination of options to address their particular needs. Based on recently completed research, IDC has identified five main types of consolidation:

- **Centralization.** Collocating servers and/or storage into fewer locations or one central location
- **Physical consolidation.** Consolidating servers or storage systems with the same application types or platforms onto fewer or larger systems with the same application type or platform

- **Data integration.** Combining data with different formats onto a similar format or platform
- **Application integration.** Consolidating servers or storage systems supporting different types of workloads onto fewer or larger systems
- **Storage consolidation.** Consolidating storage onto fewer or larger storage systems independent of server type, operating system type, or application

As mentioned earlier, consolidation is rarely a bounded activity; more often, it is an ongoing proposition. Most organizations are pursuing the more basic types of consolidation — centralization and physical consolidation, as shown in Figure 3. IDC expects to see increased activity in the more sophisticated areas of data integration and application integration during the coming years. These activities are much more complicated and strategic in nature, so laying a good foundation by tackling the more basic elements first is important.





## **THE IMPORTANCE OF GOOD PLANNING**

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On paper, consolidation makes obvious sense — replacing a lot of expensive things with fewer, less expensive things. Like any significant IT undertaking, consolidation must start with a business plan before moving on to a design plan, implementation plan, and support plan.

A healthcare provider consolidated multiple systems from five hospitals in a little more than six months, with no hitches, and attributes much of its success to planning. "The planning was key. Project documentation was critical. You may not want to do it, but it is important. Too many people underestimate the importance of the documentation," says an operations director with the healthcare provider.

The business plan requires careful analysis aimed at identifying both the total cost of the initiative and the potential return. The process must include a qualitative review of the requirements of the affected business units or user groups. This process can both secure the support of affected groups and properly set their expectations for the levels of service that will result from the new environment.

Ensuring that executive sponsorship, appropriate funding, and resources are in place to support the consolidation project is also essential. As the project progresses, financial metrics must be carefully monitored to ensure that expenditures are resulting in actual value to the organization.

In planning, organizations must also pay careful attention that their proposed solution meets current requirements and can support future needs. One of the greatest risks in considering consolidation is underestimating future hardware, software, and application requirements. IDC recommends a services-driven approach to consolidation, one that starts from the requirements, works through the design and implementation, and considers the overall return on investment (ROI). The appropriate technology, then, supports the overall business objectives. This is more pragmatic and effective than a plan that starts with a proposed solution and works backwards to justify the need.

Companies should begin the consolidation design plan by carefully assessing their current environments, identifying opportunities for eliminating redundancy, and improving efficiency. This approach includes considering all elements of the infrastructure: systems, storage, networks, system software, databases, and applications. Goals must also be specified for availability, capacity, performance, security, and growth. In the design and implementation phases, each project will require different services, whether they are custom solutions, packaged services, systems integration services, or management and outsourcing of services. Companies should put in place a process for assessing progress against specified objectives throughout the implementation and into production.

The consolidation design plan must address how administrative resources will be redeployed and deal with any pertinent personnel issues. The implementation plan should cover physical deployment, training and organizational issues, porting and migration, programming and reengineering work, and data conversion, as well as a support plan for the new environment.

Communication, change management, and training must be addressed throughout the phases of the project. Keeping both IT personnel and affected users informed about objectives and progress will facilitate the adoption of the new system. The healthcare provider's consolidation effort was driven by the IT organization as a way of replacing its older equipment while consolidating its IT centers into one location. The change was significant for many users, who saw their local datacenters being eliminated.

The CIO stresses the importance of communicating the project's overall success to the affected constituencies: "Throughout the project, we kept our users abreast of what was going on. We bombarded them with information on what was happening and what the benefits are. They now see IT as more than corporate overhead."

Finally, it is essential to look at consolidation as a process of continual improvement rather than a discrete project. Otherwise, the organization may eventually find itself faced with the same problems it set out to eliminate through consolidation.

### **ELEMENTS OF THE CONSOLIDATION SOLUTION**

From a technology and infrastructure point of view, consolidation may encompass all elements of the IT environment, including servers, storage, software and applications, databases, and IT services. A well-designed plan must consider each area in terms of the desired benefit, the state of the current environment, and the applicability of available solutions.

As mentioned earlier, consolidation should be more about improving processes on a continuing basis than about one-time projects. Organizations should develop a plan that takes this into consideration, focusing on short-term milestones but also allowing the flexibility to expand as needs change. A key piece of this planning is investigating how the money saved through consolidation can help to fund subsequent initiatives. By making the right investments, many organizations find that what started as a cost-cutting effort delivers substantial strategic benefit.

An HP customer in the utility industry began a consolidation process because of a serious need to reduce cost. Near bankruptcy, this company developed a plan where investment in technology would actually allow it to lower overall operating costs.

This company's plan was to integrate nine separate database schemas, which had resided on separate systems, into a single, unified data store using AlphaServers, Tru64 Unix, and Oracle9i Real application Clusters (RAC). "We want one place for all our enterprise users to access data," says the manager of IT operations. "We were paper bound. We had forms for everything and were shuffling a lot of paperwork. In the old days, if there was a power outage, we would receive thousands of calls. Customer service reps would stack the forms on the table by location, and the biggest pile would get a crew."

The utility has reduced costs in maintenance and system administration. Beyond cost savings, the company has been able to transform its customer service delivery by the use of reliable, current data. "Spatial data, customer data, crew data are all spokes of the same wheel," says the manager of IT operations. Instead of dispatching crews based on the size of the pile of customer complaints, the company relies on its integrated database to display outages on a map to determine which areas are most critical.

The utility has also virtually eliminated paper entry of data, leading to data that is more current and reliable. "We have pushed the data entry down to the source," says the manager of IT operations. "We don't want a line crew filling out a form and someone else entering the data. We have validations onboard to check the reliability of critical information."

Critical information is also more accessible to those who need it most. Line crews are equipped with laptops, which they use to download and update equipment records and view territory maps and documentation. Before the consolidation, many of the maps in the GIS system were out of date, which created dangerous situations for line crews. Now, they have instant access to current survey data, down to each utility pole.

## **Servers**

Scalability is an important consideration in choosing a server platform. IDC advises users to be generous in estimating the capacity required for the new environment because many variables are difficult to predict and workload demand can be uneven. Multiprocessor and clustered systems that offer good scalability at reasonable cost are well suited to the consolidated environment.

The utility company has found that AlphaServers and RAC offer tremendous benefit in their ability to scale. The database administrator describes it as, "real scalability; starting at four servers in the cluster, it becomes linear. That kind of scalability is hard to come by." Having this kind of scalability allows the company to accommodate a growing workload while doing real capacity planning to meet future needs.

Most IT managers must be able to provide — and, in some cases, guarantee — a specified level of service, making systems and application availability an important criterion. Users expect their applications to be available during the required service window, which is increasingly 24 x 7, especially in organizations that operate across multiple time zones or accommodate Internet-based applications that must always be up and available. In addition, the application must perform as expected with a specified response time.

A large teaching hospital chose to consolidate its IT environment onto HP-UX servers and Windows desktops. The project was driven by the IT department to better serve its user communities. "Management doesn't expect us to do anything but deliver applications 24 x 7," says the director of IT. "They like us to do it for the least cost, without compromising patient care."

The hospital was able to improve its service levels by standardizing its environment around a core set of hardware platforms and software technologies. Having a consistent environment is critical to its ability to provide service to very different sets of users: clinical, administrative, billing, finance, research, and so on. "We have an IT staff of 25," says the IT director, "to service more than 2,500 employees. If we have the same hardware, we can easily replace equipment that needs repair and easily deploy hundreds of systems, all with lower TCO."

Achieving optimum performance levels becomes even more complicated in an Internet world, where the user base and workload are often difficult to define and predict. The basic reliability of the system is certainly a consideration. Failures in disk, CPU, and memory, must be minimized to achieve high levels of availability. IT managers must also be able to allocate system resources to handle changing business conditions and shifting workload requirements while keeping the applications available.

Infrastructure must be very adaptive to changing business needs. The concept of hardware partitioning, once limited to mainframe systems, has become more widely implemented across different classes of systems. Hardware partitioning allows administrators to partition one large multiprocessor system to act like several smaller systems, supporting different workloads, applications, or operating system versions. Failures in one partition are isolated from the others, increasing reliability. Partitioning also gives administrators greater flexibility in configuring the system to support changing workload demands or to support SLAs with different customers. Software partitions, which can be combined with hardware partitions, offer even more flexibility. Processor capacity may be dynamically reassigned based on application and business needs. Through workload management tools, the process of adapting software partitions can be automated based on application response times or service level objectives.

## **Storage**

Storage consolidation can help companies dramatically reduce the high maintenance cost of proliferated storage, more fully utilize storage assets, and improve the quality of storage services that IT offers to the enterprise. Storage consolidation is the pooling and provisioning of shared storage resources. Rather than having storage directly attached to each server and workstation, a network provides access to storage, which is allocated on an as-needed basis. Additional resources can be provided when, for example, a seasonal increase in a customer care application requires them. These resources can be returned to the pool when demand lessens.

For many organizations, the ROI from storage consolidation is tremendous. While enterprise storage can cost twice as much as server-dependent storage to deploy, IDC believes the total cost of storage is lower with enterprise storage due to improved management efficiency. In both cases, management becomes much more efficient, and the labor costs associated with storage management

can be reduced significantly. Organizations see improvements in asset tracking, capacity planning, and performance monitoring and tuning when they manage storage centrally. Consolidated management of storage can significantly improve the backup and recovery process, reducing the time needed to complete backups and improving the availability of the system. Managing storage centrally also increases the reliability and completeness of the backup procedure.

The utility company created a SAN environment as part of its database consolidation. The company now has 200GB in the SAN, which it expects to double during the next year. "We have a scalable SAN and will be able to add storage as we need it," says the manager of IT operations.

It is also wise to be generous when estimating future needs for storage capacity. In many industries, the proliferation of complex data types is driving tremendous increases in capacity. Networked storage is beneficial here because it allows incremental growth without disrupting the environment.

### **Software and Applications**

Although server and storage requirements often drive an organization's overall consolidation plans, streamlining the software and application environment is equally important. In fact, consolidation becomes an opportunity for introducing new software technologies that improve management efficiency, security, and interoperability. Consolidation can be as simple as adopting a consistent software environment across the enterprise, whether distributed or local. Greater efficiency, however, can be gained from examining the products installed and looking for ways to eliminate redundancy and reduce the overall number of products in use. Doing so can lead to significant savings in license fees, asset management, maintenance and upgrades, and administration costs.

It is not unusual to find companies that have hundreds or even thousands of applications to support, many of which are running on individual servers, which results in high capital and operations cost. This problem can be solved by combining different strategies.

Application portfolio simplification helps to reduce the number of business applications by either reducing or combining functional redundant applications or by replacing a large set of small applications with a single enterprise solutions package. This could be an enterprise resource planning (ERP) or customer relationship management (CRM) package or even an integrated employee services portal. Application instance reduction is another strategy to reduce application complexity and save operational cost. This method helps to decrease the number of instances of a given application that are needed to serve the capacity needs of the whole enterprise, as well as potential centralization opportunities for these instances.

Application stacking is another technique, which involves running multiple applications or application instances on a single physical server, using logical or physical partitioning technologies to provide the needed levels of application isolation, limit possible contention, and warrant the required services levels to the business.

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The utility company found that it needed to invest somewhat in training to ramp up for a Tru64 Unix environment, but that consolidation paid off in the longer term. "We were managing multiple platforms and operating systems," says the manager of IT operations. "Now we need to pay less attention to legacy platforms. By eliminating these other environments, we are more effective with one environment."

Many IT organizations must support different operating system environments to effectively serve their customers. If this is a requirement, IT managers should look for a vendor that offers comprehensive capabilities across multiple operating system platforms. Moving toward the datacenter utility concept, the ability to support more than one operating system in the same consolidated environment is attractive. This allows greater flexibility and efficiency in meeting diverse customer application requirements.

## **Databases**

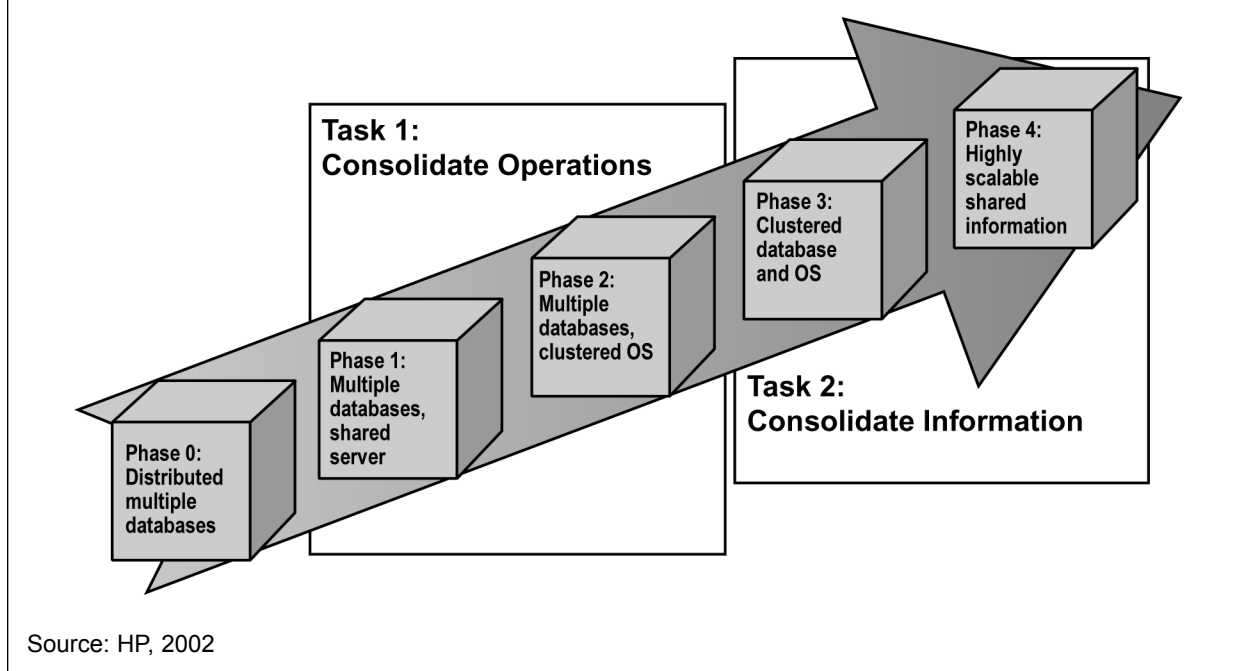
Availability of critical business data is at the core of most organizations' requirements. The need to share data with multiple user bases, using different types of devices and interconnects, continues to increase, as does the volume of data that must be managed. Database consolidation is a way of both reducing the overall cost of managing the data and increasing service. Like consolidation as a whole, database consolidation is often pursued as a series of phases (see Figure 4).

Database consolidation involves moving multiple databases or instances of a database onto fewer powerful servers or clusters. Having a more centralized view of the data can facilitate both management and application deployment. Depending on how the new system is configured, it can also boost availability by reducing planned and unplanned downtime. Cost savings can be realized through lower licensing fees for database software and through lower costs associated with database administration.

The utility company that is consolidating its databases has already realized efficiency gains in database administration, freeing its staff to work on more strategic efforts. The database administrator also serves as a system developer. "The DBA staff went from two full-time people to one, part-time. This is due to the fact that I am not monitoring all of those databases anymore. There is also a reduction in maintenance because the applications are faster, more reliable, and require less time to manage. That allows me to put more time into advancing the technology to stay on top of the business."



**Figure 4: The Database Consolidation Journey**



### **Management**

Management is critical to an overall consolidation solution. The ability to move forward in the ongoing process of consolidation will be gauged directly by the ability to monitor, measure, and predict what needs to happen next. This management scheme should have a focus on common management tools with centralized views for application, servers, network, and storage. This approach will enable more universal troubleshooting, simplified management capabilities, and the needed information for the next steps in the consolidation process.

The management solution must also look beyond the technology to consider how the people, processes, and technology all come together to form the management fabric of the organization. These three elements must work together to provide delivery of services that are aligned to meet the organization's business needs. Consistency in the management environment can deliver tremendous ROI, both in the short term and in providing an infrastructure that is adaptive to meet changing requirements.

### **HEWLETT-PACKARD'S CONSOLIDATION SOLUTIONS**

HP is bringing together HP and Compaq consolidation solutions into a comprehensive, services-led program that encompasses server, storage, and database consolidation on different hardware and operating system platforms.

IDC research has shown that IT consolidation is primarily an installed-base activity, with organizations generally choosing to consolidate with their existing vendors. HP can respond to former HP

and Compaq customers by offering strong consolidation capabilities across its platforms. These elements are unified by the OpenView management solutions and delivered through a portfolio of consolidation-related services. The breadth and depth of its consolidation platforms are powerful assets for HP. It offers highly scalable and powerful servers, from density-optimized Intel-based ProLiant servers to the large Superdome and AlphaServer systems. In the storage realm, HP includes a full range of storage arrays, NAS, tape libraries, network switching, and host bus adapters, which comprise the physical component of the adaptive storage infrastructure. In addition, HP supports Linux, Unix, Windows, and OpenVMS to address customers' specific requirements.

Services drive the consolidation efforts based on a methodology that is founded on analysis of business requirements and ROI. Out of this process comes a plan that covers the design, development, implementation, and support of the consolidated environment, as well as periodic reviews to ensure project objectives are being met.

HP has begun to introduce a series of business practices that will make it possible to implement a truly virtual datacenter. Through utility-based pricing, organizations will be able to pay as they use capacity and gain access to capacity on demand. Such an environment offers a great deal of flexibility while managing costs by associating them tightly with the services being consumed.

### **The Services Approach**

HP uses both in-house-developed and third-party tools to assess the potential business value of a consolidation effort, along with the associated costs. The model looks at consolidation as being made up of several discrete steps, each with associated benefits and costs, which lead to specific outcomes. It provides an assessment of the potential business value by comparing the relevant costs with the benefits of reduced operational cost, better service levels, and increased availability.

To any consolidation effort, HP brings service offerings focused specifically on consolidation, as well as other services from its portfolio, such as high-availability planning. HP begins with a consolidation value-assessment workshop, which helps identify the potential areas of opportunity. A key step is the preparation of an investment justification. HP bases its entire consolidation approach on determining and meeting well-defined, measurable objectives. The program begins with the investment justification and revisits the objectives throughout the process to ensure that the investment is producing a tangible return.

Another deliverable is the architecture blueprint, designed using HP's solution and enterprise architecture methodology. The architecture blueprint, along with the business value justification, provides the functional, business, technical, and implementation views of the consolidation project in alignment with the customer IT strategy and project objectives.

During the actual implementation, a number of different services may be employed, including porting and migration, processes and procedures, testing, and high-availability or business continuity services. HP also offers services that support migration to a SAN to facilitate storage consolidation.

For many organizations, having a third-party partner to assist in the consolidation process can help identify opportunities that might not be immediately obvious and provide objective guidance in both design and implementation. A consolidation project can involve many different technologies, requiring expertise in many areas. HP's broad product and service lines allow it to provide an end-to-end solution, which helps ensure the project is well planned, well run, and delivers on its intended objectives.

### **The Utility Data Center**

Last year, HP announced the Utility Data Center solution, which it sees as the next phase of evolution in computing environments. This is a service-centered model, where information and services are delivered to users on demand in a transparent way. The Utility Data Center solution includes server, storage, and networking offerings that are integrated and deployed by intelligent management software.

Implementing the Utility Data Center solution, IT organizations can become true service providers, reprovisioning and reallocating resources to their users on demand, based on their specific business needs. Service levels, business flexibility, and ROI increase dramatically as idle resources are practically eliminated. As more organizations become convinced of the benefits of consolidation, the move toward this virtual environment will be easier to envision.

### **Hewlett-Packard Server Consolidation Offerings**

HP's consolidation solutions encompass all of its server platforms: Intel-based ProLiant systems running Windows and Linux, HP9000 systems running HP-UX, and AlphaServer systems running Tru64 and OpenVMS. Across its hardware and operating system platforms, HP offers a high degree of capacity and performance with flexibility, ease of management, clustering, high availability, and sophisticated workload management capabilities.

HP 9000 servers provide a strong consolidation platform, with scalability up to 64 processors, a complete partitioning continuum, workload management, and a sophisticated operating system and management environment that supports consolidation at different levels. At the high end, HP offers its Superdome systems for large-scale consolidation projects. These systems balance performance and bandwidth capability to provide a robust and flexible foundation for consolidation and can be implemented on a pay-per-use or on-demand basis. The 16-processor rp8400 and the 8-processor rp7410 also support hardware and virtual partitioning and are well suited to medium-sized consolidation projects.

AlphaServer systems have a strong heritage in server consolidation, stemming from their performance and scalability. In the midrange, the ES systems, which offer up to four processors and can be

clustered up to 96 nodes in multiple sites that can span up to 800km, are positioned for database and application consolidation. The GS systems, with up to 32 processors, are positioned for the highest availability and workload requirements.

The ability of HP-UX Tru64 Unix and OpenVMS to support business-critical applications has steadily increased, making them very capable platforms for consolidation of applications such as ecommerce, business intelligence, and business processing. All platforms offer partitioning, workload management, resource allocation, clustering, and failover capabilities that allow the flexibility and resiliency needed in a consolidated environment. In addition, HP-UX, Tru64 Unix, and OpenVMS all have the ability to support hot-swappable CPUs and other critical components, providing even higher levels of availability for mission-critical environments.

System partitioning is an important part of supporting demanding application requirements in a consolidated environment. The ability to segment a single system into several smaller systems allows multiple instances of the operating system to be supported. This capability improves efficiency by allowing applications to be run where they are most effectively supported. The partitions can be set to dynamically reconfigure the system based on changing workload requirements. Partitioning also boosts availability by allowing for testing, upgrades, and maintenance on segregated partitions and by isolating software faults.

Partitioning allows extensive flexibility in how systems are configured, which is desirable in building a consolidated environment. The partitions can be configured, for example, to support multiple instances of the same version of an operating system to create an environment that simultaneously supports production, development, and testing. Another possibility is running different versions of the same operating system to support different applications' requirements, legacy applications, or testing of new software. Partitions can also support different operating systems, which may be attractive in a consolidated environment with diverse application requirements.

In addition to system partitioning, HP offers a wide range of workload management solutions across multiple operating systems to allow its customers to meet SLAs and guarantee quality of service at all times. HP has outlined its plans to merge key features of Tru64 Unix into HP-UX. These features include TruCluster capability, advanced file system, and dynamic tuning capabilities, which are essential in providing high levels of performance and availability.

For many years, the OpenVMS operating system has offered outstanding clustering and availability capabilities and is recognized for its ability to provide mission-critical application support and disaster tolerance. Many organizations rely on OpenVMS to consolidate older VAX systems or smaller AlphaServer systems. The OpenVMS Galaxy software that is bundled with OpenVMS supports both soft and hard partitioning. It provides the capability to provide memory and dynamic CPU resource reallocation within cabinet clustering between different operating system partitions on AlphaServer GS160/320 systems. OpenVMS also supports the system management, clustering,

and resource allocation capabilities that form the foundation of a consolidated environment.

There are significant benefits to be gained from consolidation in the standard Intel architecture server (SIAS) market space. Many organizations have found that these small, relatively inexpensive servers have proliferated, leading to an environment that is inefficient and difficult to manage.

The typical workloads found in this space, such as collaborative, file and print, and LAN serving, make a natural fit for consolidation, as they are easily divisible. Many organizations are incorporating consolidation efforts as part of their regular technology refresh cycles, using upgrades to new versions of Microsoft Windows and Exchange as consolidation opportunities.

As clustering and more sophisticated management capabilities have become available on these smaller servers, HP's ProLiant series has become an attractive consolidation platform, due to its small footprint, high levels of functionality, strong integration with other platforms, and HP's service capability.

Among the important consolidation attributes these systems offer are fault resilience, dynamic resource scaling, and remote, automated management. ProLiant systems are valued in situations where they must operate in a lights-out fashion, without extensive management or operator intervention. Their intelligent fault resilience capabilities allow them to proactively anticipate and respond to fault conditions, improving their availability and reducing the need for management attention. Through dynamic resource scaling, system resources are transparently reallocated based on workload demands.

Included in Workload Management Pack (WMP) optional software for ProLiant systems is the HP Resource Partitioning Manager. The manager allows the configuration of resource partitions that allocate a specific amount of processor and memory resources to specific applications. This allows system managers to establish boundaries that both ensure sufficient resources are available to applications and manage the consumption of resources. Another HP healthcare customer relies on ProLiant systems to manage its patient information and give medical professionals access to the information they need to make critical decisions. Nearly 30,000 employees have on-demand access to patient records concerning diagnoses, treatment histories, and test results.

This organization, which comprises several of the largest hospitals in the United States, is approaching consolidation in a phased manner. First, it chose to streamline its deployment and management processes by implementing consistent hardware and software platforms and instituting standard procedures across the environment.

The results include not only better patient care but also a protection of the IT investment and an ability to adapt the infrastructure more quickly. The organization can now launch a new application within a week, instead of the 12 weeks required before the streamlining.

Upgrading or even adding new systems is also much more efficient, because the environment is standardized.

The healthcare organization is now looking to further consolidate its environment by reducing the overall number of industry-standard servers. Its objective, facilitated by using HP's ProLiant products, is to reduce the number of servers by more than 40%, conserve datacenter space, lower license fees, and further consolidate the management of mission-critical applications.

### *The Managed Environment*

Managing the infrastructure is essential to reducing IT costs. Management software provides a consolidated view and optimizes the enterprise's entire heterogeneous environment, including networks, servers, applications, and storage.

It also provides a way of managing IT as a set of business services as opposed to merely managing the infrastructure over which IT services are delivered. This infrastructure management software supports a business-driven approach to reengineering IT focused on delivering IT services to business customers at agreed-upon service quality and cost.

HP OpenView provides integrated fault, performance, and service-level management and proactively manages networks, systems, applications, services, and storage. HP OpenView's comprehensive portfolio manages and optimizes services that run over complex, multivendor IT, voice, and data infrastructures. Managing from a service perspective not only provides an understanding of every element that can ultimately affect service performance but prioritizes and resolves problems before they impact service levels. OpenView solutions enable companies to understand, manage, and optimize the user experience (top down), the infrastructure elements (bottom up), and the direct linkage between the two.

### **Hewlett-Packard Database Consolidation Offerings**

HP has worked with Oracle on technology that enhances database performance and reliability, and has established partnerships to help organizations better implement these capabilities.

Like IT consolidation, database consolidation is a continuum involving different phases of consolidating the organization's operations and information. The first phase involves moving multiple databases onto a shared server to reduce hardware and associated requirements. In the next step, multiple databases are deployed across a clustered operating system to begin to take advantage of higher levels of availability and manageability. The next phase involves clustered databases and operating system. The final goal, for many, is to create a highly scalable virtual environment, where all data is readily and transparently accessible.

Compaq began a partnership with Oracle to integrate elements of its TruCluster technology into Oracle9i RAC. Using RAC, organizations can deploy a clustered database or series of databases that take



advantage of the high availability, performance, and scalability offered in a clustered environment. Multiple databases or instances are managed as one database, greatly simplifying administration and improving service levels. HP is in the process of making these capabilities available on HP-UX and moving components of HP-UX, such as partitioning and MC/ServiceGuard, into RAC.

HP has a partnership with Oracle to offer clustered database server packages based on the AlphaServer ES systems. It offers preconfigured Oracle9i RAC Tru64 OpenVMS installations as well. The two companies also provide services through both their consulting organizations that manage the design, implementation, and management of the consolidated solution.

### **Hewlett-Packard Storage Consolidation Offerings**

Compaq began to outline a vision for storage as a utility with its Enterprise Network Storage Architecture (ENSA). The primary objective of ENSA was to create a portfolio of products that were modular, scalable, and highly available — key aspects for consolidation. HP continues to build on that vision, supporting storage consolidation at a number of different levels, from consolidation on a single system, to SANs, to a truly virtual storage utility environment.

Today, with ENSAextended, HP has expanded the tools for consolidation by adding management capabilities, presenting data in more application-centric ways, and providing a business perspective of storage. The company does so by building on its existing foundation of network storage and centralized management to deliver automation with capabilities that will make it easier to control the storage environment and reap the business benefits of consolidation that only an adaptive storage infrastructure can deliver.

### **CHALLENGES**

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During 2002, the profile of the IT consolidation market has risen for all major server and storage systems suppliers. As a result, HP's IT consolidation initiative will face a wide range of competitive challenges in the marketplace. Much of the ongoing consolidation work in the industry is platform specific and often focused on Windows NT/2000, Unix, and OpenVMS. Consequently, HP will see a comprehensive set of competitors targeting both efficiency-based volume opportunities and more strategic value-based initiatives. Because end-user goals are often so varied, it will be important for HP to listen closely to each customer's needs and package an IT consolidation solution that meets short-term needs and provides a platform for future IT growth.

Although many end users are more familiar with the benefits of IT consolidation than ever before, it can be a challenge to help customers fully understand the business value IT consolidation can bring to an enterprise. Additionally, since most consolidation does not involve migrating users from competitive platforms, executing a successful consolidation strategy often requires hardware suppliers to target their own installed base. This challenge can be addressed

through education, which highlights the options available to the customer. In the same light, it is important that customers understand that IT consolidation is not just about a reduction in the number of servers installed, but it is instead fundamentally linked to higher-level business needs. HP must demonstrate not only its full suite of server, storage, software and services offerings but also the applications and benefits of these new technologies.

## **CONCLUSION**

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For IT organizations, IT consolidation is about delivering business value, and any consolidation effort must be driven by business priorities. While the primary driver is often a desire to reduce costs, consolidation can also present opportunities to realign business processes for efficiency and greater strategic value. As HP's utility customer realized through a consolidation project, "Senior management was wise enough to realize that spending money on technology is a way to cut cost. We can now implement some things we could not do before. There is an awareness that technology has to be moving forward."

It is possible that the initial cost savings returned through consolidation can even fund new technology initiatives. In any case, organizations must focus on delivering the value associated with an IT infrastructure that is more efficient and more adaptive rather than consider consolidation as a one-time venture.

HP's approach to consolidation takes this to heart, focusing on assessing the potential business value and then providing a solution that delivers it in the most cost-effective form. HP is both pragmatic and forward thinking in its consolidation programs. It helps organizations focus on immediate opportunities for savings while also planning and managing an infrastructure that will continue to deliver business value into the future.

HP recognizes that consolidation is not just about servers and storage but encompasses the people, processes, and technologies that form the fabric of the IT infrastructure. It encourages its customers to adopt an attitude of continual process improvement to ensure that the benefits of IT consolidation are ongoing.

The Utility Data Center solution is promising; IDC believes the IT industry is moving toward a model of delivering computing services on an as-needed basis. HP has begun to deliver products, services, and solutions that make such an environment possible. It must continue its efforts to educate organizations on the benefits of utility computing and to demonstrate its applicability.

HP's consolidation solutions are founded on substantial technology: powerful and scalable systems, sophisticated system management software, clustering and high-availability capabilities, and storage hardware and software. The company's services-led consolidation programs help organizations maintain focus on both the business

issues and the processes that are essential to implementing a successful consolidation effort.

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