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Tivoli software
IBM TotalStorage™

IBM storage solutions:
Evolving to an on demand
operating environment



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e-business on demand

The business environment today requires real-time responsiveness to change – whether it is new demands by customers, changes in the supply chain or unexpected competitive moves. Lowering costs is also an issue – fixed costs need to be turned into variable costs that scale with business volume. And don't forget beefing up your resiliency to threats – be they computer viruses, earthquakes or sudden spikes in demand.

To a large extent, success in the on demand world depends on your ability to leverage information technology. Because IT infrastructures are traditionally built along functional lines (finance, sales, manufacturing and so on), the applications, operating systems, databases and hardware platforms often fail to communicate effectively. In an on demand model, however, IT services would be capable of spanning multiple business processes. Eliminating silos of information could help companies support better, faster decisions and provide comprehensive services to customers.

Greater dependence on information means greater dependence on storage. The impact of evolving your storage systems to an on demand environment could help produce a positive ripple effect throughout an enterprise. Access to consolidated information could support more integrated business processes; better resource utilization can help reduce costs. Automation of routine storage management tasks would help enable your IT staff to focus on providing better service to users, and improved data protection to shield important information from unforeseen threats – providing greater resiliency to respond to unanticipated events.

Integrated information fuels on demand businesses

At its most basic level, the IT foundation of an on demand business relies on integrated systems to allow the business process interactions throughout the IT environment to leverage the appropriate data regardless of its source. Integration not only helps enable better real-time decision making, but it also provides critical support for systems – such as online self-service initiatives – that can make your organization more responsive to customers.



Obviously, integrated storage is essential to integrated information systems. The traditional model of storage directly attached to distributed servers makes it difficult to share data among host servers because of networking bottlenecks as well as format and device incompatibilities. These weak links can make sharing data among host servers difficult. However, by consolidating data into centralized pools of storage, you can avoid the pitfalls of the traditional storage model. With a consolidated storage environment, you can be positioned to leverage emerging technologies that will allow many servers to share information quickly and securely.

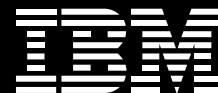
In addition to enabling business process integration, storage consolidation can also address another critical aspect of the on demand paradigm: the efficient use of resources. The economies of scale and simplified administration enabled by centralized storage can help reduce costs and improve responsiveness to changing demand.

Server and storage utilization is shockingly low. The problem originates with inexpensive servers – millions of them – sprouting up in data centers and departments around the world. Improving on the 5 to 15 percent server and storage utilization rates common to distributed servers can generate massive savings. Moreover, consolidation can lead to improved performance, reliability and scalability – all essential in an on demand world.

Integrated systems require common, open standards

The benefits of open standards are self-evident. Integrating information systems means that connections among components must be well defined. The ability to integrate these components across business systems as well as within your IT management environment is dependent, in part, on the level of conformity to open standards.

Open standards support choices, which cause vendors to compete to provide the best products at the best prices. This competition not only helps drive prices down, but it also helps prevent your business from getting locked in to any one vendor. Standards that support the move to on demand computing already exist – and more standards are on the horizon, which will enable new capabilities. For example, IBM embraces an emerging standard known as the Storage



Management Interface Specification (SMIS). Currently overseen by the Storage Networking Industry Association (SNIA), the SMIS aims to help IT managers monitor and control devices, file systems, databases and other networked storage resources – regardless of vendor. It also supports more powerful management products and will include support for legacy storage products.

Virtualization facilitates on demand computing

One technique for enhancing on demand computing is called *virtualization*. In a virtualized environment, applications request services – such as processing or storing data – by defining service levels for fulfilling their requests. The serving entity, such as a cluster of servers or a storage pool, can be leveraged to fulfill the request in the most optimal way.

Storage systems can leverage virtualization techniques in exciting ways. Figure 1 shows how storage virtualization fits into an on demand computing environment. Application owners describe their storage needs in terms of capacity, response time, cost and backup frequency. Storage administrators can then provide an agreed-upon level of service however they see fit.

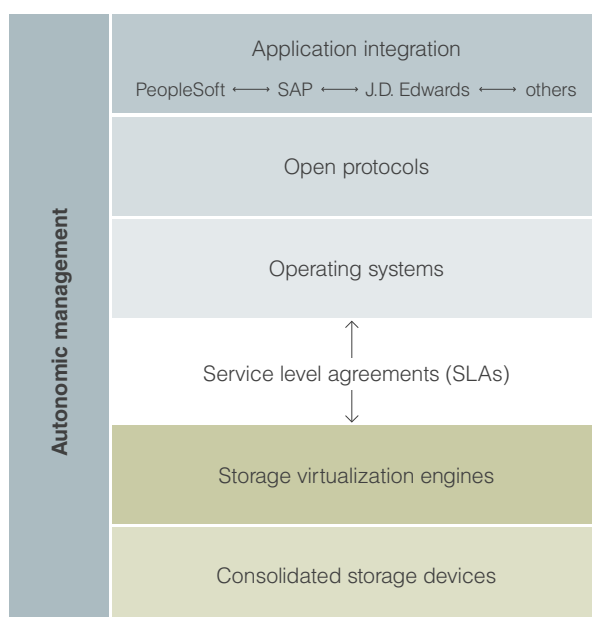


Figure 1. Storage virtualization helps support the needs of an on demand business.



Virtualization gives IT administrators greater flexibility in allocating the capacity of their systems. This flexibility can lead to higher resource utilization, greater availability and more options for supporting business continuity despite equipment updates, failures, security threats and disasters.

Virtualization is particularly relevant to storage area networks (SANs) because they are the preferred architecture for sharing large pools of storage. Servers connected to a virtualized pool of resources in the SAN are shielded from the physical storage devices. Through centralized management tools, administrators can make changes to storage allocation, such as increasing volume sizes or moving volumes to alternative storage devices, without affecting the applications using the storage and without the physical administration required in traditional distributed storage architectures.

Consequently, on demand businesses can use virtualization to help lower costs and improve flexibility and application availability. The ability to make transparent changes to storage resources could also help eliminate costly downtime. This approach encourages more-efficient use of existing capacity and reduces the amount of storage your company needs to hold in reserve to handle spikes in demand. The result could be not only equipment savings, but also reduced growth in staffing and training.

Automation cuts costs, frees administrators from routine tasks

Just as the human nervous system regulates itself, computer technologies can not only help hardware and software manage themselves, but also anticipate needs and perform preventive maintenance. For example, if a server detects that its storage space is becoming scarce or if a server finds higher-than-normal recoverable error rates in the SAN combined with slower-than-normal performance, it may notify a system administrator and take a predefined evasive action – such as dynamically increasing the space or isolating a failing component in the SAN.

The word *autonomic* describes this self-configuring, self-healing, self-optimizing and self-protecting ability. Through its autonomic computing initiatives, IBM aims to help free IT personnel from managing routine administrative tasks – to help users lower costs and allow IT personnel to focus on higher-level business needs.



Autonomic technology can benefit almost any device and can take several forms. First, a system can be *self-configuring*, which means it detects its environment and recommends or implements configuration settings. Second, it can be *self-healing*, whereby it performs self-diagnostics and notifies administrators of issues or errors as well as potentially taking actions to address the issue. Third, it can be *self-optimizing* in its ability to sense workload trends and manage tasks such as system availability. And last, it can be *self-protecting* in monitoring security and taking measures to improve security.

Used together, these advances contribute to simpler IT management, better resource utilization and improved system availability. Automation can prevent storage problems before they happen, and when they do, it can help speed resolution of problems, including quick restores of critical data in case of disaster.

Evolving to an on demand environment

Nobody just flips a switch to instantly transform a company into an on demand IT environment. Migrating to on demand computing occurs over time. However, evolving your IT infrastructure to support an on demand business model can yield substantial potential dividends – enabling your business to be more responsive, making costs more manageable and predictable, adding resiliency, and freeing employees from routine administrative tasks to focus on your company’s core differentiating capabilities.

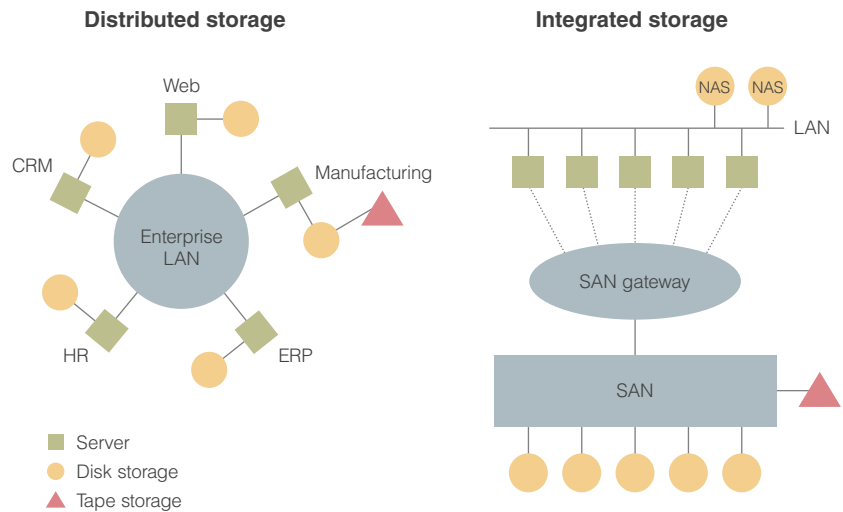
The evolution to on demand computing typically occurs in four areas.

Consolidate

Consolidation is the first step on the path to an on demand storage infrastructure. The left side of Figure 2 shows a typical distributed server environment with storage attached to individual servers. This architecture reinforces silos of information because the enterprise local area network (LAN) does not have the capacity to integrate business processes. Its distributed nature and complexity result in high administration costs and a great deal of inflexibility in responding to shifts in demand. Resource utilization is low and resiliency is expensive to provide. By consolidating storage into larger integrated pools, as shown on the right in Figure 2, the storage infrastructure can be shared across servers. Centralized pools can make management much easier and create economies of scale – helping to improve resource utilization and reduce hardware costs.

SANs – specialized high-speed networks that fulfill the storage needs of many servers – offer today’s best solution for enterprise-scale storage consolidation. Within these networks, SAN switches and gateways act much like a LAN, regulating the flow of data at high speeds using Fibre Channel connectivity.

Network-attached storage (NAS) is a complementary approach for shared storage. Disk subsystems attach directly to a LAN and are shared by several servers. NAS gateways can leverage the SAN infrastructure by providing storage to servers through the LAN.



In the traditional distributed model, data is spread across the enterprise in storage systems attached directly to application servers. Data sharing is limited by the speed of LAN and server capabilities, while storage management is inflexible.

SANs and NAS improve data access by pooling storage resources onto a high-speed network. Centralized management tools provide flexibility for resource allocation and simplify management tasks.

Figure 2. Consolidated storage pools on a SAN enable integrated business processes.

By concentrating systems and resources into fewer geographical locations with a smaller number of more-powerful servers and storage pools, you may be able to increase IT efficiency. Data and application integration can help simplify systems management and improve security. Centralized storage management tools can contribute to better scalability, higher availability and improved disaster tolerance.



Virtualize

Storage virtualization is intended to reduce complexity and opens the door to dramatically better resource utilization. Insulating your storage systems from your applications may not only help reduce capital and administrative costs, but also can enable better services and availability to users. Without changing applications or disrupting user behavior, virtualization could make your IT infrastructure more responsive, scalable and reliable.

New architectures in SAN-based file system and volume management will help you implement virtualized storage.

First, virtualized volume management consolidates the variety of volume management functions into a single point of control in the storage network. It is designed to unify and centralize the management of storage pools across multiple storage controllers in an open-systems SAN environment. It enables administrators to reallocate and scale storage capacity as well as make changes to the underlying storage systems without disrupting applications. Virtualization will also help give storage administrators the flexibility to use a wide range of devices from many vendors.

A second new layer of virtualization is a common file system that is designed to provide a central point of file system management for provisioning storage capacity on demand—resulting in greatly improved utilization. It is intended to help improve application availability and reduce application downtime for storage and data management tasks by allowing you to make additions or changes to your storage with minimal disruptions. It will also be capable of facilitating data sharing—at high speeds—across open-systems servers and applications. By moving intelligence from devices and servers onto the storage network, these virtualization products are intended to provide more flexibility and centralization in managing data and storage resources—contributing to lower administration costs.

Automate

Choosing storage components with autonomic capabilities could help keep costs down while improving availability and responsiveness. Given that storage needs will only continue to grow in the future, autonomic capabilities could help protect your data.



Autonomic techniques have evolved quite a bit from the early days of error-correcting code (ECC) and Redundant Array of Independent Disks (RAID). IBM builds autonomies into many of its storage products. Today, for example, capacity upgrade on demand with auto-configuration helps eliminate traditional upgrade outages. Other applications of autonomic technology include IBM Predictive Failure Analysis®—which uses recoverable error thresholds to determine when a component should be fenced off—and redundant, hot-swappable hardware that enables continuous operation while components are replaced.

IBM storage management software products are designed to proactively diagnose storage systems from end-to-end—helping to prevent and heal problems before they escalate—creating a more reliable, less costly storage environment. This software also can help consolidate information about the storage environment and dynamically take action to prevent problems based on predictions. Actions are based on policies set by storage administrators (such as automatically growing resources, archiving or deleting data, and migrating data out of storage pools).

IBM continues to expand its self-configuring and self-optimizing autonomic capabilities. For example, storage subsystems will soon be able to allocate variable amounts of cache per workload and storage resource management software will recommend logical unit number (LUN) allocations. The upcoming common file system is being designed to provide automation at a file level, such as the automatic placement of files based on class of service.

Integrate

Integrating storage management with the broader system-wide management tools and processes can help minimize business risk. The ultimate value of an on demand environment will be how it facilitates this integration of data across your business processes and also that it frees up resources to work on this integration. When all servers have secure access to all data, and when your data, storage, servers and business processes are managed from an integrated view, your infrastructure will be positioned to respond better to the information needs of an on demand world.



Integrated storage solutions from IBM, organized under both the IBM TotalStorage™ and IBM Tivoli® brands, can help IT managers evolve to an on demand operating environment.

For more information about e-business on demand™ and IBM storage, visit ibm.com/ondemand, ibm.com/totalstorage and ibm.com/tivoli

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