

Data center virtualization

A Dell Technical White Paper | August 2011

Lay the foundation for impressive
disk utilization and unmatched
data center flexibility



Compellent

Executive summary

Many enterprise IT departments have attempted to respond to growth by adding servers and storage systems dedicated to specific applications, business functions, customers and geographic locations. In many cases, the result has been a complex, inflexible infrastructure that is difficult and costly to manage. Virtualization technologies are the generally accepted way to solve these issues.

Server virtualization allows several applications to run independently on a single physical server, an important first step toward achieving a virtualized environment. But by combining server virtualization with storage virtualization, enterprises can achieve the full benefits of virtualization. Consolidating resources through data center virtualization techniques can improve return on IT investments, boost IT productivity, increase system reliability and availability, and ultimately enables IT to meet the needs of the business.

There are several field-proven virtualization software and hardware products available, including Dell Compellent™ Fluid Data™ storage virtualization and VMware® vSphere™ server virtualization. This white paper will discuss the benefits of combining Dell Compellent storage virtualization with VMware server virtualization for large and small enterprises.

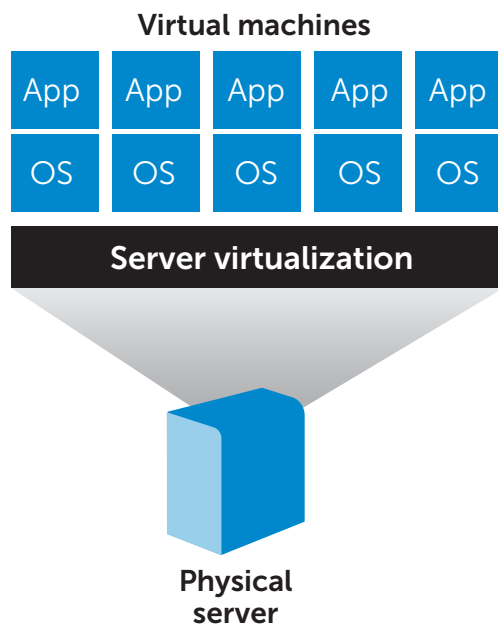


Figure 1: Server virtualization software allows multiple server instances to run on a single physical server.

Virtualization improves utilization and reduces costs

The fundamental technique for consolidating data center resources is virtualization. Virtualization creates a pool of servers, storage and other infrastructure resources that applications can share. Because applications draw from the resource pool without specifying the type of processor, memory or storage required, the IT department gains the flexibility to choose the best underlying components. Meanwhile, as new virtualization tools become available, those technologies easily can be added to the pool, further enhancing the reliability and availability of IT services while boosting IT staff productivity.

Server virtualization increases IT flexibility

Server virtualization increases IT flexibility and reduces equipment and labor costs by consolidating applications and workloads onto fewer physical servers. Rather than using five separate physical servers for five distinct applications, enterprises can employ VMware vSphere to run all five applications on the same physical server. Figure 1 illustrates five virtual servers running on a single server.

On that physical server, administrators create distinct virtual machines (VMs) that host operating systems and applications. Each VM is completely isolated from the others and operates as if it has a dedicated set of resources. But in fact, the VMs share the same physical resources. Virtualization management tools such as VMware vCenter Server enable IT administrators to dynamically adjust the size and number of VMs as computing needs change.

Decreasing physical servers means less complexity and reduced software licensing and operating costs (for space, power and cooling). In addition, server virtualization offers important advantages for testing and development. By creating VMs, administrators can establish full-fledged test and development environments by simply copying the production environment onto test VMs. Through server virtualization, enterprise IT departments can reduce the need for dedicated test systems.

Storage virtualization extends the benefits of server virtualization

Server virtualization offers several important advantages, but to reap its full benefits, enterprises must overcome significant storage challenges. In many IT infrastructures, storage is directly attached to servers and cannot be shared beyond the physical server. Storage area networks (SANs) let servers share a centralized pool of storage resources. But virtualizing storage on a SAN is only the first step.

Traditional SAN offerings can experience some of the same stumbling blocks as direct attached storage in a virtualized environment. In fact, sometimes server virtualization actually complicates traditional SAN solutions. When virtualized server environments are coupled with traditional storage, administrators must fine-tune storage requirements for each application. An application might benefit from a particular server interface, disk drive type or speed, RAID configuration, or snapshot schedule. But when the virtualized server environment is directly attached to storage, all of the applications running on the physical server are forced to use the same storage with the same storage characteristics. Traditional SANs do not solve this problem. They offer only a limited number of volumes, not enough to accommodate each of the large number of applications that can run on a virtualized server.

To take full advantage of server virtualization, IT departments need a storage solution that allows fully shared resources, easy and automated storage classification and migration, and complete data protection.

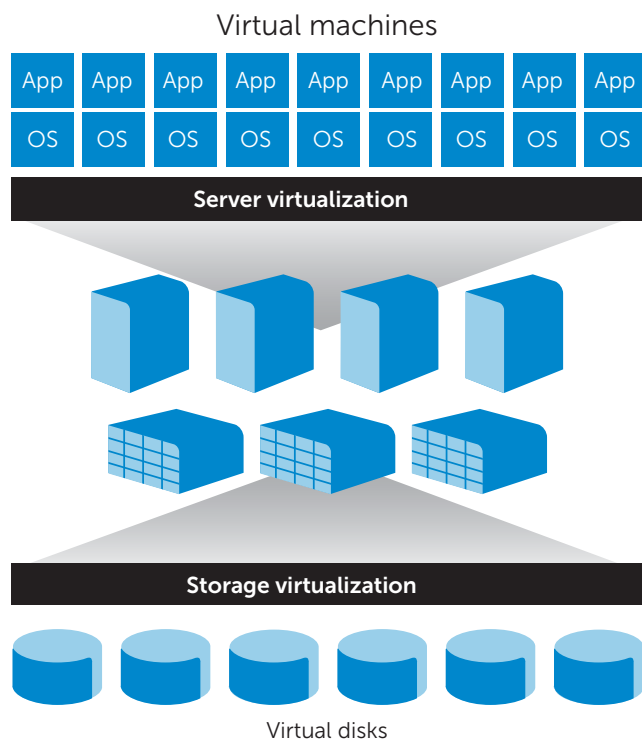


Figure 2: Server virtualization and storage virtualization combine to create a powerful data center virtualization solution.

Create a powerful data center virtualization with Dell Compellent and VMware

It is only through data center virtualization — virtualizing both storage and servers (as illustrated in Figure 2) that enterprises can fully benefit. Dell Compellent Fluid Data storage features many key integration points with leading server virtualization software, including VMware vSphere, to form the foundation for data center virtualization.

Dell Compellent Fluid Data storage provides a full range of storage virtualization capabilities alongside other features that complement server virtualization initiatives and enable a complete data center virtualization solution.

Thin provisioning

Traditional SAN implementations require pre-allocation of disk space, and storage is under-utilized. For example, an administrator might pre-allocate 2TB of disk space for an application in anticipation of growth over the next two years. But if only 500GB of that storage is used within the first year, the other 75 percent of that allocated space remains unused. Administrators are often reluctant to purchase and allocate storage in smaller increments, however, since allocating storage can be a complex and time-consuming process that interrupts availability for users.

With Fluid Data storage, there is no need to pre-allocate drive capacity to volumes before that capacity is used. Dell Compellent dynamic capacity allocates storage in real time when data is written to disk. This approach, also called thin provisioning, can dramatically increase storage utilization while reducing the need to over-provision capacity in anticipation of future growth. As a result, enterprises can purchase significantly less storage than they would need in a non-virtualized storage environment.

For example, an enterprise might use VMware vSphere to create 10 virtual machines on a single physical server. Each of those virtual machines might require 1TB of storage. Without virtualizing storage, the enterprise would need to purchase 10TB of capacity to satisfy the applications' requirements. Figure 3 shows how enterprises can create a virtual storage volume for each server based on a single terabyte of storage with Fluid Data technology. Each application has access to the full amount of storage it needs. If and when the enterprise actually requires more storage capacity, the administrator can simply add storage capacity while applications remain online.

Dell Compellent enables administrators to create an unlimited number of virtual storage volumes across a SAN and then match those volumes with individual applications running on VMs. As a result, administrators can fine-tune storage characteristics for the individual applications. Each application can use the optimal server interface, disk drive type or speed, RAID configuration, and snapshot schedule. Fluid Data technology lets administrators create an unlimited number of volumes, in turn supporting the large numbers of applications running in virtual server environments.

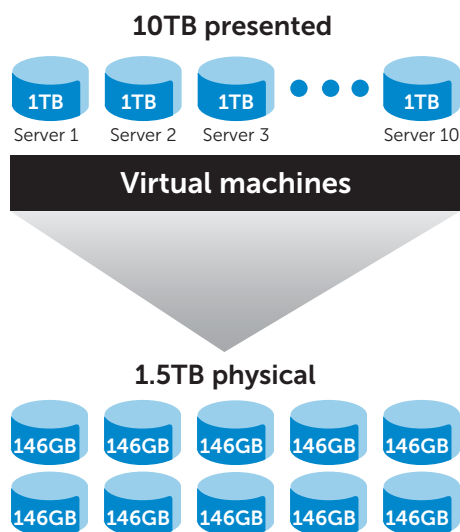


Figure 3: Dell Compellent dynamic capacity can present 10 virtual storage volumes, 1TB each, for use by 10 unique VMs based on only 1.5TB of physical capacity.

Automated tiered storage

The complexity of managing SANs is amplified by the use of multiple storage classes. Most enterprise SANs have a combination of faster (expensive) and slower (economical) storage to provide several price/performance options in an effort to optimize costs. But managing a multi-class SAN can be labor intensive. Administrators need to effectively analyze data usage and manually migrate data to the most cost-effective storage. Otherwise, they risk leaving unused data on expensive, high-performance drives.

Dell Compellent data progression optimizes tiered storage by tracking usage and automatically moving data between storage tiers and RAID levels based on user-defined rules. Frequently accessed data remains on high-performance storage, while inactive data is pushed to more economical storage tier and/or lower RAID level. By automating this process with the built-in algorithm, IT staff has more time to address more strategic tasks. Moving inactive data off high-performance drives can also help improve performance for all VMware instances by freeing up Tier 1 spindles to be used for performance-intensive applications.

Continuous snapshots

Data protection is a challenge for typical SANs. For enterprises that use RAID storage, the cost of adding storage capacity is significantly increased by RAID overhead. When storage is pre-allocated to specific applications, much of that expenditure will be for allocated but unused space. Mirrored SANs intensify these costs. Using Dell Compellent data instant replay, enterprises can purchase less storage while continuously protecting data.

Data instant replay automatically creates space-efficient snapshots, called replays, which protect data against loss or corruption. These replays do not require full-volume clones during the creation or recovery process. The Dell Compellent Storage Center SAN simply maps the replay as a logical unit number (LUN) to be used by the server. Negligible storage is consumed for mapping. Replays can be mapped any number of times as read/write volumes. In fact, the size of the replay grows only to accommodate changes as blocks are modified. This efficient use of storage, compared to other SANs, means many more replays can reside in a given amount of physical storage. Also, integration with data progression ensures that replays automatically move to the lowest available tier within 24 hours of capture, freeing Tier 1 space for new writes and highly-active read/write blocks.

With data instant replay, administrators can also restore recovered data extremely rapidly. In the event that a file must be rolled back to a previous point in time, data instant replay does not need to restore the entire volume; it simply restores the blocks that contain changed data. Replays can also help administrators test new applications and service packs, efficiently support server Boot from SAN operations, and virtually eliminate backup windows on production systems.

When combined with VMware technology, data instant replay is designed to recover VMs within 10 seconds. This sophistication leads to a highly available and completely protected data center.

Current volume



Replays



Figure 4: Example of multiple replays taken at successive points in time. These replays can be used to provide granular data protection for VMware server instances.

Remote replication

For even greater data protection, Dell Compellent remote instant replay enables organizations to replicate storage volumes between multiple locations. Administrators can create any combination of replays at local and remote locations, or establish frequent local replays with periodic replication to a remote location.

Using data instant replay and remote instant replay together provides a high level of protection with a minimum investment. Administrators can replicate multiple volumes to multiple sites space efficiently, as only block-level changes in data are replicated. And they can opt to utilize existing IP networks rather than more costly fibre channel data links.

Using remote instant replay in VMware environments allows businesses the flexibility to easily replicate entire server instances off site.

Dell Compellent and VMware provide data center virtualization

With Dell Compellent and VMware, data center virtualization can be deployed today, allowing enterprises to realize several immediate and tangible benefits.

Reduced costs

Using server and storage virtualization, enterprises can consolidate their infrastructure into resource pools that have fewer servers, disk drives and enclosures. By consolidating resources, organizations can lower equipment and administration costs. Infrastructure consolidation also reduces power, heat and cooling expenses while decreasing the physical space needed for equipment.

Enhanced IT productivity

Consolidated infrastructures are simpler to manage. They often require lower IT skill levels than complex, widely distributed infrastructures. Dell Compellent and VMware also provide powerful tools to deploy new servers and allocate storage for new applications, changing workloads and maintenance needs. VMware VMotion enables administrators to move functions from one VM to another, or one physical box to another, with straightforward workload management tools. Moving volumes between storage systems is accomplished with equal ease using Dell Compellent live volume.

Greater system availability

If a storage system or server requires service, administrators can use the intuitive Dell Compellent interface to move storage volumes on the fly and preserve application availability. Administrators no longer have to wait for narrow change windows to make modifications or to service components.

Other tools help minimize interruptions due to failures. Data instant replay, for example, enables administrators to quickly move a volume to another drive and roll back to a state prior to the failure. As a result, companies can overcome a failure very rapidly, affecting very few infrastructure elements.

Greater IT flexibility

Virtualization gives an IT department greater flexibility to choose the best mix of resources for its needs — without having to make changes to applications. This flexibility lets IT be more responsive to changing user demands and the associated service-level agreements (SLAs).

For example, administrators can use Fluid Data management tools to quickly add or remove volume capacity without interrupting ongoing operations. By using Dell Compellent Fluid Data storage in combination with VMware vSphere, administrators can also change the type of server-to-storage connectivity to quickly move an application from test to production, or to increase the bandwidth to meet rising demand. Since the Storage Center SAN supports both iSCSI and fibre channel interfaces, administrators can use VMware software to move an application from one physical server, which uses an iSCSI connection, to another physical server, which uses a fibre channel connection — all without any downtime.

Enhanced business agility

Ultimately, virtualization delivers benefits to the enterprise. As enterprises increasingly rely on IT to achieve their goals, IT flexibility translates into business agility.



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