



EFFICIENT INFRASTRUCTURE ENABLES VIRTUALIZATION STRATEGIES

Successful IT Initiatives Depend on Virtualization in an Optimized Physical Environment

Information Technology has never been more strategic to businesses of all kinds. The cloud, big data, social media and mobile technologies are creating new opportunities to serve customers, enable workforce collaboration and keep costs under control. IT's high strategic profile, thanks to these new business initiatives, is placing new pressures on servers, storage and networks – as well as the data center infrastructure on which they rely.

*IT executives must respond in several ways. This white paper, the last in a series of three, addresses optimizing physical infrastructure to support virtualization technologies. Look for these additional papers sponsored by Panduit: **Making Your Data Center More Efficient** and **Optimizing Infrastructure for Hybrid Data Center Strategies**.*

In data centers, the age of virtualization has arrived. The reason is simple: Virtualized servers, storage and networks are efficient and economical. That's important for all applications and especially for new strategic initiatives such as cloud and management of big data.

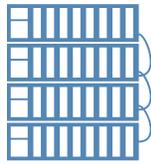
Building a highly virtualized data center requires a comprehensive strategy that includes not only virtualized computing running on virtual machines but virtualized storage in the form of storage-area networks (SANs) and virtualized networks, also known as software-defined networks (SDNs). Often overlooked, however, is the impact of virtualization on the underlying physical data center infrastructure.

VIRTUALIZATION AND PHYSICAL INFRASTRUCTURE

To ensure the success of virtualization initiatives, special attention must be paid to the physical data center infrastructure. That's because virtualization eliminates underutilized capacity on servers, storage and network switches, significantly changing the demands placed on the underlying physical infrastructure that supports those devices, including electrical power, cooling and physical space.

For example, a highly virtualized server running many virtual machines should be run at a higher level of reliability than a conventional single-purpose server. After all, when one virtualized server goes down, many VMs and the applications they are running go down as well. Consequently, all factors that affect uptime, including physical infrastructure, should be reexamined when a server is virtualized. The same is true when networks are virtualized through SDN capabilities. There is a plethora of factors to consider with regard to IT resources.

Here's a detailed look at the impact of virtualization on specific parts of the physical data center infrastructure.



Storage. Today, organizations store more data than ever before. This is due to the falling price of storage media, as well as to the ballooning quantities of data. For companies in all industries, everyday applications such as email often contain large file attachments such as images, photos and videos. Companies in the financial services and insurance industries, meanwhile, must often retain large numbers of documents and records spanning decades.

Virtualization has reached the point where it is the rule, rather than the exception. According to Gartner, the majority of server OS instances are virtualized (71% in 2014), but growth is beginning to plateau. By 2018, it will reach 82%.

-Forecast Analysis: x86 Server Virtualization, Worldwide, 2014 Update 04 December 2014 G00270281

In addition, the emergence of storage-hungry initiatives such as big data and both trending and predictive analytics is having an impact. Big data and integrated analytics are largely enabled by the falling price of disk storage, which makes it economical to store large amounts of sensor and social media data on disk. Thus, an organization launching a big data initiative is likely to use more disk storage than ever, as well as disk storage of longer duration than had previously been typical.

The explosive growth of data merits a tiered storage architecture that serves different levels of data criticality and the need to retrieve those different levels of data with varying degrees of promptness. The tiered architecture should make critical data immediately accessible, while allowing longer retrieval times as the level of importance diminishes.

Tiered storage should include flash storage for data requiring the fastest access. Some organizations are making increasing use of flash storage for all kinds of data and are using flash to mirror their primary data center at a backup location. Disk storage is typically used for important data that does not require instantaneous access, and is gradually displacing tape for archival purposes. As a result, tape storage equipment may disappear completely from a data center as it is replaced by newer, smaller disk storage devices with different physical infrastructure requirements.

The effects of such changes on physical infrastructure should be studied. For example, replacing disk drives with flash memory and tape libraries with disk arrays could have a significant impact on power and cooling requirements as well as cabling.



Electrical power. Thanks to the benefits of consolidation and the reduction of unused capacity, virtualized servers, storage and network devices are generally denser than predecessor technologies, and hence may require more electrical power than before. Because electrical power is a source of heat, this may in turn require changes to the cooling infrastructure.



Thermal risk management. The higher utilization rate of virtualized servers, storage and networks means that, in general, those resources run hotter, thus requiring greater cooling capacity. Consequently, extensive virtualization calls for a review of a data center's thermal management infrastructure.

The review should encompass the containment systems to optimize airflow across hardware. A number of factors must be considered. For example, new network switches may require a new configuration of inlet and exhaust ducts for more effective control of cold and hot air. An examination of airflow patterns may determine that vertical exhaust ducting is needed. Sealing accessories are essential components in any containment system. These should be installed so that cables entering the cabinets are properly sealed. In addition, gaps between rack units should be sealed to prevent air from bypassing the racks.



Bandwidth and cable management. The implementation of devices with greater compute, storage and bandwidth capacities, as well as the demand to handle huge data sets, is placing unprecedented stress on the network. As a result, organizations are seeking to increase network bandwidth through SDN capabilities, which rely on software to route data according to priority. These changes call for rethinking the overall provisioning of bandwidth and therefore of cable management. Stated simply, "Virtualization may drive the need for higher bandwidth links," says Todd LaCognata, senior business development manager at Panduit.



For example, a single server running a single application might need a certain amount of bandwidth, but if the server triples its computing work by running multiple VMs, then the bandwidth available to that server must increase, potentially by three times. This might mean that higher-bandwidth network interfaces must be deployed along with higher-capacity cabling.

As data center bandwidth demands increase due to new applications, a high-bandwidth architecture designed for speeds of 40Gbps to 100Gbps, may be required. Implementation of that architecture may require a cabling upgrade to high-capacity fiber.

The bandwidth needs of storage virtualized in SANs must also be considered. Fibre Channel speeds are on the increase, from 16Gbps to 32Gbps and even to 128Gbps, which may also call for fiber upgrades and routing changes.

Although it might seem a simple matter to substitute new cables for old and to add cables as needed, in practice, care must be taken to route the cables so that best cable management practices are followed. These include maintaining the proper bend radius and not blocking air vents.

As network speeds increase, it is important to assure the cables themselves deliver data at their rated throughput. To do so, the fiber cable end faces must be kept clean. It's easy for those end faces to become contaminated, which can significantly impede the performance of a connection.

PANDUIT SOLUTIONS

Panduit solutions have all the capabilities required to maximize infrastructure performance in the virtualized data center. They encompass all levels of data center infrastructure, including cabling, ducts, cabinets, thermal management and power management.

Panduit's SmartZone DCIM solution provides facts and data in an interactive graphical interface for proactive empowerment and optimal decision making. SmartZone Thermal Assessment and Optimization Services use Computational Fluid Dynamics (CFD) modeling. This enables administrators to test "what-if" scenarios to weigh the cost of remediation against potential energy savings. The result is maximum return on investment (ROI).

Also included is LiveImaging, which provides thermal, pressure differential, humidity and dew point mapping using real-time data from multiple levels of the data center. LiveImaging enables administrators to see hot spots and direct airflow to avoid overheating or the wasteful mixing of hot and cool air.

Panduit works closely with industry partners such as Cisco, EMC, VCE and more. By gaining detailed knowledge of leading vendors' equipment and its needs, as well as future product plans, Panduit is able to provide physical infrastructure products that are specifically geared to industry-leading equipment not only at present, but for the future as well.



PANDUIT[®]
SMARTZONE™ SOLUTIONS



DCIM: VISIBILITY FOR PROACTIVE MANAGEMENT

The ability for administrators to track and manage the resources in their data centers is critical. However, the ease and rapidity with which changes are made in a virtualized environment present challenges to administrators. A Data Center Infrastructure Management (DCIM) solution enables administrators to grasp visually what is happening with regard to cooling, power and physical assets in a virtualized environment in real time.

Because of the increased density of virtualized data centers, it is prudent to deploy more sensors in more locations, including at the rack and device level, to gather and report such information as power and cooling. An intelligent DCIM solution collects sensor information and presents it to an administrator in an integrated fashion through a graphical user interface.

The best DCIM solutions go even further, enabling administrators to design the infrastructure layout in an interactive way, using what-if scenarios to determine the most efficient and highest-performing layout. For example, a DCIM solution can enable the administrator to look at where IT assets are in relation to electrical power supplies. As moves and changes are proposed, the impact of changing power densities can be measured against acceptable thresholds. Also, because cabling can be quite complex, a DCIM that includes a schematic map of the cable infrastructure is highly valuable. Such a tool enables an administrator to see how cabling would need to be altered to accommodate changes to the servers, storage devices or network switches.

A DCIM solution also enables self-service provisioning of resources through automation. Users may request virtual machines, which in turn may require computing, storage and networking resources. The ability of a user to automatically provision resources, knowing that the underlying infrastructure is sufficient, saves time and money because it reduces the need for an administrator to intervene. That staff, in turn, may be deployed on more strategic IT and business initiatives.

OPTIMIZING INFRASTRUCTURE FOR VIRTUAL RESOURCES

In just a few years, virtualization has become an essential and pervasive data center technology. While many applications benefit from the economies enabled by virtualization, such important strategic initiatives as cloud and big data would not be possible without the use of virtualized resources. For companies to compete effectively, they must embrace these new business strategies and enable them not only with virtualized servers and storage devices, but with networks virtualized through SDN capabilities.

Those virtualized resources, in turn, require administrators to take a comprehensive view of the data center, because virtualization significantly impacts physical infrastructure. Often, major infrastructure adjustments must be made in order to enable virtualization without wasting data center resources or exceeding power or thermal thresholds.

With a comprehensive view of data center resources provided by a DCIM solution such as Panduit SmartZ-one, an administrator may proactively make changes to increase reliability, enable a tiered storage architecture and deploy efficient thermal, power and cabling management. The resulting infrastructure, optimized for virtualization, will enable an organization to gain a critical business advantage.



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