

Open Network Automation is Critical to the Virtual Data Center

A Dell Technical White Paper



THIS WHITE PAPER IS FOR INFORMATIONAL PURPOSES ONLY, AND MAY CONTAIN TYPOGRAPHICAL ERRORS AND TECHNICAL INACCURACIES. THE CONTENT IS PROVIDED AS IS, WITHOUT EXPRESS OR IMPLIED WARRANTIES OF ANY KIND.

© 2011 Dell Inc. All rights reserved. Reproduction of this material in any manner whatsoever without the express written permission of Dell Inc. is strictly forbidden. For more information, contact Dell.

Dell, the *DELL* logo, and the *DELL* badge, *PowerConnect*, and *PowerVault* are trademarks of Dell Inc. *Symantec* and the *SYMANTEC* logo are trademarks or registered trademarks of Symantec Corporation or its affiliates in the US and other countries. *Microsoft*, *Windows*, *Windows Server*, and *Active Directory* are either trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. Other trademarks and trade names may be used in this document to refer to either the entities claiming the marks and names or their products. Dell Inc. disclaims any proprietary interest in trademarks and trade names other than its own.

September 2011

Contents

The Evolving Data Center 2

The Role of Automation 3

The Different Approaches to Network Automation..... 5

 Approach 1: Integrated Network Automation 5

 Approach 2: Network Controlled Automation 5

 Approach 3: Open Network Automation..... 5

What to Look for in a Solutions Provider..... 6

Conclusions 6

Figures

Figure 1. Computing through the ages2

Figure 2. The virtualized data center is connected by the network2

Figure 3. The virtual data center is everyone’s responsibility4

Authored by Zeus Kerravala, Senior VP, Yankee Group

Mr. Kerravala is a distinguished research fellow at The Yankee Group, leads the Research Council and is chartered with the responsibility of providing thought leadership to the research organization. Comprising senior research leaders, the Research Council provides outreach to clients and the broader Yankee Group community, as well as ensures that the company's research agenda addresses the needs of business leaders. Kerravala drives the strategic thinking of the research organization and helps shape the research direction.

The Evolving Data Center

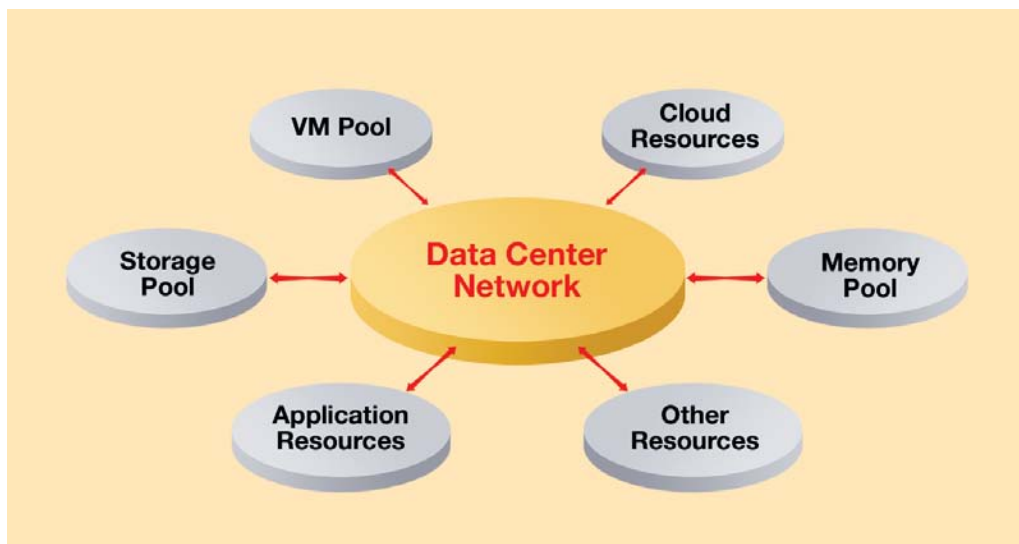
The data center has undergone several significant transformations since the birth of computing. The data center has evolved from mainframe computing to client server to Internet computing to SOA. Now we sit on the precipice of another major technology shift - the move to a fully virtualized data center (Figure 1). With each transition, the cost of computing was driven down by orders of magnitude and organizations were able to increase the efficiency of data center operations, software development, and most importantly, corporate workers.

Figure 1. Computing through the ages



The shift to a virtual data center will be the most significant IT transformation since the invention of the mainframe as it promises to bring together the network stack, storage and the computing layer to optimize application performance. In a fully virtualized data center, compute resources exist as VMs (virtual machines), storage becomes virtualized “pools” that can exist anywhere, and the network fabric connects these virtual elements to form a flexible, scalable computing environment (Figure 2).

Figure 2. The virtualized data center is connected by the network



The use of virtualization technology is widespread. A recent enterprise survey revealed that 82% of organizations today are using virtualization technology¹. The primary driver for almost all companies using virtualization is to consolidate the number of servers. Obviously, this can have a huge impact on TCO since the number of servers can be dramatically reduced, sometimes by a factor of 10. However, there are many other reasons for deploying virtualization technology, including:

- It allows software developers or other users to provision their own virtual machines. This will allow developers, engineers or others to have near instantaneous access to compute resources without having to involve several other departments.
- It ensures application performance is maintained when the workload is increased by provisioning additional computing resources.
- It increases the uptime of applications by mobilizing virtual workloads. In the event of an outage, the VM can move across a rack, across the data center or across the network whenever required.
- It acts as the bridge between physical and cloud-based data centers. Resources must be virtualized if they are to easily migrate between private data centers and cloud-based data centers.

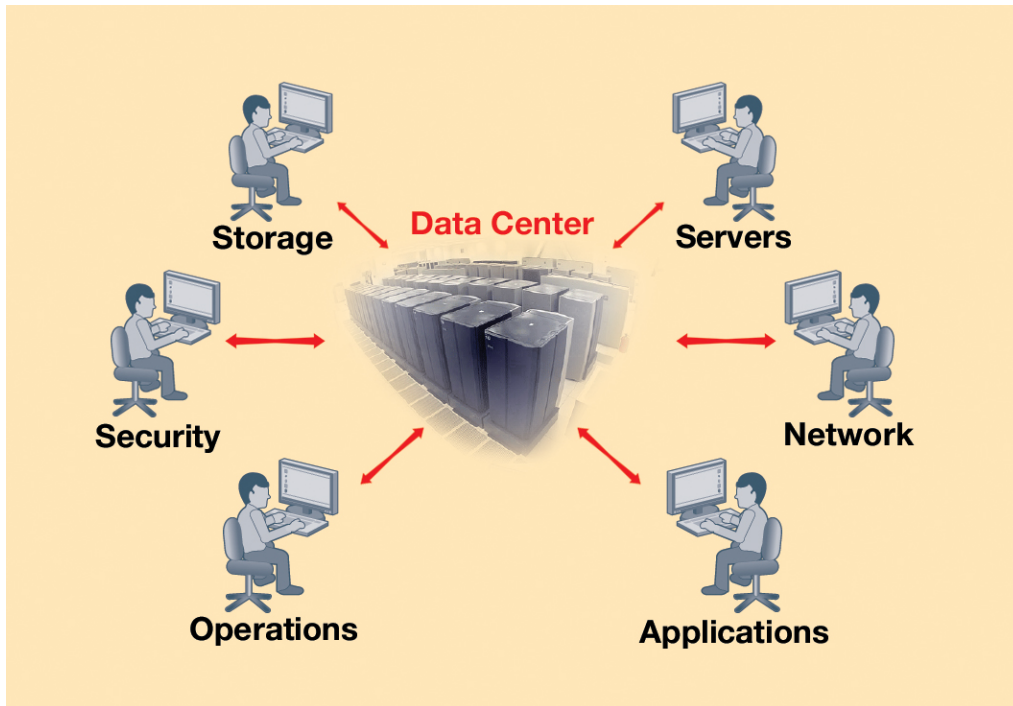
The adoption of new technology always creates new challenges for data center managers, and virtualization is no exception. While server consolidation can dramatically reduce the number of physical servers, an unfortunate side-effect is that it results in an explosion in the number of virtual machines. Managing this so-called “sprawl” of virtual machines is much more difficult than managing physical resources. As organizations move from hundreds of VMs to thousands, questions such as “Where is that VM?”, “Who created that VM?”, “Who owns that VM”, “Why did it migrate?” and “Where is the data?” become more common. This new complexity results in additional work for server administrators as they shift their workload from managing tens or hundreds of physical servers to managing hundreds to thousands of virtual machines.

But the challenge does not stop there. With virtual machines, data center managers must also provision virtual storage pools and virtual network resources. In earlier times, managing the computing environment, which consisted of a static stack of compute, network and storage resources, was much simpler. But with virtual compute, storage and network resources, complexity has dramatically increased, resulting in more work for system, network and storage administrators.

The Role of Automation

The solution to the additional complexity caused by the extensive use of virtualization in the data center is automation. Automation will play an important role in helping data center engineers better manage virtual resources. Without automation, data center managers need to manually re-provision and optimize server, storage and network resources every time the smallest change in the environment is made. Keeping all of the virtual resources in sync is a near-impossible task for any data center of significant size. In fact, only 17% of respondents polled in Yankee’s recent survey² feel that the tools to virtualize mission critical applications exist today. This leaves a big gap between the vision of the fully virtualized data center and the current market reality.

Figure 3. The virtual data center is everyone's responsibility



The challenge associated with managing a virtual environment is not limited to just deploying new technology, as data center operations and organizational structure are also impacted in a significant way. Today, most large data centers have administrative staff for supporting server, network and storage resources (Figure 3), and each of these groups have expertise in managing their respective technology. Prior to the adoption of virtualization technology, these groups could successfully operate in what were essentially independent groups. But the adoption of virtualization, combined with the need to quickly shift resources as demanded by the business, is now requiring these groups to work closely with each other.

Automation

The additional complexity caused by the explosion of VMs, the need to tightly coordinate the provisioning of virtual resources, and the organizational challenges of managing this new virtual environment are best solved by automation. Automating the monitoring, management and provisioning of common tasks can greatly reduce the additional workload caused by virtual environments. Automation can also help standardize data center configurations, enforce best practices and increase availability.

For the network, automation can improve data center operations in the following ways:

- Instantly adjusts to changes in data flows, without manual reconfiguration, to optimize application performance. Virtualization, cloud computing, web 2.0 and other trends have given rise to bursty and unpredictable traffic flows. A congestion free network that provides non-blocking switching and routing performance can reduce the end to end latency of the transaction. This will also lead to the flat, layer 2 network that VMotion requires.

- Delivers an “always on” data center fabric. A high capacity, modular, fully redundant network can shift resources almost instantly to withstand any outage. Additionally, the network architecture can be simplified by increasing the density of the ports in the network devices. This means less hardware, a simpler architecture and increased uptime.
- Provides on demand resource allocation through automated network reconfiguration. The network can adhere to any business SLA (service level agreement) to automate tasks such as reallocating resources by moving VLANs, changing priorities through QoS policies, reallocation of bandwidth or reducing power consumption by shutting off underutilized resources.

Because the network is at the heart of the virtual data center, it is unique in its ability to enable organizations to maximize their investments in virtualization and cloud architectures.

The Different Approaches to Network Automation

The goal of network automation is to provide a self-optimized network that is capable of dynamically allocating virtual resources to where they are needed in a timely fashion. Several approaches to network automation have emerged, and data center architects, CIOs and others involved in designing virtual data centers need to be aware of the differences. The network vendors can be seen as falling into one of three high-level approaches:

Approach 1: Integrated Network Automation

This approach involves the vendor adopting a highly integrated, proprietary architecture that requires the customer to source all elements in the stack from a single vendor, or closed system of vendors. The upside of this “vertically integrated” approach is that it delivers a solution that works “out of the box”, so there is some short-term benefit. Long-term however, this approach means vendor lock-in, which deprives customers of the power to choose the best technology for their specific environment. To date, Cisco has chosen to adopt this approach.

Approach 2: Network Controlled Automation

In this environment, the monitoring, management and provisioning of virtual environments is controlled from, or by, the network. When a new virtual environment is required, or if an existing virtual environment needs more resources, network management tools provision the network, compute and storage resources. This is a network-centric strategy that requires all of the data center functions to fall under the control of the network rather than working in a cooperative manner. This requires a huge cultural and operational shift by data center managers. This approach has been adopted by Brocade and Extreme Networks.

Approach 3: Open Network Automation

The third approach toward network automation is one that leverages open standards that allow the data center network fabric to be controlled by existing automation or middleware tools. Because this approach is server and application centric, it is consistent with current data center operations, allowing an organization to adopt network automation more seamlessly because current best practices can remain in place. With an open strategy, the network infrastructure aids the operations of the virtual data center but doesn't take on the role of managing the virtual environment. Managing the virtual environment is done by existing virtualization management or system management tools designed for this express purpose. Additionally, standards based protocols are used for exchanging information between the network fabric and hypervisors or virtual switches to manage network configurations. This allows companies to choose best-of-breed technologies and still have the assurance

that the solution will work. The open, standards based approach to network automation provides the best long-term benefits for the customer, as it retains the current data center operational structure but still provides a path to the future. Dell is an example of a vendor that utilizes this approach

What to Look for in a Solutions Provider

As network automation continues to evolve, more and more vendors will claim to have solutions that can help an organization make the transition to a virtual data center. Considering the important role the network will play in the evolution of the data center, it is critical that the following be considered when making a purchase decision:

- An open, standards based approach. There are many solution providers that claim to be open and many that claim to be standards-based. However, it is crucial that the network truly be both. Some vendors that claim to be both will actually be including a number of proprietary features that are “based on standards”.
- Hypervisor, virtual switch and server agnostic. If this isn’t the case, the organization may lose its choice in compute platforms. Considering the rate of innovation and the reach of virtualization, it’s important the network be able to support any of the hypervisor vendors.
- Non-blocking, congestion free architecture. This will minimize the end-to-end latency of traffic flowing across the network. Solutions that are “near non-blocking” or over-subscribed could lead to congestion problems that impair the performance of applications.
- Future proofed technology - high density, 40 GbE and 100 GbE ready. The network infrastructure being purchased today should be thought of as a five year investment. So, the hardware being procured needs to provide sufficient density to allow simplification of the network and upgradability to both 40 and 100 GbE. This will avoid a rip and replace event in the future.
- A vendor with a history of data center innovation. Networking in the data center has many demands that are unique. Choose a vendor that understands the demands placed on the data center network. Vendors who grew in the wiring closet may not have the right culture to meet the challenges of a data center.
- A broad ecosystem of partners. No single vendor can deliver on the vision of the virtual data center. The network solution provider used should have solutions that work with all of the major compute, virtualization, storage and management vendors.
- A solution provider that utilizes common scripting languages. Data center operations today are driven by scripts written in perl, python and UNIX. A network vendor that utilizes the de facto standard scripting tools can help bridge the gap between networking and computing more efficiently and more quickly.

Conclusions

The data center is on the verge of another major transition - the shift to a fully virtualized data center. This will lower the cost of computing, improve uptime and application performance and raise corporate productivity to new heights. However, along the way, data center managers will encounter new challenges in managing a data center built on pools of virtual resources instead of physical ones.

Open network automation can help meet many of these challenges by delivering a network that works with the compute infrastructure to automate many of the mission critical, time sensitive tasks needed to run a virtual data center. Open network automation will:

- Enable a virtual infrastructure that can scale to handle unpredictable traffic demands.
- Create an elastic environment where virtual resources can be allocated where and when they are needed based on business policy.

Open Network Automation is Critical to the Virtual Data Center

- Improve application uptime by instantly adapting and applying network configuration changes that arise due to changes in the compute environment.
- Provide a bridge to cloud computing by allowing companies to coordinate the movement of resources to the cloud at their own pace.
- Help move customers towards the vision of a virtual data center much faster than solutions that use vertically integrated technology.