IMPLEMENTING VIRTUALIZATION IN A SMALL DATA CENTER

Ionka Gancheva, PhD student[213]

Abstract: *The article contains design and implement virtual data center cluster in a small campus. Cluster contains virtual machines combined in a pool of devices for better management. For better cluster protection is used features like High availability, Fault Tolerance and Distributed Resource Management and Site Recovery Manager. With clustering is achieving dynamic and flexible way to organize computing resources in a virtual environment and link back to the physical resources such as CPU, memory, disk space.*

Key words: *Data center, virtual network, network architecture, virtual machine*

1. INTRODUCTION

Virtualization technology such as VMware ESXi server require Ethernet connection to access network resources. Using virtualization in the data center and between them allows changes in building topologies from widely scalable layer 3 network models to widely scalable layer 2 network models. Change requires the use of different technologies for maintaining and managing large layer 2 domains. Usually technique used to prevent layer 2 loop, Spanning Tree Protocol is replaced by technologies such as vPC and Cisco FabricPath. STP protocol is a traditional mechanism that build a layer 2 logical loop-free topology and it goes one major Ethernet principle. For keeping busy or alternative access routes always you have only one active link, others are blocked and unblocked only if the primary link falls [1].

Another layer 2 technology is a port-channel or Etherchannel. It allows for the aggregation of physical links between two devices providing more bandwidth. The big limitation of port-channel is that it operates only between two devices. And for large data centers need to provide alternative access routes between more than two network riddle in case of hardware problems on some devices. To address all the above restrictions Cisco supports technology vPC / virtual Port Channel /, MST / Multiple Spanning Tree / and FabricPath. Traffic arrays of data will pass through the network itself.

2. VIRTUALIZATION SOFTWARE

On a single physical hardware server can be supported many virtual machines with different operating systems. Each virtual machine has its own unique MAC and IP addresses. Virtual machines are connected via internal virtual switch. An essential platform for virtualization is VMware ESXi - an operating system that is installed directly on the hardware and serves to maintain the virtual machines. Vmware operating system guarantee that always will be available hardware resources: memory, processor arrays, network adapters for virtual machines. In other words, Vmware virtualize physical hardware and makes it available for use on virtual machines. Virtual switches connect physical network cards to virtual network cards

---

to provide network access to virtual machines. Virtual switches support port and tags through which can separate the network into separate vlans [2].

Vmware vCenter Server (Fig. 1) is a software, designed to manage multiple VMware vSphere ESXi hosts and virtual machines on them and serves as a centralized administration.
Vmware vCenter Server supports up to 10,000 virtual machines for each vCenter instance and 1000 hardware host.
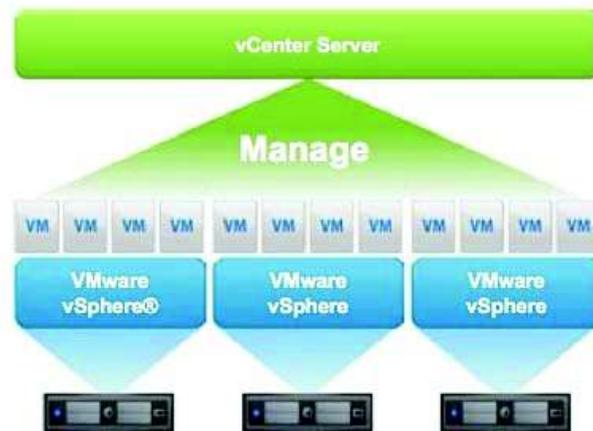

Figure 15 Logical architecture of vCenter server

2.1 vCenter architecture

The vCenter main services and tasks will include resource management, event management, configuring virtual machines, configured virtual switches (Fig. 2).
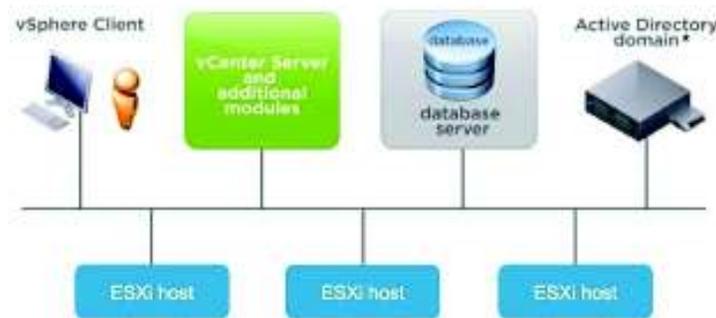

Figure 16 vCenter Server logical architecture, with datastore and Active Directory

vCenter Distributed services includes "vMotion", "DRS" and "vSphere HA", through which migrate virtual machines provide backups of virtual machines, disaster recovery and more.

3. VCENTER SERVER OBJECTS MAINTAINED IN DATA CENTER

vCenter Server consists of a hierarchy of objects. The objects include containers of other objects, such as folders or objects that are managed. Objects are host servers, virtual

machines, templates, clusters ranges resources, disk space for storage or networks. The hierarchy is used to group objects for ease of administration (Fig. 3)
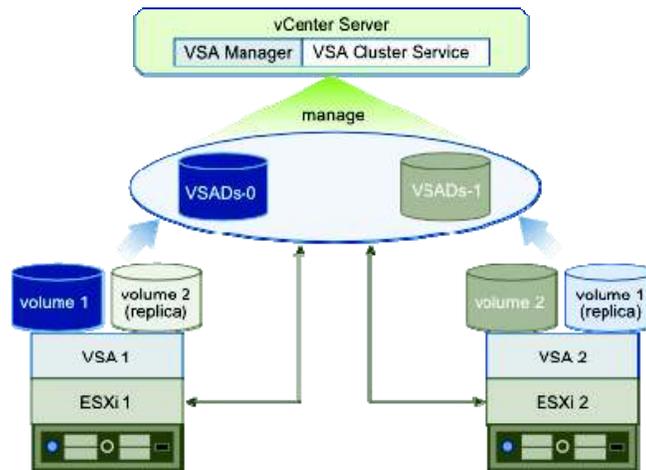

Figure 17 Vmware logical view of a cluster

Some of the objects may migrate within the data center, but not between different data centers, but the other virtual machines could be cloned between data centers [3].

Hosts in the data center can be grouped in clusters (Fig. 4). The figure shows created cluster including hosts and virtual machines, organized in folders for easier administration.

Figure 18 vSphere Esxi cluster

"VCenter" disk space for data storage. Each host has a massive data storage, where the virtual machines are stored. Figure 5 shows three built disk space for data storage.

Figure 19 Data Storage

VSphere is software, which is accessed and managed objects in a data center. vSphere provides protection against stopping at each of the sites of every level of hierarchy in the data center using various tools such as migration of virtual machines, load balancing or distribution, fault tolerance, recovery tools in denial or suspension any of the sites [4].

Tool used between data centers is VMware vCenter Site Recovery Manager (SRM). Through them can be quickly restored an organization infrastructure if a disaster occurres.

Vsphere High Availability provides application availability under all conditions of running virtual machines. Problems with hardware server virtual machines will automatically migrate and restart on another server hardware with sufficient hardware resources for them (Fig.6).
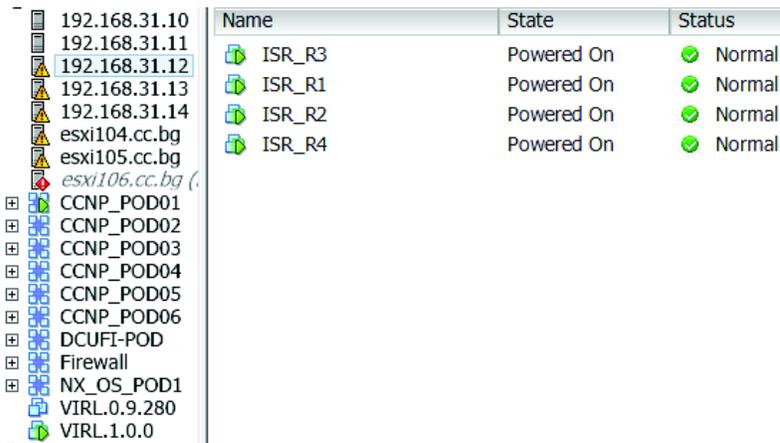

Figure 20 Data Center Cluster

VSphere HA provide a basic level of protection for virtual machines as they restart another hardware host. Fault Tolerance provides a high level of protection and availability of applications running on virtual machines, allowing users to protect besides applications and data transactions and relationships. Fault Tolerance is used for important and critical applications that must be available at all times, have zero tolerance for problems and store data for a long time. Fault Tolerance create copies of virtual machines to another host hardware and synchronizes data between them [5].

The above features are available to connect ESXi hosts in the cluster (Fig. 6). This is a dynamic and flexible way to organize computing resources in a virtual environment and link back to the physical resources such as CPU, memory, disk space [6].

A cluster acts and can be managed as one. It represents the aggregate computing and memory resources of a group of physical x86 server that share the same network, and disk arrays. For example, if the group contains eight servers with four dual-core processors each running at 4GHz and 32GB of memory, the cluster is a collection of 256GHz of computing power and 256GB of memory available for running virtual machines. Below are specified basic concepts in virtualization:

- Server virtualization. The basis of modern data center is server virtualization. It significantly increases the efficient use of hardware resources and reduces maintenance costs. Will examine the most commonly used products for server virtualization technologies used and will implement the most effective.

- Virtualization LAN. Many logical servers running within a physical server can have different security requirements, sometimes imposed isolation between them. Traditional solutions for achieving these goals are virtual LANs (VLANs) and private VLANs (PrivateVLAN), through which achieves inter-server isolation.

- Use of disk space for data storage. Virtualization of servers can only be a plus if required use of disk space for data storage. Arrays for Storage are a mandatory component of modern computing centers.

- Routing and switching;

- High availability and disaster recovery. Overlay Transport Virtualization (OTV) is a technology that can be used to connect a second data center which operate under active / standby or even active / active, in order to increase the availability and productivity.

4. ESTABLISHMENT OF POOL OF DEVICES (PODS) ON END HOSTS.

In a local project we implemented end PODs that consists of 4 numbers of virtual machines. Virtual machines can be created in several ways, depending on the size and type and infrastructure. In our case is used Open Virtual Machine Format (OVF), which is a preconfigured virtual machines. Additional parameters of the virtual machines are set, such as name, hardware resources, host, cluster, or resource pool, disk space.

On local disks of servers is installed Vsphere ESXi, and virtual machines are stored on a network array for data /network attached storage/ in VMFS datastores. Local drives are also used for local data array that stores ISO images of different operating systems and applications.

The solution is workable even if 25% of all hardware resources stops because they united in a cluster, 25% are reserved for providing high availability. Individual "ESXi" hosts have provided network access to any LAN segment, according to Management segment, a separate network card for redundancy, Vmotion segment, Fault Tolerance segment segments VM Data 1 and VM Data 2 to provide alternative ways for network access. The physical server is managed by a separate out-of-band Ethernet connectivity to storage, the number of network adapters and their type.

vSphere High Availability is configured for basic level of protection so virtual machines can automatically restart on another host in case the main problems occur. In addition, with vSphere Fault Tolerance is increased the protection of virtual machines providing identical copies of various hosts, whose status updates at any time maintained to be the same.

REFERENCES

[1] Vmware USA [Official site] VMware® NSX for Multi-Hypervisor (NSX-MH) Network Virtualization Design Guide, [Visited on 20.01.2016]

[2] Vmware USA [Official site] NSX Operations Guide Rev. 1.3 August 2015, [Visited on 7.08.2015]

[3] Vmware USA [Official site] NSX for vSphere Getting Started Guide VMware NSX for vSphere, release 6.0.x July 21, 2014, [Visited on 23.02.2016]

[4] Vmware USA [Official site] https://pubs.vmware.com/vsphere-50/index.jsp?topic=%2Fcom.vmware.vsa.doc_10%2FGUID-4E1B69D9-57A6-4AA1-B5D6-7C7DF125CB72.html [Visited on 23.05.2016]

[5] Vmware USA [Official site] http://www.vmware.com/products/datacenter-virtualization.html [Visited on 23.05.2016]

[6] Vmware USA [Official site] http://www.vmware.com/products/vcenter-server/ [Visited on 23.05.2016]