VDM Challenge

Beyond the Clouds

Seth Forgosh
July 2014 | Challenge 1 – Design and Orchestration
@sforgosh

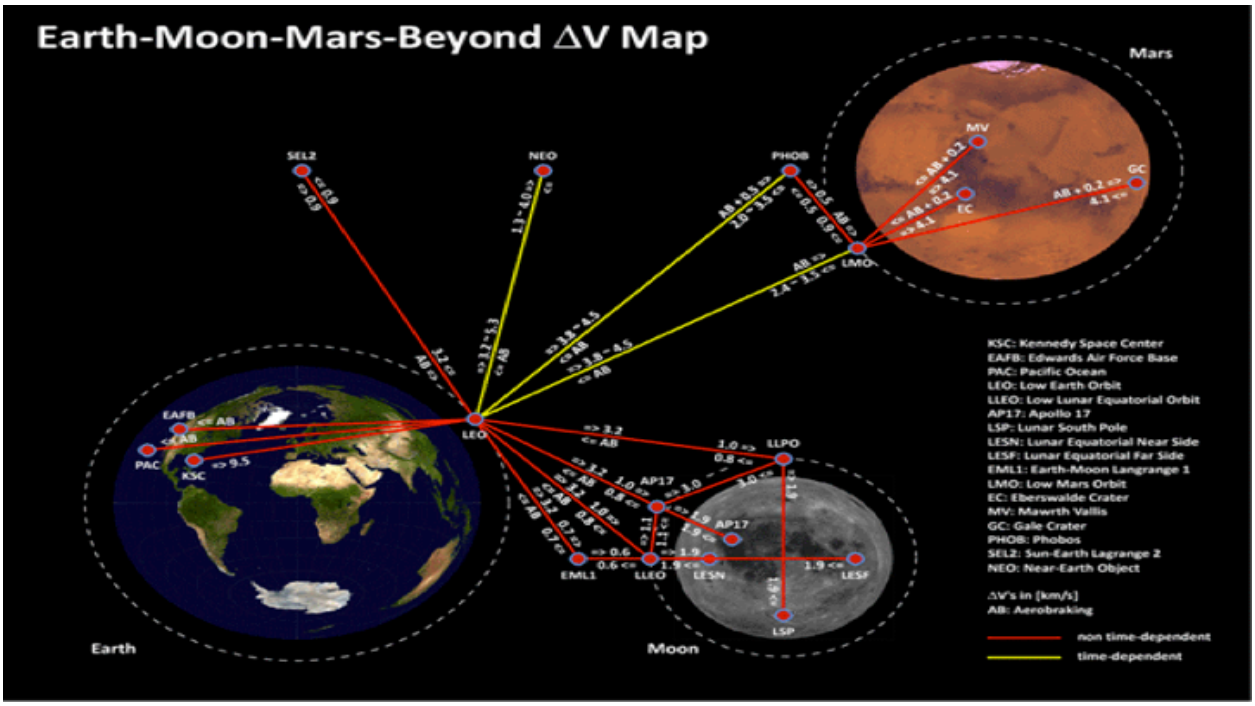


TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Executive Summary

We thought that we had contained the outbreak; we were wrong. The outbreak is back with a vengeance and society as we knew it has fallen. Fortunately, Mr. Billionaire planned for this contingency. His space tourism company has built a large lunar base, designed to support what is left of the human race until the first colony can be established on Mars.

1.1 Scope

Currently, there is only one space ship depot on earth, located in Cape Canaveral, Florida however three more are being built as quickly as possible with plans for additional depots to follow. Our task is to build a completely orchestrated infrastructure that is highly reliable and easily deployable to ensure that these sites are up and running as soon as possible.

The application controlling the depot has the following requirements:

- Client facing web layer
- Message queuing middle tier
- Database backend

For this project, I've selected a FlexPod solution for compute, network and storage. This was done to provide flexability, repeatability, scalability and performance delivered as a converged infrastructure for this critical infrastructure.

The FlexPod architecture is highly modular or "podlike." Although each customer's FlexPod unit varies in its exact configuration, after a FlexPod unit is built, it can easily be scaled as requirements and demand change. The unit can be scaled both up (adding resources to a FlexPod unit) and out (adding more FlexPod units).

Specifically, FlexPod is a defined set of hardware and software that serves as an integrated foundation for both virtualized and nonvirtualized solutions. VMware vSphere® built on FlexPod includes NetApp storage, NetApp Data ONTAP, Cisco networking, the Cisco Unified Computing System™ (Cisco UCS®), and VMware vSphere software in a single package. The design is flexible enough that the networking, computing, and storage can fit in one data center rack or be deployed according to a customer's data center design. Port density enables the networking components to accommodate multiple configurations of this kind.

A VMware vSphere 5.5 environment will be built on the FlexPod(s) to provide the required compute infrastructure to support each depot. A blade from the Cisco UCS component will be dedicated to supporting VMware vCenter Server while a second is allocated for the vCenter Database. Additionally, a Windows 2008 R2 Active Directory server will be built to support AD integrated SSO, DNS and DHCP.

NetApp Workflow Automator (WFA) and Cisco UCS Director will be utilized to automate allocation of physical compute and storage.

2 Current State

2.1 LAN & WAN

- LAN

  No current LAN infrastructure exists and will need to be built as part of the project.
- WAN

  WAN termination points exist and internet access will be available once LAN network equipment is put in place and configured.

2.2 Physical Servers and Storage

- Servers

  No physical servers are currently in place. All compute will be deployed as part of the project.
- Storege

  No storage infrastructure is currently in place. All storage will be deployed as part of the project.

2.3 Power and Cooling

- Power

  Sufficient power circuits are available and cabling available on site.
- Cooling

  Cooling provided by FAST Modile Data Centers

2.4 Datacenter

- Mobile Datacenter(s)

  Nine (9) rack FAST Mobile Data Centers will be deployed to support this project to facilitate the capability to evacuate the site along with the IT infrastructure should the perimeter fall.

2.5 Site Locations

There is currently only one depot though at least three (3) others will be built following this design with the potential for more. We will use an Alpha, Beta, Gamma, Delta naming convention for the depots as this will denote the order they come online and avoid locking them to a specific geographical location should the perimeter be breached and a site needs to be relocated.

Table 1 shows the current depot as well as additional proposed sites and their corresponding Virtual Datacenter.

Table 1) Depots and corresponding Virtual Datacenters

Depot Location	vCenter Virtual Datacenter
Cape Canaveral	Alpha
TBD	Beta
TBD	Gamma
TBD	Delta

3 Workload Definitions

3.1 Applications and VM & Physical Sizing Estimates

- **Windows 2008 RD Physical Domain Controller (DC):**

  Quantity 4 (2 plus 2 spare)

  1x Ciscso B22 M3, 2x Intel Xeon E5-2400 processors, 23GB RAM, 500GB RAID 1 internal storage
- **Linux Application Server VM:**

  2 vCPU, 2GB RAM, 50GB VMDK, 1 VNIC
- **Linux MySQL Database Server VM:**

  4 vCPU, 16GB RAM, 50GB VMDK, 2 VNIC
- **vCenter Server Appliance 5.5 Medium Inventory:**

4 vCPU, 24GB RAM, 500GB VMDK, 1 VNIC

- **Linux Web Server VM:**
  2 vCPU, 2GB RAM, 50GB VMDK, 1 VNIC
- **Linux Message Queue Server VM:**
  4vCPU, 16GB RAM, 50GB VMDK, 1 vNIC
- **WFA VM:**
  2vCPU, 16GB RAM, 50GB VMDK, 2vNIC
- **UCS Director VM:**
  4vCPU, 16GB RAM, 50GB VMDK, 2vNIC

3.2 Host Server Sizing and Information

As part of the FlexPod confirguration, Cisco B200 M3 blades will be installed in each Cisco UCS 5100 Blade Server Chassis. Each chassis will be configured with 2x 2208 Fabric Extenders (FEX). Each blade will be configured with a VIC 1240 UCS Interface Adapter, 2x E502600 v2 CPUs and 512GB RAM. Storage for ESXi boot will be provided through FCoE LUNs provided by the NetApp Unified Storage Clustered Data OnTap (cDOT) system.

Each blade is capable of providing up to 4 10GB UTAs with support for VMWare VMDirectPAth with vMotion.

Additionally, a pair of Cisco UCS 6296UP 96-Port Fabric Interconnects will be utilized in this configuration.

3.3 Storage Sizing and Information

As part of the FlexPod configuration, a four (4) node NetApp Clusterd Data OnTap (cDOT), configuration will be deployed. NetApp cDOT provides a unified scale out architecture providing ease of management, non-disruptive operation, storage efficiency and backup/recovery and business continuity. Configured as part of a FlexPod architecture, Storage Virtual Machines (SVMs) provide secure isolation for multi-tennant environments.

The cDOT soulution for this project will be a four node configuration consisting of four FAS 8060 controllers with 2,753 PiB of effective SSD capacity in 20RU. Each node includes 4x10GbE ports and 4xUTA ports which will be configured with a 10GB FCoE personality.

DR storage will be provided through the use of NetApp OnCloud for AWS utilizing Glacier storage. OnCloud is a software only implementation of the NetApp Data OnTap storage operating system. It is engineered to run on Amazon compute and provides the full range of Data OnTap functionality including SnapMirror and SnapVault.

3.4 Network Sizing and Information

Cisco Nexus 5000 switches will handle the core of our infratstructure. A pair of Nexus 5627UP switches will each provide 48 ports 10GB Ethernet access, FEX aggregation, VXLAN segmentation and LAN-SAN convergence. Each depot will support a unique Class B range sub-netted into VLANs for traffic segmentation. DHCP reservations will be used for all VMs.

4 Active Directory Design

Windows 2008 R2 Active Directory will be used in conjunction with VMware SSO to provide access to the vCenter infrastructure. AD LDAP will also be used to provide user authentication for the Depot application stack. As such, HA is a requirement and accordingly, two blades (one from each chassis) will be dedicated to AD/DNS/DHCP.

4.1 Domain Design

The top level domain will be named exodus.net and the primary AD site will be named exodus.net. Each depot will have an OU created as it comes online. This will allow any user with the proper credentials and rights to manage any depot from any location and maintain simplicity.

Each depot will have the same DC configuration (2 DCs per depot) ensuring resiliency of the authentication infrastructure.

Each DC will be configured as an authoritative time source and be synced to 0.north-america.pool.ntp.org, 1.north-america.pool.ntp.org, 2.north-america.pool.ntp.org and 3.north-america.pool.ntp.org. All services will sync to their depots local DCs to ensure consistent time.

4.2 Naming Conventions

Location-TUUU##

Location is the depot name, previously defined in Section 2.5. T denotes the type of VM, **P**roduction, **T**est and **D**evelopment. UUU will be a either **APP**, **WEB** or **SQL.** And finally, ### will be a three digit counter to support multiple instences.

5 FlexPod Configuration

This document provides details for configuring a fully redundant, highly available configuration for a FlexPod unit with clustered Data ONTAP storage. Therefore, reference is made to which component is being configured with each step, either 01, 02, 03 or 04. For example, node01, node02, node03 and node04 are used to identify the four NetApp storage controllers that are provisioned with this document, and Cisco Nexus A and Cisco Nexus B identify the pair of Cisco Nexus switches that are configured. The Cisco UCS fabric interconnects are similarly configured. Additionally, this document details the steps for provisioning multiple Cisco UCS hosts, and these are identified sequentially: AlphaVM-Host-Infra-01, AlphaVM-Host-Infra-02, and so on.

Table 2 describes the VLANs necessary for deployment as outlined in this guide. The VM-Mgmt VLAN is used for management interfaces of the VMware vSphere hosts. Table 3 lists the virtual storage area networks (VSANs) necessary for deployment as outlined in this guide.

Table 2) FlexPod VLANs

VLAN Name	VLAN Purpose	VLAN ID
Mgmt in band	VLAN for in-band management interfaces	3175
Mgmt out of band	VLAN for out-of-band management interfaces	3170
Native	VLAN to which untagged frames are assigned	2
NFS	VLAN for NFS traffic	3172
FCoE-A	VLAN for FCoE traffic for fabric A	101
FCoE-B	VLAN for FCoE traffic for fabric B	102

VLAN Name	VLAN Purpose	VLAN ID
vMotion	VLAN for movement of VMs from one host to another	3173
VM Traffic	VLAN for VM application traffic	3174
Packet Control	VLAN for Packet Control traffic (Cisco Nexus 1000v)	3176

Table 3) FlexPod VSANs

VSAN Name	VSAN Purpose	VSAN ID
VSAN A	VSAN for fabric A traffic. ID matches FCoE-A VLAN	101
VSAN B	VSAN for fabric A traffic. ID matches FCoE-B VLAN	102

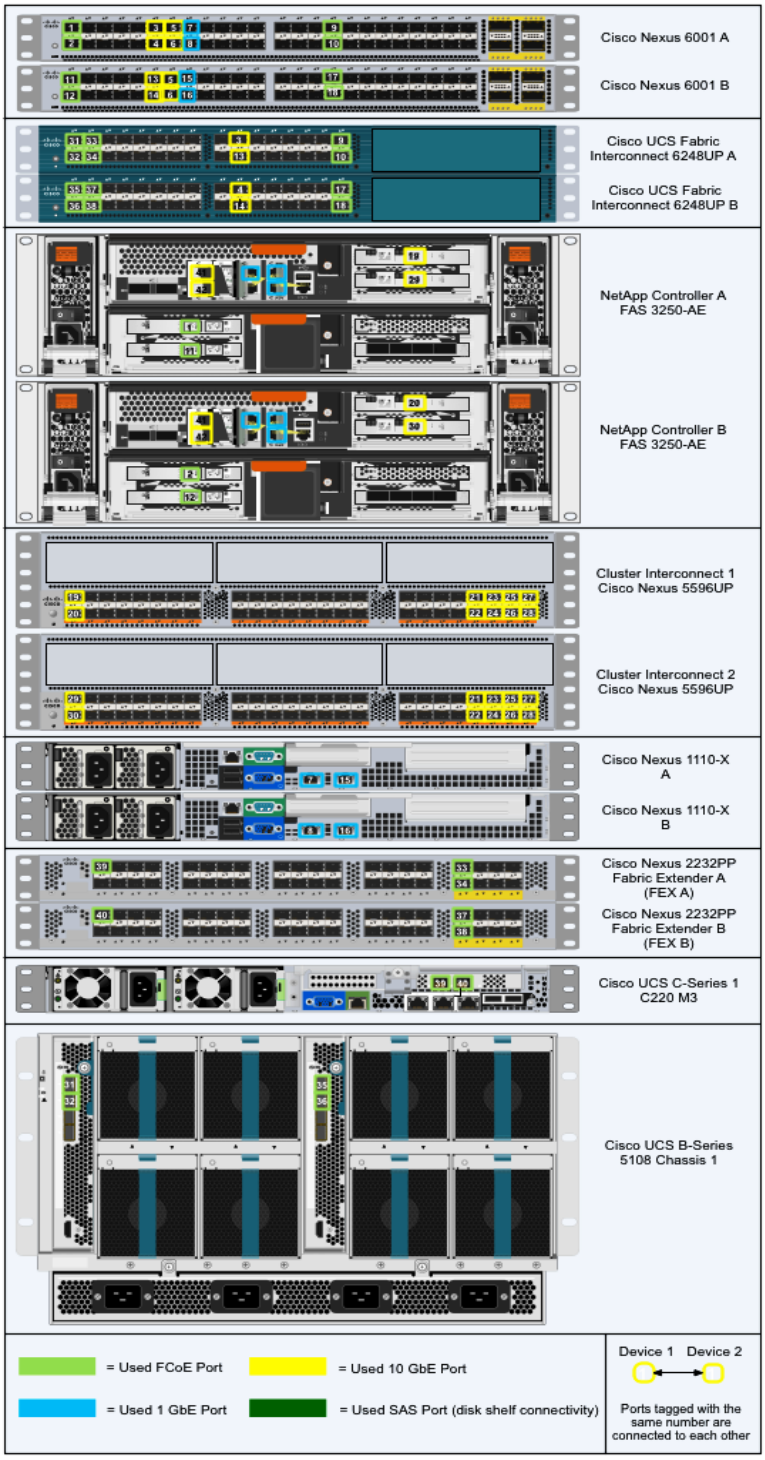
Table 4) VMware virtual machines (VMs) created

Virtual Machine Description	Host Name
vCenter Server	Alpha-VC
NetApp Virtual Storage Console	Alpha-VSC
NetApp OnCommand Unified Manager	Alpha-OCUM
NetApp VASA Provider	Alpha-VASA

5.1 Physical Infrastructure

Figure 1 shows the cabling diagram for a FlexPod configuration using clustered Data ONTAP.

Figure 1) FlexPod cabling diagram in clustered Data OnTap.



The information provided in Table 5 through Table 20 corresponds to each connection shown in Figure 1.

Table 5) Cisco Nexus 6001 A cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 6001 A	Eth1/1	10GbE	NetApp controller A	e3a	1
	Eth1/2	10GbE	NetApp controller B	e3a	2
	Eth1/11	10GbE	Cisco UCS fabric interconnect A	Eth1/19	3
	Eth1/12	10GbE	Cisco UCS fabric interconnect B	Eth1/19	4
	Eth1/14	10GbE	Cisco Nexus 6001 B	Eth1/14	6
	Eth1/13	10GbE	Cisco Nexus 6001 B	Eth1/13	5
	Eth1/15	GbE	Cisco Nexus 1110-X A	LOM A	7
	Eth1/16	GbE	Cisco Nexus 1110-X B	LOM A	8
	Eth1/31	10GbE	Cisco UCS fabric interconnect A	Eth1/31	9
	Eth1/32	10GbE	Cisco UCS fabric interconnect A	Eth1/32	10
	MGMT0	GbE	GbE management switch	Any	

Table 6) Cisco Nexus 6001 B cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 6001 B	Eth1/1	10GbE	NetApp controller A	e4a	11
	Eth1/2	10GbE	NetApp controller B	e4a	12
	Eth1/11	10GbE	Cisco UCS fabric interconnect A	Eth1/20	13
	Eth1/12	10GbE	Cisco UCS fabric interconnect B	Eth1/20	14
	Eth1/13	10GbE	Cisco Nexus 6001 A	Eth1/13	5
	Eth1/14	10GbE	Cisco Nexus 6001 A	Eth1/14	6
	Eth1/15	GbE	Cisco Nexus 1110-X A	LOM B	15
	Eth1/16	GbE	Cisco Nexus 1110-X B	LOM B	16
	Eth1/31	10GbE	Cisco UCS fabric interconnect B	Eth1/31	17
	Eth1/32	10GbE	Cisco UCS fabric interconnect B	Eth1/32	18

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
	MGMT0	GbE	GbE management switch	Any	

Table 7) Cisco Nexus 5596UP A cluster interconnect cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 5596UP A	Eth1/1	10GbE	NetApp controller A	e1a	19
	Eth1/2	10GbE	NetApp controller B	e1a	20
	Eth1/41	10GbE	Cisco Nexus 5596UP B	Eth1/41	21
	Eth1/42	10GbE	Cisco Nexus 5596UP B	Eth1/42	22
	Eth1/43	10GbE	Cisco Nexus 5596UP B	Eth1/43	23
	Eth1/44	10GbE	Cisco Nexus 5596UP B	Eth1/44	24
	Eth1/45	10GbE	Cisco Nexus 5596UP B	Eth1/45	25
	Eth1/46	10GbE	Cisco Nexus 5596UP B	Eth1/46	26
	Eth1/47	10GbE	Cisco Nexus 5596UP B	Eth1/47	27
	Eth1/48	10GbE	Cisco Nexus 5596UP B	Eth1/48	28
	MGMT0	GbE	GbE management switch	Any	

Table 8) Cisco Nexus 5596UP B cluster interconnect cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco Nexus 5596UP B	Eth1/1	10GbE	NetApp controller A	e2a	29
	Eth1/2	10GbE	NetApp controller B	e2a	30
	Eth1/41	10GbE	Cisco Nexus 5596UP A	Eth1/41	31
	Eth1/42	10GbE	Cisco Nexus 5596UP A	Eth1/42	32
	Eth1/43	10GbE	Cisco Nexus 5596UP A	Eth1/43	33
	Eth1/44	10GbE	Cisco Nexus 5596UP A	Eth1/44	34
	Eth1/45	10GbE	Cisco Nexus 5596UP A	Eth1/45	35

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
	Eth1/46	10GbE	Cisco Nexus 5596UP A	Eth1/46	36
	Eth1/47	10GbE	Cisco Nexus 5596UP A	Eth1/47	37
	Eth1/48	10GbE	Cisco Nexus 5596UP A	Eth1/48	38
	MGMT0	GbE	GbE management switch	Any	

Table 9) NetApp controller A cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
NetApp controller A	e0M	100MbE	100MbE management switch	Any	
	e0a	GbE	GbE management switch	Any	
	e0P	GbE	SAS shelves	ACP port	
	c0a	10GbE	NetApp controller B	c0a	41
	c0b	10GbE	NetApp controller B	c0b	42
	e1a	10GbE	Cisco Nexus 5596UP A	Eth1/1	19
	e2a	10GbE	Cisco Nexus 5596UP B	Eth1/1	29
	e3a	10GbE	Cisco Nexus 6001 A	Eth1/1	1
	e4a	10GbE	Cisco Nexus 6001 B	Eth1/1	11

Table 10) NetApp controller B cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
NetApp controller B	e0M	100MbE	100MbE management switch	Any	
	e0a	GbE	GbE management switch	Any	
	e0P	GbE	SAS shelves	ACP port	
	c0a	10GbE	NetApp controller A	c0a	41

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
	c0b	10GbE	NetApp controller A	c0b	42
	e1a	10GbE	Cisco Nexus 5596UP A	Eth1/1	19
	e2a	10GbE	Cisco Nexus 5596UP B	Eth1/1	29
	e3a	10GbE	Cisco Nexus 6001 A	Eth1/1	1
	e4a	10GbE	Cisco Nexus 6001 B	Eth1/1	11

Table 11) Cisco UCS fabric interconnect A cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco UCS fabric interconnect A	Eth1/19	10GbE	Cisco Nexus 6001 A	Eth1/11	3
	Eth1/20	10GbE	Cisco Nexus 6001 B	Eth1/11	13
	Eth1/1	10GbE	Cisco UCS Chassis 1 FEX A	Port 1	31
	Eth1/2	10GbE	Cisco UCS Chassis 1 FEX A	Port 2	32
	Eth 1/3	10GbE	Cisco Nexus 2232PP FEX A	Port 2/1	33
	Eth 1/4	10GbE	Cisco Nexus 2232PP FEX A	Port 2/2	34
	Eth1/31	10GbE	Cisco Nexus 6001 A	Eth1/31	9
	Eth1/32	10GbE	Cisco Nexus 6001 B	Eth1/32	10
	MGMT0	GbE	GbE management switch	Any	
	L1	GbE	Cisco UCS fabric interconnect B	L1	
	L2	GbE	Cisco UCS fabric interconnect B	L2	

Table 12) Cisco UCS fabric interconnect B cabling information

Local Device	Local Port	Connection	Remote Device	Remote Port	Cabling Code
Cisco UCS fabric interconnect B	Eth1/19	10GbE	Cisco Nexus 6001 A	Eth1/12	4
	Eth1/20	10GbE	Cisco Nexus 6001 B	Eth1/12	14
	Eth1/1	10GbE	Cisco UCS Chassis 1 FEX A	Port 1	35
	Eth1/2	10GbE	Cisco UCS Chassis 1 FEX A	Port 2	36
	Eth 1/3	10GbE	Cisco Nexus 2232PP FEX A	Port 2/1	37
	Eth 1/4	10GbE	Cisco Nexus 2232PP FEX A	Port 2/2	38
	Eth1/31	10GbE	Cisco Nexus 6001 A	Eth1/31	17
	Eth1/32	10GbE	Cisco Nexus 6001 B	Eth1/32	18
	MGMT0	GbE	GbE management switch	Any	
	L1	GbE	Cisco UCS fabric interconnect B	L1	
	L2	GbE	Cisco UCS fabric interconnect B	L2	

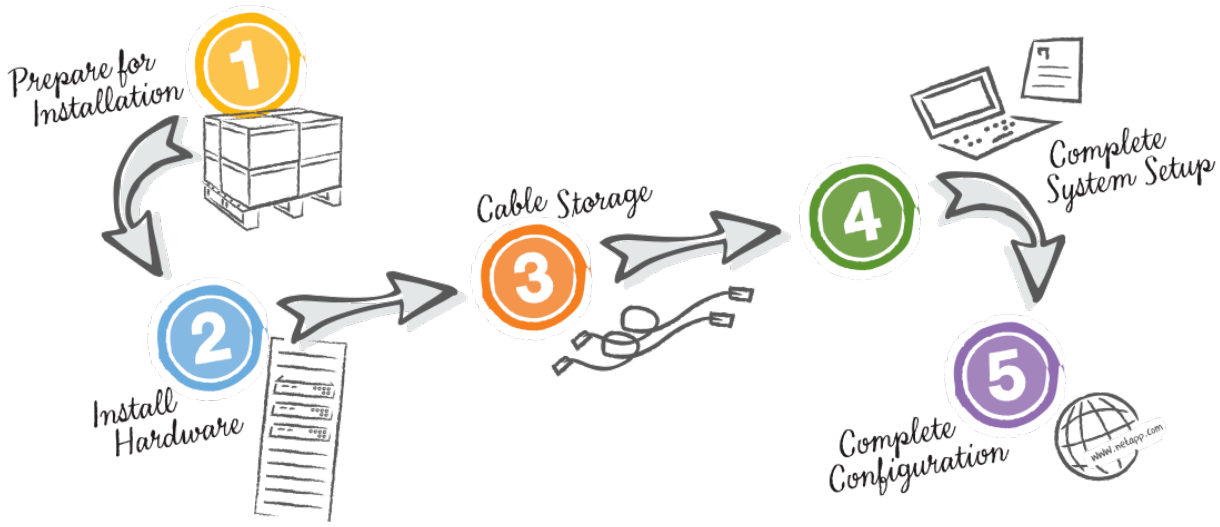
Table 13) FAS3250 card layout

Slot	Part Number	Description
1	X1117A-R6	NIC 2-port 10GbE (ports e1a and e1b)
2	X1117A-R6	NIC 2-port 10GbE (ports e2a and e2b)
3	X1140A-R6	Unified target 2-port 10GbE (ports e3a and e3b)
4	X1140A-R6	Unified target 2-port 10GbE (ports e4a and e4b)
5	X1971A-R5	Flash Cache™ – 512GB
6	X2065A-R6	SAS, 4-port, 6Gb

Table 14) Cisco C220M3 card layout for Single-wire management

Slot	Part Number	Description
1	Cisco UCS VIC1225	CNA 2-port 10GbE (ports 0 and 1)

5.2 Installation and Setup Instructions FAS8060 Systems



Install Hardware

1. Attach cable management tray.
2. Cable e0a through e0d on all controllers to switches.


10GbE Network cables

3. Connect wrench ports to the management switch.


Network cables

4. Connect GbE ports e0i and e0k to GbE data network switches.


Network cables

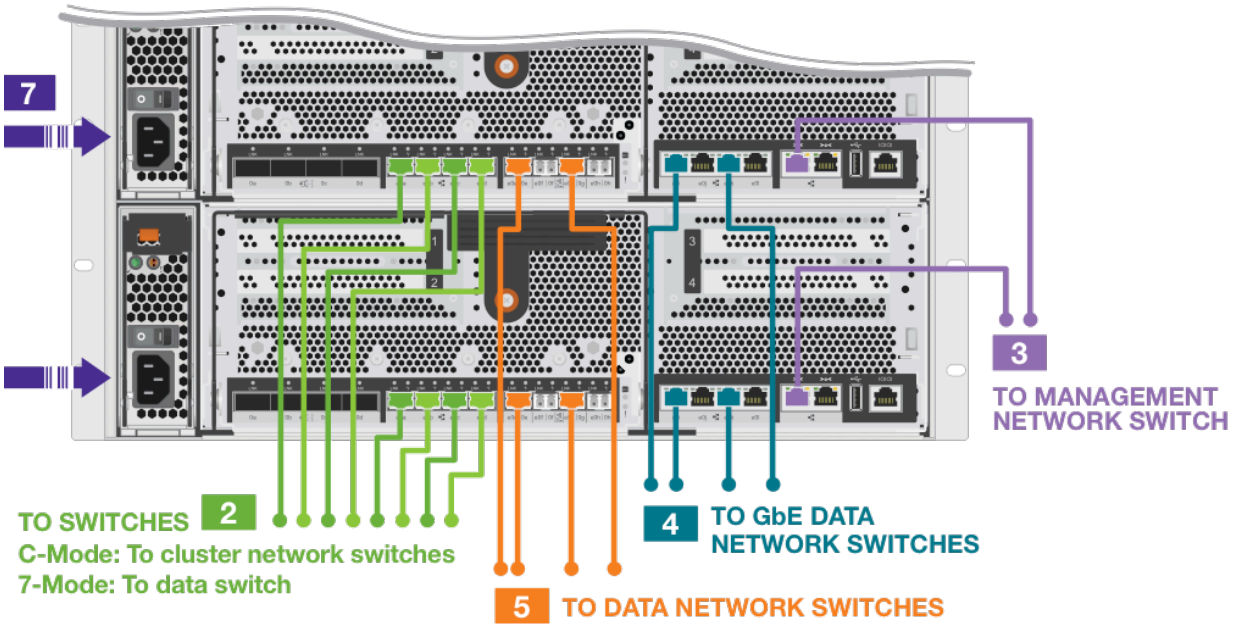
5. Connect ports e0e|0e and e0g|0g to data switch.


10GbE Network cables

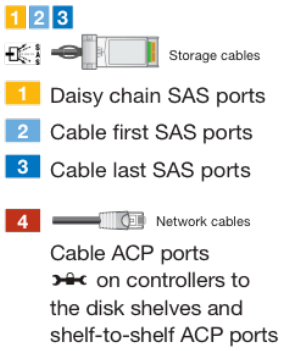
6. Strap the cables to the cable management tray.
7. Cable both power supplies for each chassis.

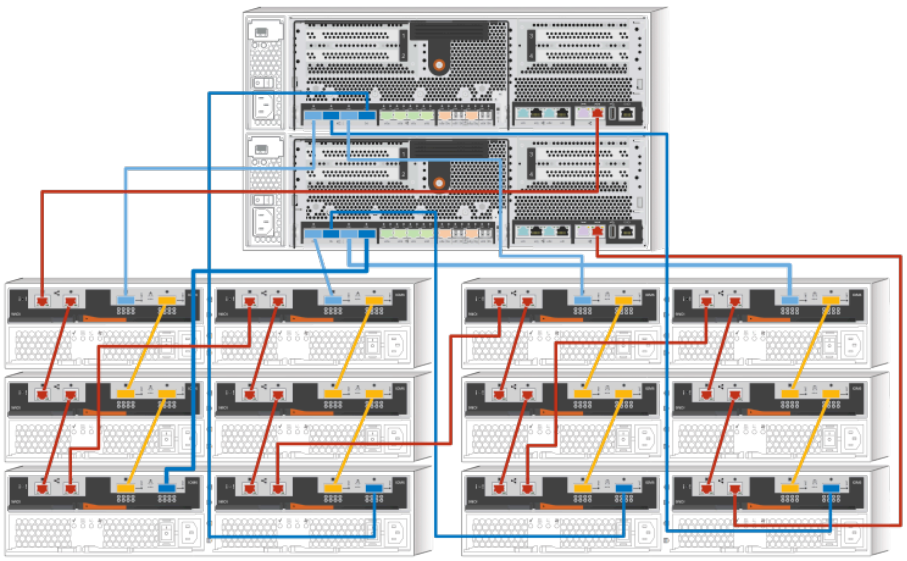

Power cables

Switched HA configuration (clustered Data ONTAP and 7-Mode)



Cable Storage





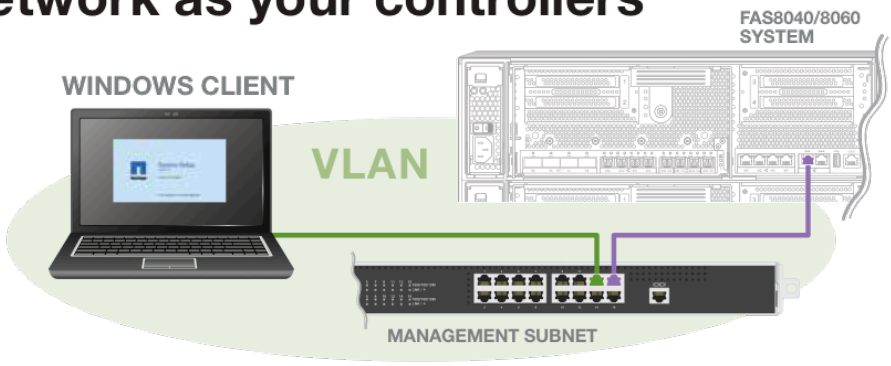
Complete System Setup

A For Clustered Data ONTAP

1 Complete configuration worksheet

From http://support.netapp.com/NOW/public/system_setup/

2 Cable Windows client to same network as your controllers



3 Power on all disk shelves ONLY and check IDs

4 Install and run System Setup software

*If you cannot use System Setup, see the Data ONTAP Software Setup Guide.

- Install System Setup software
- Do not power on your system until directed by System Setup software
  Both power supplies MUST be powered on.
- Discover the system.
  Wait for discover to complete.
- Enter the values from the configuration worksheet into System Setup.*

6 ESXi Host Configuration

Each host will be configured with ESXi 5.5 as noted below.

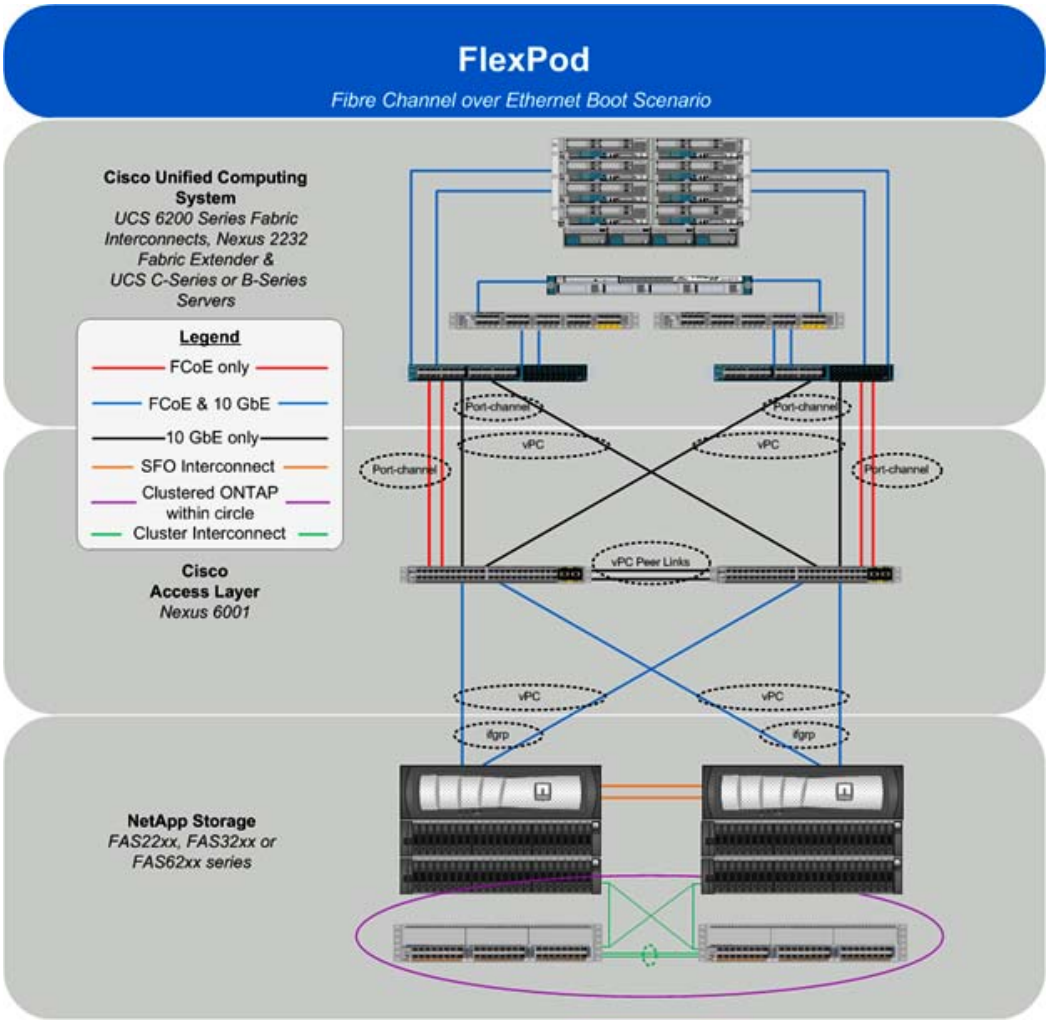
6.1 Storage

NetApp Workflow Automator (WFA) will be used to provision several NFS datastores presented to each host supporting the management application infrastructure.

WFA will be used to provision a NFS FlexVol containg all MySQL binaries which will be mounted to each MySQL database VM.

WFA will be used to provision FC LUNs for each host boot drive.

Figure 2) VMware vSphere Built on FlexPod.



6.2 Licensed Features

Each host will be licensed with VMware vSphere Enterprise Plus

6.3 Time Configuration

Each host will be configured to start NTP automatically and point to the domain controllers in their respective data centers.

6.4 DNS and Routing

DNS will be configured with to point to the domain controllers in their respective data centers. The default gateway will be the IP address of the VLAN on the network switch.

6.5 Virtual Machine Swap File Location

This setting will be configured at the cluster level and inherited by the host. A dedicated NFS Datastore will be configured for the purpose of VM Swap storage. The FlexVol backing this Datastore will be configured without NetApp storage efficiency features enabled as VM Swap represents non-persistent data.

6.6 Host Profiles

Host profiles will be configured for each host to automatically create and configure vSwitch and VLAN information.

7 vCenter and ESXi Cluster

A single vCenter server per depot was selected to simplify the configuration.

7.1 vCenter

VMware vCenter Appliance 5.5 will be deployed utilizing the Medium Inventory configuration. This will provide a simplified deployment while still supporting the environment without exceeding vCenter maximums. The vCenter Appliance will utilize the embedded Postgress DB rather than a separate Oracle DB. Again, this is done to minimize the complexity of the configuration. SSO/vCenter will be configured to utilize AD authentication.

7.2 Datacenter

Each depot will be its own Datacenter in its respective vCenter server. This will help to facilitate DR/BCP through Site Recovery Manager (SRM).

7.3 Cluster

Each depot will begin with twelve (12) Cisco B200 M3 blades available. Only ten (10) of these blades will be assigned ESXi service profiles providing two spares should a hardware failure occur. Initially, these ten hosts will comprise a single cluster, Alpha01 (Site##). If necessary, additional FlexPods can be deployed.

7.4 HA

HA will be enabled for each cluster, Admission Control will be disabled initially until the environment has been running for 90 days. VM restart priority will be set to medium and isolation response to Leave Powered On. After 90 days an in-depth review of resource utilization will be performed to identify the appropriate Admission Control Policy and isolation response settings.

Datastore hearbeat selection will be designated to two NFS datastores.

7.5 DRS

vSphere DRS will be set to fully automatic to allow for dynamic rebalancing of workload across all nodes in the cluster. Affinity rules will be set to keep all members of a a vAPP together on a host in order to maximize communication between the VMs. One component of the vAPP alone serves little value and multiple instances of the vAPP will be distributed across nodes in the cluster for horizontal scaling and high availability.

7.6 VASA

The NetApp VASA VP will be installed as a VM. Storage capabilities will be utilized to determine best placement for Datastores and intital placement of VMs. VASA will also provide alerts on overcommit and performance for the Datastores.

7.7 VSC

NetApp VSC will be installed and utilized to ensure that all hosts are configured in accordance with NetApp Best Practices. These settings are detailed in the VSC Install and Admin Guide. Additionally, WFA will make remote calls to VSC to enable Datastore creation, again ensuring adherence to best practices, as well as VM cloning leveraging NetApp Zero-Cost Clones, AKA file level FlexClone.

VSC Backup & Recovery will be employed to provide SLA policies for each Datastore. By doing so, any VM hosted on the Datastore is automatically protected by that policy. Each Datastore will be backed up on an hourly basis utilizing NetApp Snapshots and those backups will be vaulted to Amazon Glacier cloud storage through NetApp OnCloud for AWS through a SnapVault relationship. This arrangement will provide for local disk to disk recovery of up to a weeks worth of hourly restore points as well as long term off-site storage of backups.

The NetApp NFS VAAI plugin will be installed and configured for each host through the VSC. Again, this is done to ensure compliance with all NetApp best practices.

7.8 WFA

OnCommand Workflow Automation (WFA) is a flexible, powerful framework and portal for creating storage-centric automation tasks. WFA brings together feature richness and simplicity to allow users to express specific automation needs and conventions easily. WFA comes with a predefined and supported base of building blocks to realize custom provisioning needs. A standard Web Services Description Language [WSDL] interface allows triggering of the WFA workflows from almost any source and orchestration software.

7.9 UCS Director

Cisco UCS Director (formerly Cisco Cloupia Unified Infrastructure Controller) is a 64-bit appliance that uses the following standard templates:

- Open Virtualization Format (OVF) for VMware vSphere
- Virtual Hard Disk (VHD) for Microsoft Hyper-V

Cisco UCS Director delivers unified, highly secure management for the industry's leading converged infrastructure solutions, which are based on the Cisco UCS and Cisco Nexus platforms.

Cisco UCS Director extends the unification of computing and network layers through Cisco UCS to provide data center administrators with comprehensive visibility and management capability. It supports NetApp FlexPod and ExpressPod, EMC VSPEX, and VCE Vblock systems, based on the Cisco UCS andCisco Nexus platforms.

Cisco UCS Director automates the provisioning of resource pools across physical, virtual, and bare-metal environments. It delivers native, automated monitoring for health, status, and resource utilization. For example, you can do the following using Cisco UCS Director:

- Create, clone, and deploy service profiles and templates for all servers and applications
- Monitor organizational usage, trends, and capacity across a converged infrastructure on a continuous basis, such as by viewing heat maps that show virtual machine (VM) utilization across all your data centers
- Deploy and add capacity to ExpressPod and FlexPod infrastructures in a consistent, repeatable manner
- Manage, monitor, and report on Cisco UCS domains and their components
- Extend virtual service catalogs to include physical infrastructures services
- Manage secure multitenant environments to accommodate virtualized workloads that run with nonvirtualized workloads

8 Storage

8.1 Clustered Data OnTap Overview

Clustered Data OnTap (cDOT) provides a scale out storage architectiure providing linear scaling for both capacity and performance. cDOT also provides data management and non-disruptive operations making data stewardship a manageable task. Additionally, the implementation of Storage Virtual Machines (SVM) provides the ability to securely share the underlying storage infrastructure among multiple independent tenents and to apply quality of service (QOS) to each of the SVMs guaranteeing that rouge VMs in on one tenant won't affect the performance of another.

8.2 Storage Model Overview

The NetApp FAS8060A was chosen because, like all NetApp FAS controllers, it fully supports a unified storage architecture supporting, simultaneously, FCP, iSCSI, FCoE, NFS 3 & 4, pNFS and SMB 2 & 3. This allows for a single node to support every protocol needed in a virtual infrastructure.

The FAS8060A is configured with 128GB RAM and 16GB of NVRAM paired with an Intel Sandy Bridge architecture with 4 x 64-bit octo-core processors for a total of 32 2.1GHz cores. For connectivity, the FAS8060A comes with 8 10GbE, 8 UTA2 (10GbE, 16Gb FC or 10Gb FCoE), 4 GbE, 8 6Gb SAS and 8 expansion slots.

The FAS8060A supports up to 1,200 SAS spindles for a RAW maximum capacity of 4,800TB. In this configuration, we have chosen the FAS8060A AFF (All Flash FAS) which is capable of supporting up to 240 1.2TiB SSDs for a RAW maximum capacity of 288TiB. With NetApp storage efficiencies, we expect a minimum of 5:1 reduction allowing for an effective capacity of 1,440TiB.

Each FlexPod will be configured with four (4) nodes and each pair of nodes will be configured with ten (10) shelves of 1.2TiB SSD. Each node will be assigned five (5) shelves or one hundred twenty (120) SSDs. These will be configured into two (2) aggregates per node utilizing RAID-DP with a raid group size of 23. This will allow for excellent performance, optimized capacity utilization and reasonable spares.

8.3 Protocols

NFS will be the primary protocol for vSphere datastores and will also be used for mounts to the Linux VMs. SMB will be used to provide access to software repositories for Windows hosts and FCoE will be used for the ESXi boot LUNs.

9 Network

9.1 Cisco 6200 Fabric Interconnects

- Two Cisco UCS 6248UP fabric interconnects

The Cisco UCS 6200 Series Fabric Interconnects are a core part of the Cisco Unified Computing System, providing both network connectivity and management capabilities for the system (Figure 2). The Cisco UCS 6200 Series offers line-rate, low-latency, lossless 10 Gigabit Ethernet, Fibre Channel over Ethernet (FCoE), and Fibre Channel functions.

The Cisco UCS 6200 Series provides the management and communication backbone for the Cisco UCS B-Series Blade Servers and 5100 Series Blade Server Chassis. All chassis, and therefore all blades, attached to the Cisco UCS 6200 Series Fabric Interconnects become part of a single, highly available management domain. In addition, by supporting unified fabric, the Cisco UCS 6200 Series provides both the LAN and SAN connectivity for all blades within its domain.

From a networking perspective, the Cisco UCS 6200 Series uses a cut-through architecture, supporting deterministic, low-latency, line-rate 10 Gigabit Ethernet on all ports, switching capacity of 2 terabits (Tb), and 320-Gbps bandwidth per chassis, independent of packet size and enabled services. The product family supports Cisco® low-latency, lossless 10 Gigabit Ethernet unified network fabric capabilities, which increase the reliability, efficiency, and scalability of Ethernet networks. The fabric interconnect supports multiple traffic classes over a lossless Ethernet fabric from the blade through the interconnect. Significant TCO savings come from an FCoE-optimized server design in which network interface cards (NICs), host bus adapters (HBAs), cables, and switches can be consolidated.

9.2 Cisco Nexus 2200 Fabric Extenders

- Two Cisco Nexus 2232PP fabric extenders

Cisco UCS 2200 Series Fabric Extenders bring the unified fabric into the blade server enclosure, providing multiple 10 Gigabit Ethernet connections between blade servers and the fabric interconnect, simplifying diagnostics, cabling, and management. It is a second-generation I/O module (IOM) that shares the same form factor with the first-generation Cisco UCS 2100 Series Fabric Extenders IOM and is backward-compatible with the shipping Cisco UCS 5108 Blade Server Chassis.

The Cisco UCS 2200 Series extends the I/O fabric between the Cisco UCS 6100 and 6200 Series Fabric Interconnects and the Cisco UCS 5100 Series Blade Server Chassis, enabling a lossless and deterministic Fibre Channel over Ethernet (FCoE) fabric to connect all blades and chassis together. Since the fabric extender is similar to a distributed line card, it does not perform any switching and is managed as an extension of the fabric interconnects. This approach removes switching from the chassis, reducing overall infrastructure complexity and enabling Cisco UCS to scale to many chassis without multiplying the number of switches needed, reducing TCO and allowing all chassis to be managed as a single, highly available management domain.

The Cisco UCS 2200 Series also manages the chassis environment (the power supply and fans as well as the blades) in conjunction with the fabric interconnect. Therefore, separate chassis management modules are not required.

Cisco UCS 2200 Series Fabric Extenders fit into the back of the Cisco UCS 5100 Series chassis. Each Cisco UCS 5100 Series chassis can support up to two fabric extenders, allowing increased capacity and redundancy.

9.3 Cisco Nexus 6000 switches

- Two Cisco Nexus 6001 switches

The Cisco Nexus 6001 Series Switch is a wire-rate Layer 2 and Layer 3, 48-port 10 Gigibit Ethernet (GE) switch with 40 GE uplinks. It is optimized for high-performance, top-of-rack 10 GE server access and Cisco Fabric Extender (FEX) aggregation. The switch delivers high performance, operational efficiency, and design flexibility for traditional, virtualized, and cloud environments.

9.4 Virtual Switch Configuration

Four (4) standard vSwitches will be configured on each host.

vSwitch0 is a standard vSwitch with two 10Gb ports carrying traffic for VLAN 3175 (ESXi Management). vSwitch0 will be configured with a VMKernel Port.

vSwitch1 is a standard vSwitch with two 10Gb ports carrying traffic for VLAN 3173 (vMotion). vSwitch1 will be configured with a VMKernel Port

vSwitch2 is a standard vSwitch with two 10Gb ports carrying traffic for VLAN 3172 (NFS). vSwitch2 will be configured with a VMKernel Port and VM Port Group.

vSwitch3 is a standard vSwitch with two 10Gb ports carrying traffic for VLAN 3174 (VM traffic). vSwitch3 will be configured with a VM Port Group.

9.5 Virtual Machine Tempates

VM templates will be created from OVF files stored in a central repository on the NetApp FAS and replicated from Alpha depot to all others. All template management will be done in the Alpha site and distributed via NetApp SnapMirror. The template configurations are as described in Section 3.1.

9.6 Virtual Machine Backup and Recovery

VM backup and recovery will be achieved through the use of VSC Backup & Recovery as outlined in Section 7.1.

10 Datacenter

There exists a significant risk that the perimeter of a depot could be overrun by zombies. In order to prevent the loss of our IT infrastructure in this event, we have decided to employ a mobile self-contained datacenter design.

We have selected the MDC 20-9 FAST Mobile Data Center for this assignment. Each MDC 20-9 supports 9 42U racks as well as cooling, UPS backup and diesel generator.

10.1 MDC 20-9 Specifications

12 kW average available per rack
108 kW total power available
288 2.53-GHz compute cores this configuration
14.40 PB of raw storage for SAN and NAS access
Redundant 35-ton chillers with 100 gallon water storage tank
Internally redundant 125 kW UPS supporting 9 minutes of battery backup at full load
250 kW Generator Container with internal diesel fuel tank that provides 24 hours runtime

Figure 3) MDC20-9 9 Rack Container.

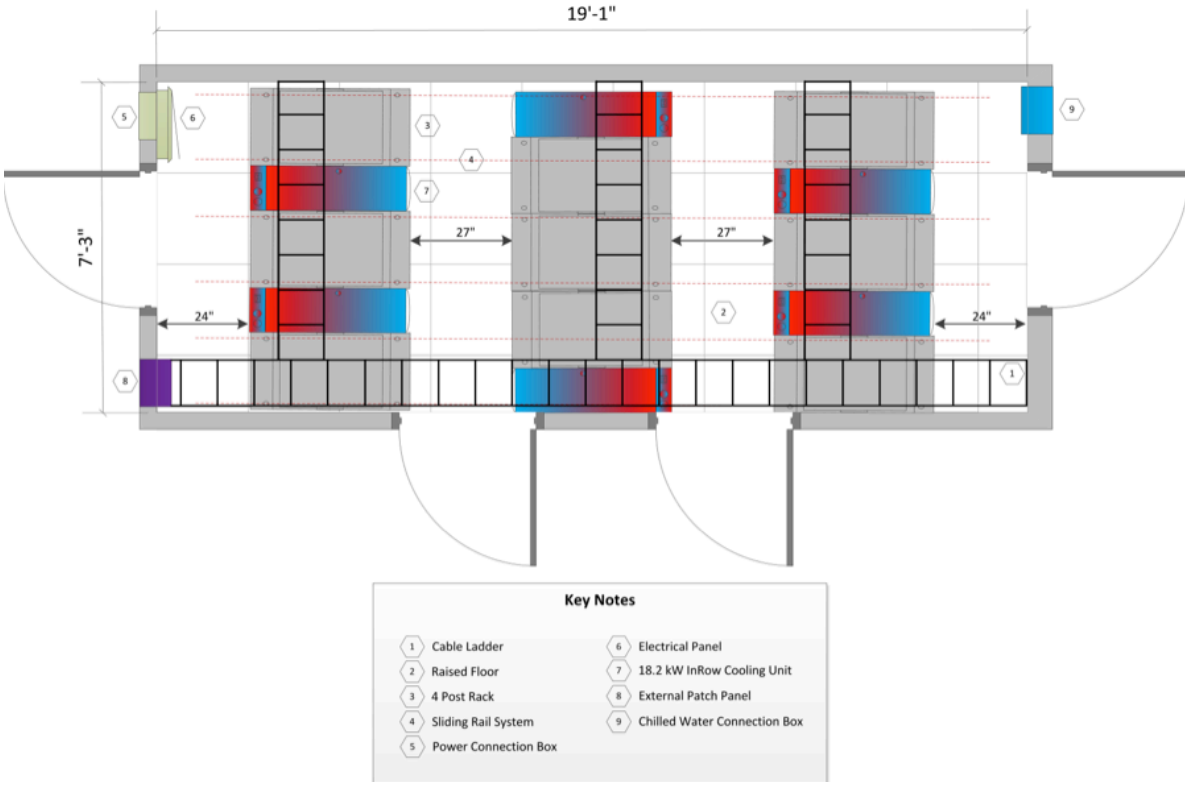


Figure 4) 250 kw Generator Container.

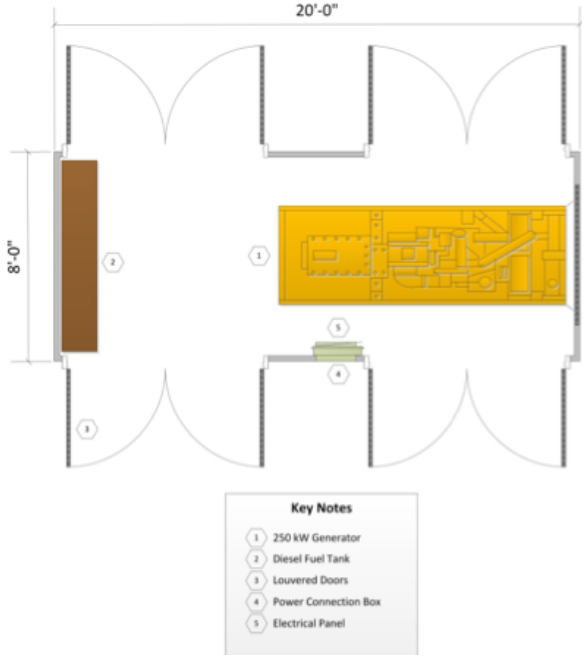


Figure 5) Redundant 35-Ton Chiller Container.

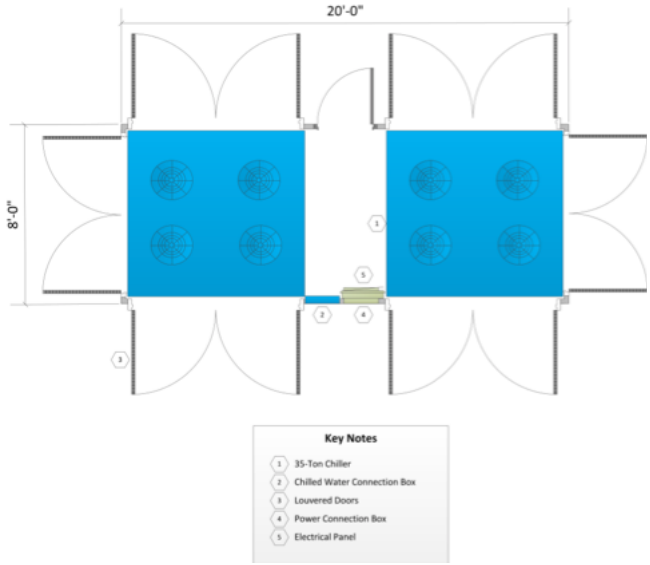
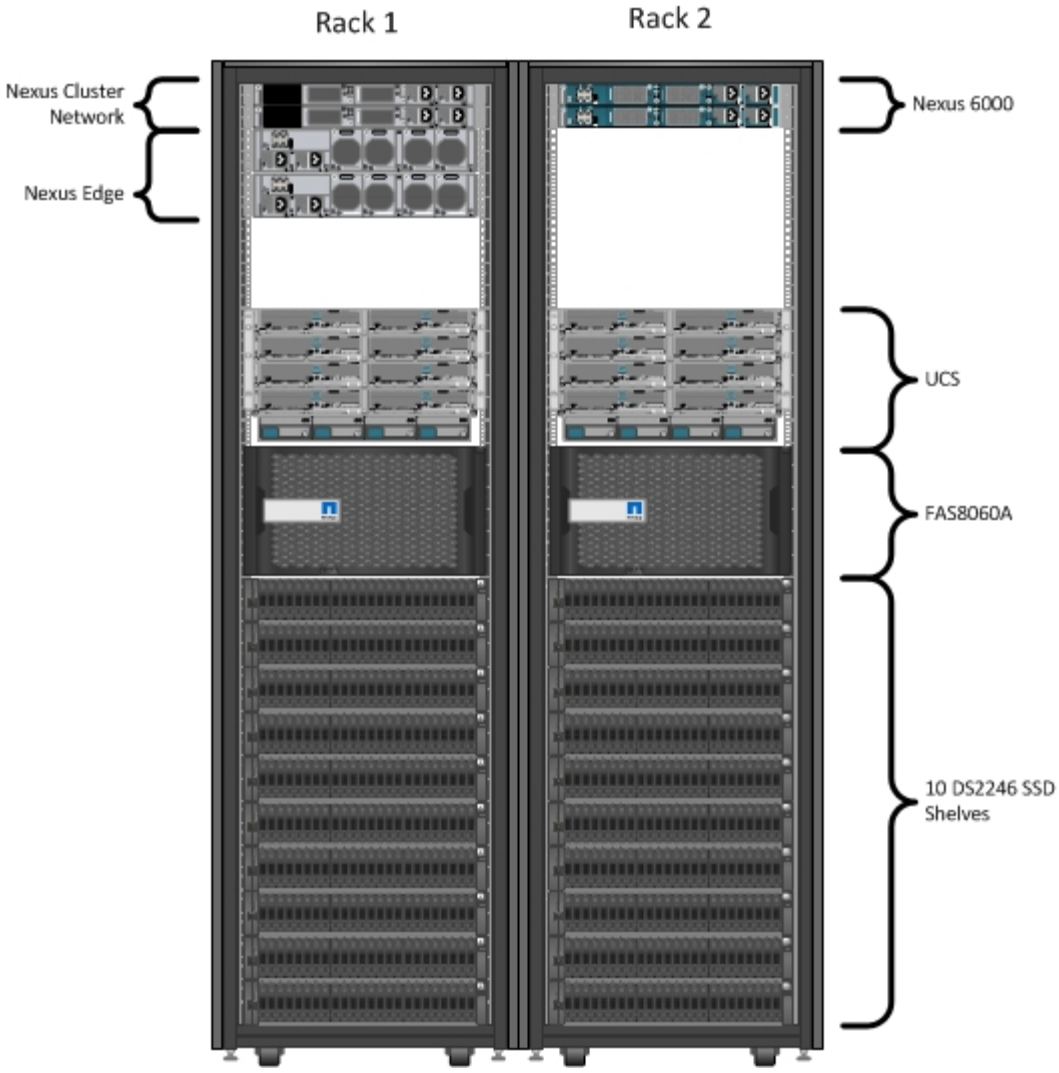


Figure 6) Rack Diagram.



References

Cisco UCS Director Install Guide	http://goo.gl/SYvYji
FlexPod Deploymnet Guide	http://goo.gl/bPbGro
Cisco 2200 Fabric Extender Data Sheet	http://goo.gl/GWhjV1
Cisco 6200 Fabric Interconnect Data Sheet	http://goo.gl/nZjQSx
Cisco B200 M3 Blade Server Data Sheet	http://goo.gl/8bmipI
Cisco Nexus 6001 Switch Data Sheet	http://goo.gl/pPDXno
VMware vCenter Appliance 5.5 Minimum Requirements	http://goo.gl/TWimBW
VMware ESXi and vCenter 5.5 Documentation	http://goo.gl/PPxMfu
Clustered Data OnTap Configuration Worksheet	http://goo.gl/5O1Kuv
FAS8060 Setup Instructions	http://goo.gl/jCRkfJ
NetApp System Setup Release Notes	http://goo.gl/704qEf
FAST MDC 20-9 Brochure	http://goo.gl/YEIpt2