Virtual Design Master

Conceptual Design
Challenge 1

Prepared by
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Executive Summary

Project Overview

Millionaire philanthropists Richard M. and Elon B., have teamed up to work towards humanity's survival after the outbreak of the virus, that lead to the zombie apocalypse and evacuation of what was left of the human species from earth. They are seeking an infrastructure design for permanent human colonization in Mars. Virtual Design Master an online reality show that challenges virtualization professionals to come up with innovative virtualization designs has been tasked to select the next Virtual Design Master to design a permanent IT infrastructure in Mars.

In Season 2 the zombies returned with a vengeance, which led humans to evacuate earth and establish a temporary base on the moon, while our new home in Mars was being setup. Towards the end of Season 2, humans had established base in Mars, along with temporary IT infrastructure to accommodate immediate needs.

It is now time to replace the temporary infrastructure with a permanent solution, since the human colonization in Mars has been stable and our needs have grown. Various critical control systems such as the Environmental system, Greenhouse control system and productivity and collaboration systems are dependent on the availability of the proposed IT infrastructure.

The Conceptual Design provides a high-level overview of the proposed solution for the three datacenter facilities, Viking 2, Sojourner and Phoenix including hardware and software components required, sizing estimates and design considerations for each layer of the technology stack.

Project Goals

During the course of the project, Virtual Design Master and Dennis George identified a number of different project goals. The following summarizes those goals and illustrates how this Conceptual Design deliverable addresses them.

Priority	Key Characteristics	Description
1	Minimize utilization of Power, Space and Cooling for the new infrastructure.	In order to minimize utilization of Power, Space and Cooling, dense infrastructure components have been selected in this design, such as Cisco UCS Blade systems for compute, Cisco Nexus 7k for network and NetApp FAS6290
2	Limit design to 10G and 40G switching gear. In order to save on space, the design should not use Fibre Channel switching.	The design leverages Cisco Nexus 7000 in the core, with a mix of 40G and 10G slots. The network is designed as a folded CLOS network, to provide aggregation layer services across the different pods.
3	Critical applications such as Environmental system, Greenhouse control system, and Communication systems should be made highly available	All critical systems will be made highly available using VMware HA, and VMware DRS. And VMware SRM will be leveraged as the BC/DR solution of choice. In addition productivity and collaboration applications will be delivered using Citrix XenApp and Citrix NetScaler appliances providing Global Server Loadbalancing services across the three datacenters.
4	The design should be able to support an unknown business critical application in the future.	The design leverages VMware NSX network virtualization technology, this will allow for seamless integration of unknown applications in the future, without issues such as IP conflicts etc.

Deliverable Summary

Supplemental Information and Links

These links provide further information on the concepts and recommendations discussed during this document.

- Phoenix (spacecraft) - Phoenix was a robotic spacecraft on a space exploration mission on Mars under the Mars Scout Program. The Phoenix lander descended on Mars on May 25, 2008.
- Sojourner (Mars pathfinder) - Sojourner was the Mars Pathfinder robotic Mars rover that landed on July 4, 1997 and explored Mars for around three months.
- Viking 2 - The Viking 2 mission was part of the American Viking program to Mars, and consisted of an orbiter and a lander essentially identical to that of the Viking 1 mission. The Viking 2 lander operated on the surface for 1316 days, or 1281 sols, and was turned off on April 11, 1980 when its batteries failed
- Mars Mileage Guide – A comprehensive guide outlining the distance between various locations on Mars.
- Cisco UCS 6296UP 96-Port Fabric Interconnect - The Cisco UCS 6296UP 96-Port Fabric Interconnect is a core part of the Cisco Unified Computing System. Typically deployed in redundant pairs, the Cisco UCS 6296UP Fabric Interconnects provide uniform access to both networks and storage.
- Cisco UCS 5100 Series Blade Server Chassis - The Cisco UCS 5100 Series Blade Server Chassis is a crucial building block of the Cisco Unified Computing System, delivering a scalable and flexible architecture for current and future data center needs, while helping reduce total cost of ownership.
- Cisco UCS 2200 Series Fabric Extenders Dat4a Sheet - 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.
- Cisco UCS B420 M4 Blade Server - Designed for demanding virtualization and database workloads, the B420 M4 combines a large memory footprint with 4-socket scalability, using the Intel® Xeon® processor E5-4600 v3 product family.
- Cisco UCS B420 M3 Blade Server - Designed for enterprise performance and scalability, the Cisco UCS B420 M3 Blade Server combines the advantage of four-socket computing with the cost-effective Intel® Xeon® processor E5-4600 and E5-4600 v2 product families, for demanding virtualization and database workloads.
- Cisco UCS Virtual Interface Card 1380 - The Cisco UCS Virtual Interface Card (VIC) 1380 is a dual-port 40-Gbps Ethernet, or dual 4 x 10 Fibre Channel over Ethernet (FCoE)-capable mezzanine card designed exclusively for the M4 generation of Cisco UCS B-Series Blade Servers.
- Cisco UCS Virtual Interface Card 1240 – The Cisco UCS Virtual Interface Card (VIC) 1240 is a 4-port 10 Gigabit Ethernet, Fibre Channel over Ethernet (FCoE)-capable modular LAN on motherboard (mLOM) designed exclusively for the M3 generation of Cisco UCS B-Series Blade Servers.
- Cisco Nexus 7700 18-Slot Switch - The Cisco Nexus 7700 Switches are the latest extension to the Cisco Nexus 7000 Series modular switches. With more than 83 terabits per second (Tbps) of overall switching capacity, the Cisco Nexus 7700 Switches delivers the highest-

capacity 10, 40, and 100 Gigabit Ethernet ports in the industry, with up to 768 native 10-Gbps ports, 384 40-Gbps ports, or 192 100-Gbps ports.

- NetApp FAS6290 Series enterprise data storage controller - NetApp FAS6200 Series storage systems are designed to deliver superior availability and proven performance to satisfy the most demanding workloads.

SECTION 2: CONCEPTUAL DESIGN

Architecture

The following diagram shows the conceptual architecture for the inter-datacenter connectivity.

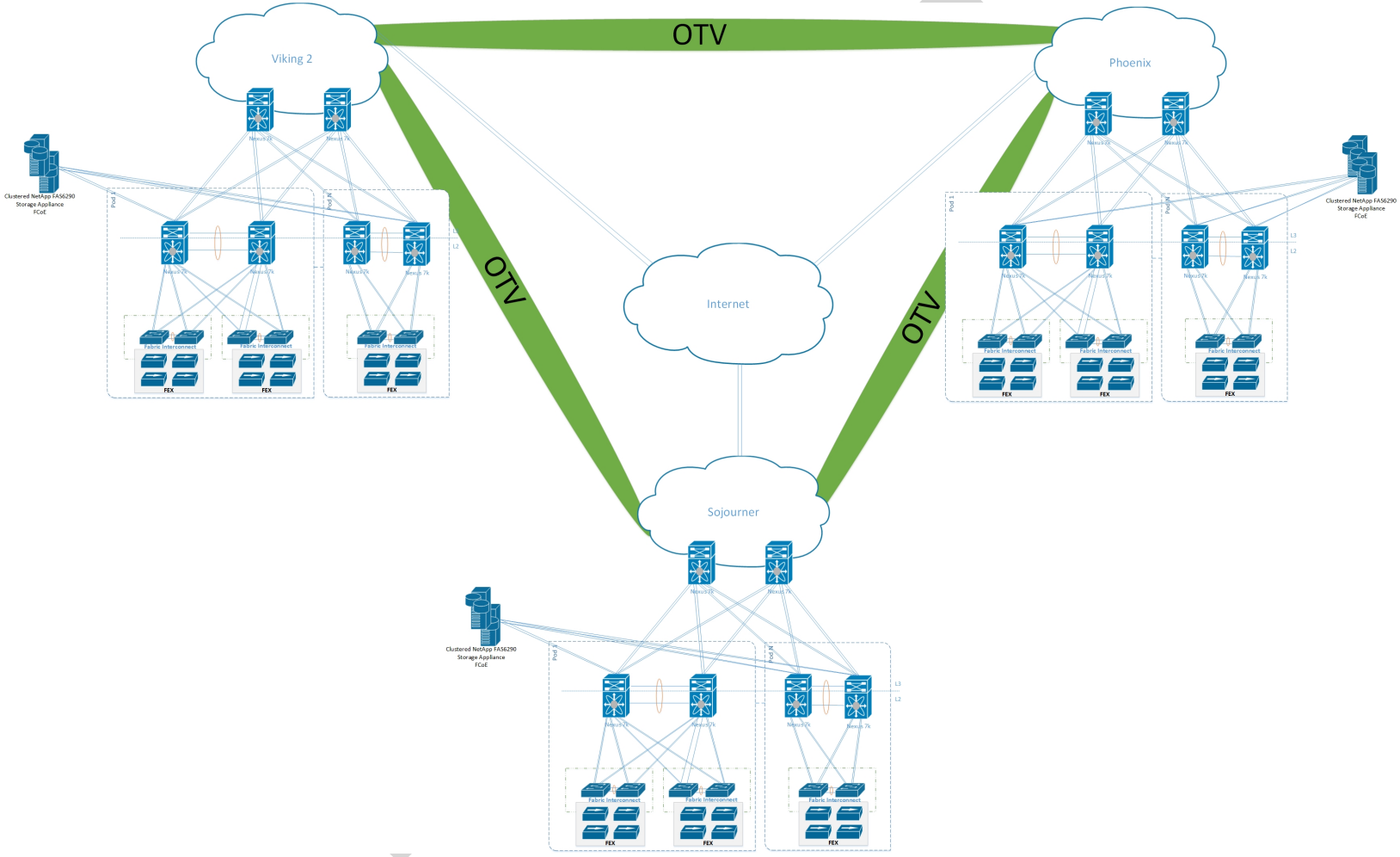

Figure 1 Multi-datacenter Architecture

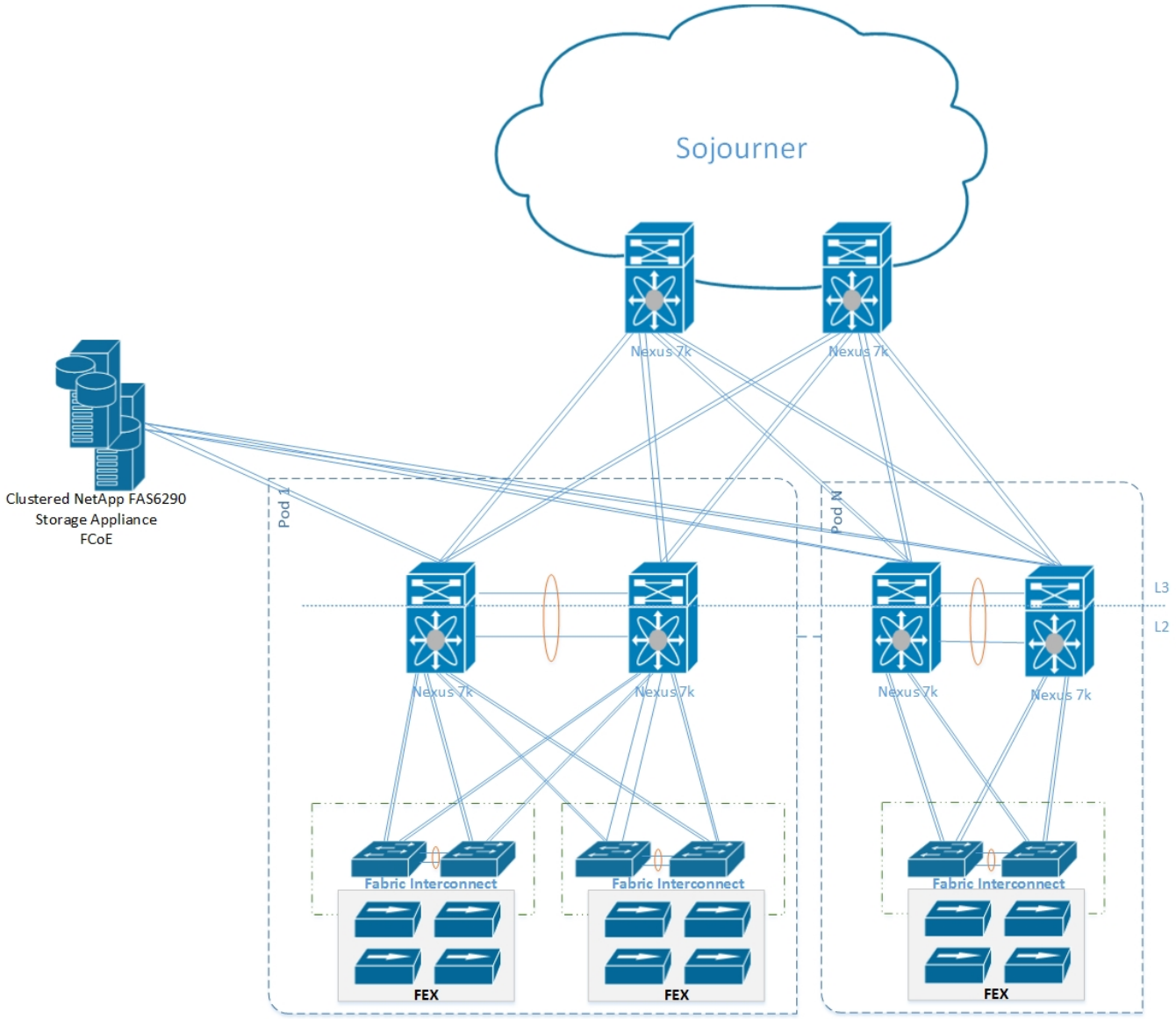

Figure 2 Pod based architecture within each datacenter

Hardware inventory

Device	Description
Cisco UCS 5108 Blade Server Chassis	• Four full-width Cisco UCS B420 M3 or Cisco UCS B440 M2 in each chassis. • Each chassis will have two FEX modules connecting to the Fabric Interconnect.

Cisco UCS B420 M3 Blade Server	• Management cluster nodes will consist of Cisco UCS B420 M3 Blades.
	  ○ 4 Sockets, 12 core
	  ○ 1.5 TB RAM (32 DIMMs)
	  ○ 4 TB HDD
	  ○ Two 16 GB SD flash memory cards

Cisco UCS Virtual Interface Card (VIC) 1240 with I/O expander	• Each management cluster node will have a Cisco UCS Virtual Interface Card 1240 with optional I/O expander, connected to redundant A and B sides of the internal UCS fabric. • Each server will have a total of 80 GigE bandwidth for server-to-server traffic in the UCS fabric.

Cisco UCS B420 M4 Blade Server	• Compute cluster nodes will consist of Cisco UCS B420 M4 Blades.
	  ○ 4 Socket, 18 core
	  ○ 3 TB RAM (48 DIMMs)
	  ○ 4 TB HDD
	  ○ Two SD card slots (external)

Cisco UCS Virtual Interface Card (VIC) 1380	• Each management cluster node will have two Cisco UCS Virtual Interface Card 1380, connected to redundant A and B sides of the internal UCS fabric. • Each server will have a total of 160 GigE bandwidth for server-to-server traffic in the UCS fabric.
Cisco UCS 2208XP Fabric Extender	• Each Fabric Extender consists of eight 10 GigE slots. • The two FEX modules per chassis provides for 160 Gb of bandwidth to the chassis.
Cisco UCS 6296UP Fabric Interconnect	• Each UCS 6296 Fabric Interconnect aggregates via redundant 10 GigE EtherChannel connections into the spine.

Device	Description
Cisco Nexus 7700 switches	• The network design leverages a folded CLOS network design, aggregating leaf level Nexus 7k switches with the Nexus 7k switches in the network spine. The leaf level Nexus 7k switches will be connected to the Cisco UCS Fabric Interconnect. • Each pod will have a minimum of two Nexus 7k switches which will be the L2 / L3 boundary. • The storage appliance will be connected at the leaf Nexus 7k switches.
NetApp FAS6290 Series enterprise data storage	• Up to 8 control cluster nodes per pod. • FCoE will be leveraged as a storage protocol of choice. • A mix of DS2246, DS4246 and DS4486 disk shelves will be leveraged for storage.

- In addition L2 connectivity will be configured across the three datacenters using the Cisco Nexus 7k and OTV technology. This will provide for seamless workload mobility across the datacenters.
- The design will leverage VMware NSX as the network virtualization product of choice.
    - Each blade will be configured with 4 VLANs
        - VLAN 100 : Management
        - VLAN 110 : vMotion
        - VLAN 120 : IP Storage (For future)
        - VLAN 200 : Transport
        - VLAN 300 : Edge DMZ
    - NSX Edge Services routers will be leveraged for North – South traffic and Distributed Logical Routers will be leveraged for East – West traffic.
    - Implementation of VXLAN based networks will allow for unknown applications to be easily integrated into the environment.