RETURN TO EARTH

Virtual Design Master Season 4

Challenge 1

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Executive Summary

After nearly a year of monitoring, it appears that the Zombie Assassin System has rid the Earth of the zombie threat. It's time to take back our home planet, but first, a suitable infrastructure must be in place to support life. Backed by Mr. Billionaire, the Earth Repopulation Technology Heroes team (ERTH for short), has been assigned this task.

Scope

Laying the foundation for the repopulation, the following objectives need to be met. First and foremost, the HumanityLink software suite must have consistent performance and uptime. This is critical to the success of the Earth repopulation project. The second objective is to build a secondary site on the Moon to support the newly built Earth infrastructure.

Requirements, Constraints, Assumptions, and Risks

Requirements

The following requirements must be met for the new Earth infrastructure:

- A datacenter location must be chosen
- Any hardware platform may be used
- HumanityLink Software Suite
    - 3 Web Servers
    - 1 Database Server
    - 2 Application Servers
- Other servers:
    - 25 Web Servers
    - 5 Database Servers
    - 10 Application Servers

Constraints

- HumanityLink suite requires high performance and uptime
- A currently existing cloud management suite must be deployed

Assumptions

- The chosen datacenter location will be an existing datacenter from the time before zombies (BZ)
- As the site would have functioned as a datacenter BZ, the assumption of adequate power, cooling, and rack space to house this solution is made
- As no SLA was set for the HumanityLink software, the assumption of 99.99% uptime will be utilized
- The WAN connection between the Earth and Moon datacenter is assumed to be 100 Mbps with redundant connections built in
- As hardware requirements were not listed for the HumanityLink software, industry recommendations for web servers and database servers will be used

Risks

- No previously known performance metrics for the HumanityLink Software Suite exist, thus providing a level of uncertainty
- The threat for the zombie hoard to return will always exist

Datacenter Location

CHIDC01

The location of the new datacenter is critical as it will serve as the base of global repopulation. The datacenter must be close to food and water resources, as well as have low susceptibility to natural disasters. For this reason, the new datacenter will be located in Chicago, Illinois. On the shores of Lake Michigan, fresh water will be abundant, and with miles of farmland outside of the city, growing food should not pose an issue. With Chicago's location in the upper Midwest, the natural disaster threat is low. Avoiding threats such as hurricanes and earthquakes, the main threat to our new datacenter (CHIDC01) is the statistically low threat of a tornado during the spring-fall months. Chicago is also susceptible to blizzards in the winter, but the main side effect would be temporarily reduced access to the datacenter from those not staffed inside before the blizzard struck

MNDC01

Our secondary datacenter, MNDC01, will be located on the Moon in the Mare Foecunditatis crater. Located on the Earth facing side of the Moon, the name of this crater translates to the Sea of Fertility. As our goal is global repopulation, the selection of this crater was purely symbolic, and a token of good luck for our mission.

Application Architecture

The servers housing the HumanityLink Software Suite (HLSS) require higher performance than the other VMs which will be running in the environment. In each sub-category below, Performance Tiered VMs are listed for HLSS requirements, while the Standard Tier VMs can be used for day to day server needs.

As exact specifications for HLSS were not listed, Microsoft SQL & IIS/.NET best practices were utilized in this design. All VMs will be configured such that Hot Add of vCPU and vRAM is available to meet growing performance needs.

Web Servers

Performance Tier

- Windows Server 2012 R2 Datacenter
- IIS 8.5 & .NET Framework 4.6
- 6 GB RAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 100 GB Data Drive D:\

Standard Tier

- Windows Server 2012 R2 Datacenter
- IIS 8.5 & .NET Framework 4.6
- 4 GB vRAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 100 GB Data Drive D:\

Database Servers

Performance Tier

- Windows Server 2012 R2 Data Center
- Windows SQL Server 2012 R2
- 8 GB vRAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 250 GB Data Drive D:\
- 250 GB SQL Backup E:\

Standard Tier

- Windows Server 2012 R2 Data Center
- Windows SQL Server 2012 R2
- 6 GB vRAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 100 GB Data Drive D:\
- 100 GB SQL Backup E:\

Application Servers

Performance Tier

- Windows Server 2012 R2 Data Center
- 8 GB vRAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 250 GB Data Drive D:\

Standard Tier

- Windows Server 2012 R2 Data Center
- 4 GB vRAM
- 2 x 2.2 GHz vCPU
- 40 GB System Drive C:\
- 100 GB Data Drive D:\

Systems Architecture

Both the CHIDC01 and MNDC01 will have identical hardware and networking structures. This design was chosen to allow ease of migration between the sites and for quick and easy disaster recovery.

Host

As we are rebuilding a new Earth after the zombie outbreak, it's been decided to leave legacy architecture behind. A Nutanix hyper converged solution will be implemented in place of the traditional storage, network, and compute structure. The Nutanix cluster will be configured with a Replication Factor (RF) of 3. This means 3 copies of data will be kept across the cluster. The cluster can withstand the failure of two hosts or disks before cluster failure.

To ensure stability and uptime in the datacenters, each cluster was designed with one additional Nutanix node more than what the system requirements called for. This is not a true N+1 design as the node will be active, but the same thought process was placed into the design as life on 3 planets depends on the availability and performance of this design. A total of four (4) Nutanix 4 node appliances will be deployed: 2 in CHIDC01 and 2 in MNDC01. Each site will have a total of 5 nodes; one full appliance, and one appliance with a single node. This leaves 3 open slots for future growth.

NX-3060-G5 4 Node Appliance

Per Node Resources:

- 2 x Intel Broadwell E5-2650v4 24 Core 2.2 GHz processors
- 6 x 1.92 TB SSD
- 256 GB RAM
- 2 x 1 GbE
- 1 x 1 GbE RJ45 (IPMI)
- 4 x 10 GbE

Total Resources

RAM	640 GB
CPU	240 Cores
Storage	57.6 TB Raw

Storage

Storage is provided by the hyper converged Nutanix solution. All flash storage will be presented by the appliances. The total raw capacity of the Nutanix Cluster will be 57.6 TB. Usable capacity will be approximately 19 TB. Storage is presented via VMDirectPathI/O directly from the Nutanix Cluster and bypassing the ESXi hypervisor.

Network

Cisco Nexus 92160YC-X Series switching will be utilized for top of rack datacenter networking. Each datacenter will have 2 Nexus switches for redundancy. The 92160YC-X switches are capable of multiple speeds, and will be configured for 10 GB between the hosts.

As the networking between the VMs occurs within the Nutanix appliances, the Cisco switches will function as a connection between each appliance and between the appliances and the Cisco ASA (WAN link). Each port on the switch connected to a host will be configured for trunking as to pass traffic for all VLANs. Below is a breakdown of the VLANS to be implemented.

VLAN	Description
10	ESXi Management
20	vMotion Traffic
30	Cluster Management
40	HumanityLink Network
50	Data Network

Cisco Catalyst series switching will be used to provide LAN connectivity between the Nexus switches and the end users.

Firewall

A Cisco 5555-X Adaptive Security Appliance (ASA) will be placed in each datacenter as an edge device between the WAN and LAN. The primary functions of the ASA will be to provide network security from external threats and to provide a VPN link between CHIDC01 and MNDC01.

Cloud Platform

VMware vSphere 6.0 U2 with Enterprise Plus licensing will be used as the hypervisor on top of the Nutanix platform. Managing the platform will be vCenter Server 6.0 U2.

vCenter Server & Platform Services Controller

The Platform Services Controller (PSC) and vCenter Server (vCSA) will both be deployed as independent appliances. By separating the PSC from the vCSA, access to various VMware features will remain should the vCenter server crash.

The vSphere Single Sign-On "administrator@vsphere.local" account will be utilized during initial configuration. The password will be created such that it meets organizational complexity requirements.

The Platform Services Controller will be deployed with the following sizing requirements:

- Size: Small
- Disk: 30 GB
- RAM: 2 GB
- CPU: 2

The vCenter Server Appliance will be deployed with the following sizing requirements:

- Size: Small
- Disk: 108 GB
- RAM: 16 GB
- CPU: 4

vSphere Cluster

Given the smaller size of the deployments, 5 hosts and 46 VMs, a single vSphere cluster will be utilized.

Datastores

Each HumanityLink VM will have its own dedicated datastore utilizing the following naming convention:

- SQL – CHIDCHLSQLDS0x
- Web – CHIDCHLWEBDS0x
- App – CHIDCHLAPPDS0x

Standard tier VMs will utilize datastore pools for VMFS storage, with a naming convention that follows a similar style as the HumanityLink stores:

- CHIDCSQLDS0x
- CHIDCWEBDS0x

- CHIDCAPPDS0x

As an all flash storage solution is utilized, notation of varying storage tiers is unnecessary.

vSphere Fault Tolerance

Given the criticality of the HumanityLink Software, the 6 VMs running the suite will be configured for Fault Tolerance (FT). FT provides a shadow copy VM of the each of the HLSS virtual machines that is up to date with the production server. Should the hardware underneath the FT protected VM fail, the shadow copy will immediately take over production duties, resulting in zero lost productivity.

Site Recovery Manager & vSphere Replication

For an added level of protection, the HumanityLink VMs will be replicated to the MNDC01 using vSphere Replication (vSR) and managed using Site Recovery Manager (SRM). As more VMs come online which may be deemed "critical", they can be added to vSR protection.

SRM & vSR must be deployed at both the Chicago (protected) site and the Moon (recovery) site.

vSphere replication is deployed as an appliance with the following requirements:

- Disk: 2 GB
- Disk: 16 GB
- RAM: 4 GB
- CPU: 2

Site recovery Manager is deployed on a Windows 2012 R2 server with the following requirements:

- Windows Server 2012 R2 Data Center configured with the "Standard Tier" resources
- Much like the vCSA, given the size of the environment, an Embedded vPostgress Database will be utilized

Other VMware Features

High Availability

HA will be enabled for the production cluster to reboot virtual machines in the event of a host failure. Host Monitoring and Admission Control will be enabled. Admission Control Policy will be set to "Host failures cluster tolerates: 1"

Virtual Distributed Switching

A Virtual Distributed Switch will be deployed across the VMware Cluster. The vDS will be configured as follows:

- Port Group 1 – Management
- Port Group 2 – vMotion
- Port Group 3 – HumanityLink
- Port Group 4 – Data

Distributed Resource Scheduling

vSphere Distributed Resource Scheduling (DRS) will be enabled to load balance VMs across the cluster. As the cluster has been configured with ample resources on matching hardware, DRS will be set to Fully Automated.

Appendix and References

Bill of Materials

Hardware	Quantity
Cisco Nexus 92160YC-X	4
Cisco Adaptive Security Appliance 5555	2
Nutanix NX-3060-G5 4 Node Appliance	2
Nutanix NX-3060-G5 Nodes	10

Reference Links

Microsoft

- https://technet.microsoft.com/en-us/library/dn303418
- http://www.pearsonitcertification.com/articles/article.aspx?p=2248808&seqNum=2
- https://msdn.microsoft.com/en-us/library/ms143506(v=sql.110).aspx
- https://msdn.microsoft.com/en-us/library/cc268240.aspx

Cisco

- http://www.cisco.com/c/en/us/products/switches/nexus-92160yc-switch/index.html#
- http://www.cisco.com/c/en/us/support/security/asa-5555-x-adaptive-security-appliance/model.html

VMware

- http://pubs.vmware.com/vsphere-60/index.jsp#com.vmware.vsphere.install.doc/GUID-88571D8A-46E1-464D-A349-4DC43DCAF320.html
- http://www.vmwarearena.com/vmware-site-recovery-manager-srm-6-0-part-2-vmware-srm-6-0-installation/
- http://pubs.vmware.com/vsphere-replication-60/topic/com.vmware.ICbase/PDF/vsphere-replication-60-admin.pdf

Nutanix

- http://www.nutanix.com/products/hardware-platforms/
- http://nutanixbible.com/