VIRTUAL DESIGN MASTER

Season 5

Challenge 1 – Grab a shovel

It's now time to use a new robot fleet to terraform the Earth. Before we get started, we need to get infrastructure in place to support HumanityLink and the robot fleet.

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1 Objective

Now that we have settled back on Earth, it's time to clean up the mess left behind. With the power-that-be agreeing on the creating of a robot fleet to perform terraforming operations for a more habitable planet, we need to provide supporting infrastructure. Thankfully, the robot fleet will be managed and scheduled with the newly released HumanityLink 2.0.

1.1 Requirements

RQ01	3 site environment
RQ02	High availability of HumanityLink software
RQ03	Support future workloads
RQ04	Design resiliency

1.2 Constraints

C01	Earth Physics
C02	24/7 fleet operations
C03	Greenfield deployment

1.3 Assumptions

A01	Workload characteristics are unknown
A02	Connectivity options are available between sites
A03	Robot fleet has satellite uplinks for connectivity to HumanityLink

1.4 Risks

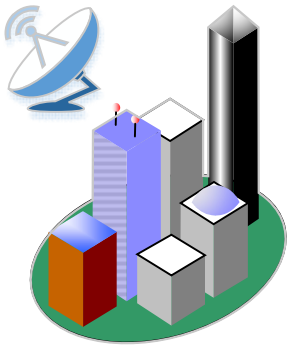
R01	Unknown Workload
R02	Limited WAN connectivity

2 Conceptual Design

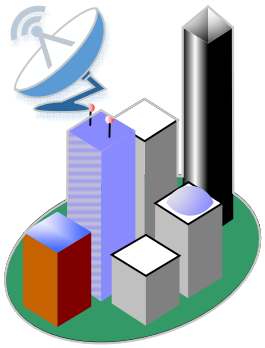
HumanityLink will be supported via 3 datacenters on Earth, each in a separate geographic region. The Houston datacenter will cover the Americas, the Jerusalem datacenter will cover the EMEA region, and finally the Pyongyang datacenter will cover the rest of the eastern world.

All 3 datacenters will be built with identical equipment, and network connectivity. Each location will house redundant satellite uplinks, as well as traditional fiber uplinks to the outside world. The datacenters will run VMware's vSphere with vSAN for a scalable solution.

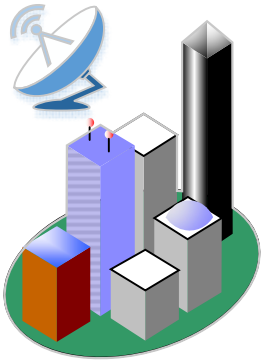
The sites were chosen due to residual bunkers used during the initial zombie outbreak, and have redundant power and cooling capability already established.



Houston



Jerusalem



Pyongyang

3 Infrastructure Design

3.1 Host Hardware

Each data center will consist of the following Cisco vSAN ready nodes: AF-8: Cisco UCS C240 M4

SKU	UCS-vSAN-C240M4-AF2-53TB
System	UCS C240 M4 SFF 24 HD w/o CPU,mem,HD,PCIe,PS,railkt w/expndr
CPU	2x UCS-CPU-E52690E 2.60 GHz E5-2690 v4/135W 14C/35MB Cache/DDR4
Memory	8x UCS-MR-1X322RV-A 32GB DDR4-2400-MHz RDIMM/PC4-19200/dual rank/x4/1.2v
Caching Tier	2x UCSSD16TB12S4EP 1.6TB 2.5” Enterprise performance 12G SAS SSD (10X endurance)
Capacity Tier	14x UCSSD38TBKS4EV 3.8TB 2.5” Enterprise Value 6G SATA SSD
Controller	UCSC-SAS12GHBA Cisco 12Gbps Modular SAS HBA
NIC	Cisco UCS VIC1227 VIC MLOM - Dual Port 10Gb SFP+
Boot Device	2x UCS-SD-32G-S 32GB SD Card for UCS servers

3.2 Cluster Design

Each cluster will consist of 8 servers, allowing for erasure coding and acceptable server maintenance. Due to the unknown requirements of HumanityLink, the solution will allow for scale out as well as scale up, with scale out being the preferred methodology.

This base deployment will have the following capacity:

- 224 CPU Cores at 2.6 Ghz
- 2 TB RAM
- 7.68 TB storage capacity (before dedupe and compression)

The following will be enabled at the cluster level:

- HA – High Availability will turned on with Admission control enabled, set to tolerate a single host failure.
- DRS – Distributed Resources Scheduling will be enabled to fully Automatic. Predictive DRS could be enabled in the future if the workload shifts throughout the day and vROPs is deployed.
- vSAN

3.3 vSAN design

vSAN 6.6 will be enabled at the cluster level. Each site will be an All Flash deployment, and dedupe and compression will be enabled. Erasure coding will also be used.

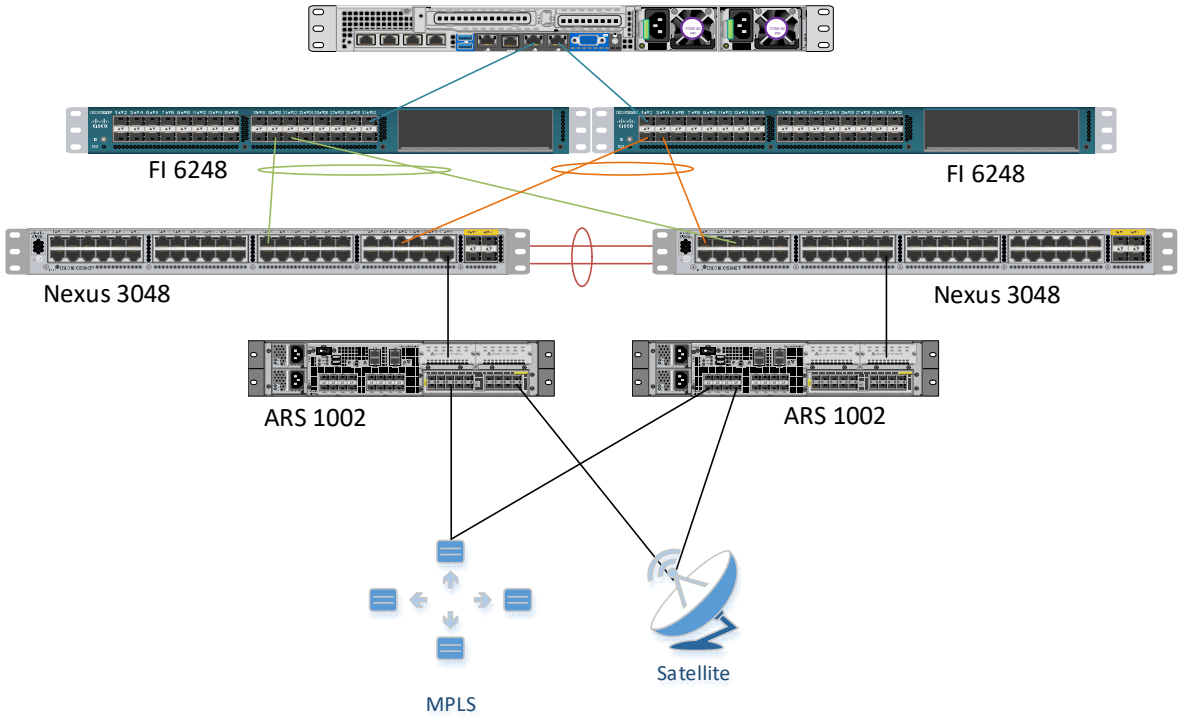
Two disk groups per host will be used. Each disk group will consist of a 1.6TB Cache Tier and 7 x 3.8TB Enterprise SSD.

1 vmk interface will be created for vSAN traffic on a dedicated vLAN, and cound to a single active NIC, with the other NIC in standby mode.

4 Network Design

4.1 Physical Layer

Each Host will utilize 2 x 10GB CNA adapters to uplink to a pair of UCS 6248UP Fabric Interconnects. Each Fabric Interconnect will uplink to a pair of Nexus 3k's with a vPC established between the 3k's.



Cisco iWAN compatible routers will be used to intelligently utilize the Satellite and copper connectivity at each site to connect to the additional datacenters.

4.2 Logical Layer

VMware's NSX will be sued to control the logical network layer. Each datacenter will contain 1 NSX Manager and a minimum 3 NSX Controllers.

4.2.1 VLANs

Multiple VLANs will be used to separate traffic on the LAN.

Mgmt Traffic	100
vSAN	200
vMotion	300
VM Traffic	400-450

4.2.2 Distributed Switching

Distributed switches will be used in the vSphere environment to support all networking. Network IO control will also be utilized at default settings to ensure vSAN and Mgmt network priority.

Uplinks:

Mgmt	vNIC0 Active, vNIC1 Standby
vSAN	vNIC1 Active, vNIC0 Standby
vMotion	vNIC0 Active, vNIC1 Standby
VM Guest	vNIC0 Active, vNIC1 Active

5 Virtual Machine Design

5.1 Management Design

Each site will house supporting VMs to manage the infrastructure. VMs listed below are identical for each site, with the names changed to reflect the site in which they are deployed.

5.1.3 Active Directory

Name	OS	Site	Roles
Hou-DC01	Server 2016	Houston	DC, GC, FSMO, DNS
Hou-DC02	Server 2016	Houston	DC, GC, DNS
Pyon-DC01	Server 2016	Pyongyang	DC, GC, DNS
Pyon-DC02	Server 2016	Pyongyang	DC, GC, DNS
Isr-DC01	Server 2016	Israel	DC, GC, DNS
Isr-DC02	Server 2016	Israel	DC, GC, DNS

5.1.2 vCenter

Each site will consist of a single vCenter server with embedded database, and embedded PSC.

Name	OS	Site	
Hou-vCSA	Appliance	Houston	
Pyon-VCSA	Appliance	Pyongyang	
Isr-VCSA	Appliance	Israel	

5.1.3 Backup Infrastructure

Veeam v10 will be deployed. The deployment will consist of a Backup and Replication VM at each site, an Enterprise Manager VM at Houston, and a Cisco c240 for a Repository server.

The c240 will be connected to the Fabric Interconnects via redundant 10GB links, and will contain 24 x 4TB drives, dual 10core cpu, and 24GB RAM. The drives will be divided into 2 raid 6 groups, formatted with ReFS.

Name	Funtion	Site	VM
Hou-VBR	Backup and Replication	Houston	Yes
Hou-EntMgr	Enterprise Manager	Houston	Yes
Hou-Repo	Backup Repository	Houston	No
Pyon-VBR	Backup and Replication	Pyongyang	Yes
Pyon-Repo	Backup Repository	Pyongyang	No
Isr-VBR	Backup and Replication	Israel	Yes
Isr-Repo	Backup Repository	Israel	No

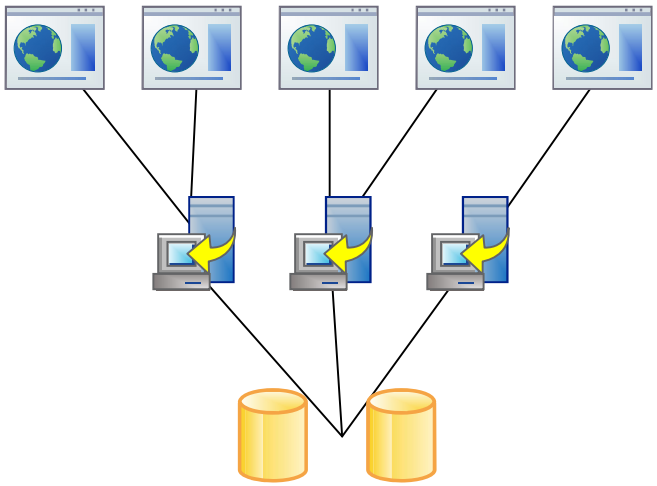
Backup jobs will be setup to run at required RPO intervals as defined by the application team. Backup copy jobs will replicate backups to 1 of the off-site locations. Critical VMs will be replicated to an off-site datacenter via traditional snapshot based replication for high RPO, and CDP replication for low RPO requirement.

5.2 Application Design

HumanityLink is a traditional 3 Tier Web Application, running on Windows IIS and SQL.

The application (per site) will consist of 2 SQL servers, configured as an Always-On cluster. 3 Application servers, running Windows 2016. Each Application server can support up to 5 Web servers.

Load Balancing will be used to distribute web traffic between the Web servers.



SQL Always-On Cluster

Each Application deployment will support the Robot fleet in that site's geographic region. Relevant data from the other off-site regions is imported into the database for reporting functionality.

DRS rules will ensure that the SQL server will reside on separate hosts, as well as distributing the Application and Web servers to minimize application impact from a host failure.