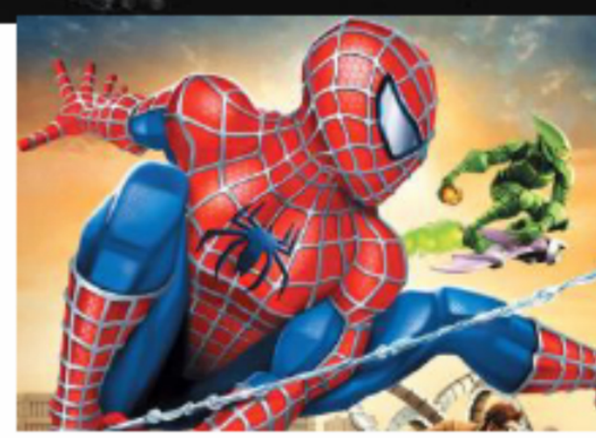
Challenge 1: After the Outbreak



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Executive Summary

This Architecture is developed to design 3 Datacenters, Primary, Secondary and Tertiary located few Kilometers away from each other. The Infrastructure defined here would be used to Support Different workload depending on the use case. It needs to support atleast 5000 Virtual Servers at Primary Site, 1000 at Secondary and 500 at Tertiary site respectively. Also, the environment should support access to 3000 Virtual Desktops and Application delivery to 1500 devices.

Design would support future growth as this infrastructure is foundation for future follow-on projects and would be further moved to cloud.

Case Background

As we all know about the recent virus outbreak which has already turned many into zombies and destroyed the world. Majority of the locations have lost connectivity as several Datacenters have been destroyed. Luckily, the Virus has been stopped and a Billionaire has stepped forward with his team of engineers who will build him an infrastructure to gain the connectivity back.

There are few old Warehouse left untouched which were already shutdown, the available hardware is 5 years old. The Billionaire would like to have Virtualization implemented 3 of his sites which already has internet connectivity. He would further expand his environment as and when he gets the hardware. Also, this Virtual Infrastructure would be the foundation for follow-on projects and his journey to cloud. So, it would be a fresh virtualization implementation with latest Virtualization products on 5 year old but compatible hardware.

Interpreting this document

The overall structure of this document is self-explanatory. It consists of many conceptual. Logical and physical diagrams to provide details of the proposed solution. Wherever any specific solution or hardware is used, it is supported by design considerations. In some cases, customer-specific requirements and existing infrastructure constraints might result in a valid but suboptimal design choice.

This Design documents has basically 3 sections for 3 Datacenters Primary, Secondary and Tertiary respectively. The complete high level overview of 3 Datacenters is proposed and then the complete design of each Datacenters respectively. This design includes Datacenter Virtualization, Desktop Virtualization and Application delivery Solutions.

Requirement | Assumption | Constraint

In this project, the primary requirement is to implement Virtualization to support huge number of Virtual Servers and Virtual Desktops in different sites. Other major requirement is the growth of the Environment both Vertical and Horizontal. Customer wishes to add additional hardware at any site as and when he gets m ore hardware and also he wishes to add more robust virtualization solutions to make his environment more agile, self-serviced and automated.

Throughout this design document, we will adhere to the standards and best practices as defined by Vmware. Would meet all the functional requirement and adhere to the constraints.

Functional requirement - mandatory condition that must be satisfied. List includes Technological, business and operational requirements

ID	Requirement
r1	Three active sites - Primary, Secondary and Tertiary.
r2	Atleast 5000 Virtual Servers in Primary site
r3	Atleast 1000 Virtual Servers in Secondary site.
r4	Atleast 500 Virtual Servers in Tertiary site.
r5	3000 Virtual Desktops with full desktop access.
r6	Application Delivery for atleast 1500 devices.
r7	Remote Access to Applications and full desktop access.
r8	Central Repository to store and share documents and data.
r9	Access to as many users as possible.
r10	

Constraints- Constraints limit the logical design decisions and physical specifications. List includes Technological and operational const raints

ID	Constraints
c1	All hardware is 5 years old, i.e., April 2008.
c2	1 Gig speed Ethernet card only
c3	4 Gig speed Fibre Channel only.
c4	Users have DSL connection at best
c5	Internet connection at 100Mbps in the primary data center.
c6	No Uninterrupted Power Supply unit in the Datacenters
c7	

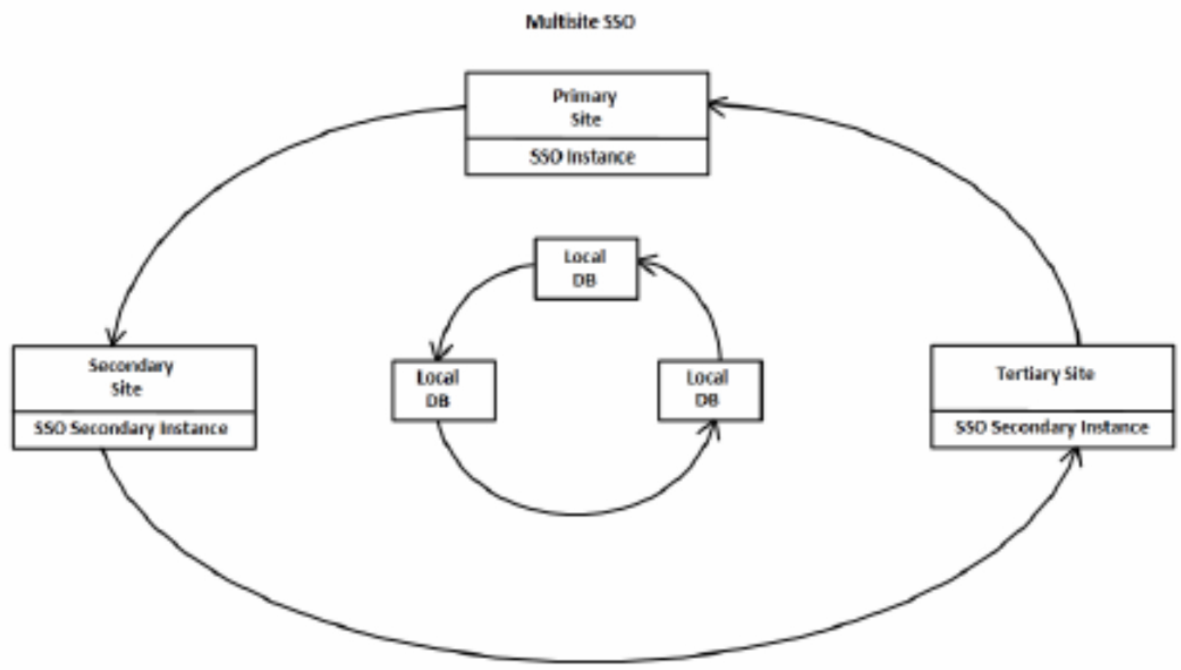
Assumptions: Any aspect of the design that accepted as fact but not backed by a requirement or a constraint. This list of the assumptio ns which are made to start the project, it doesn't consists of all the assumptions, but every assumption is stated as and when it used for any design decisions.

ID	Assumptions
a1	Point to point network connectivity between 3 sites.
a2	All Virtual Server have same load and sizing.
a3	All Virtual Desktops have same load and sizing.
a4	Physical Storage configuration and connectivity is done by Storage Admin.
a5	Physical Network configuration and connectivity is done by Network Admin.
a6	
a7	

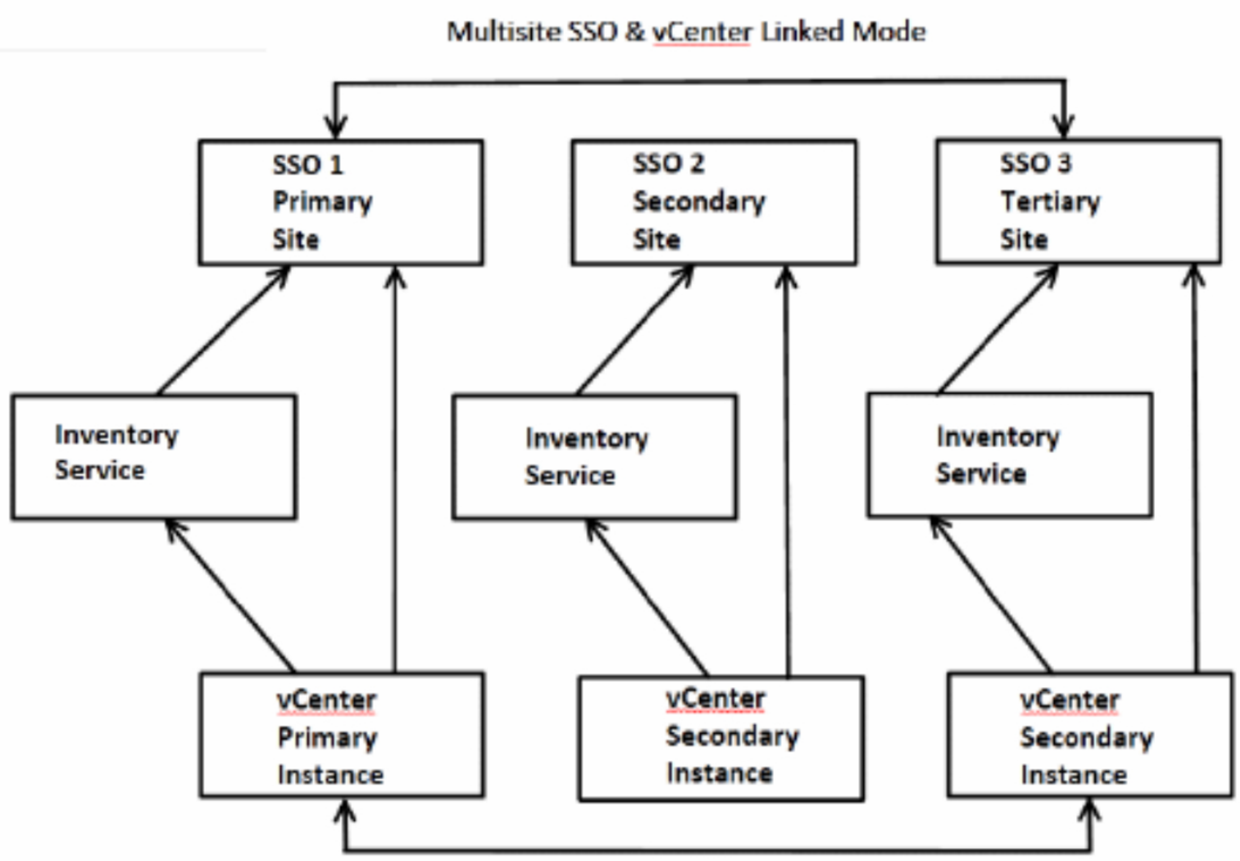
Complete Project's Conceptual Architecture Overview

This design document explains the conceptual diagram of 3 Datacenters. It provides you the peripheral overview of 3 Datacenters and the major solutions deployed in the respective Datacenter. Further sections include detailed conceptual and logical diagrams of respective Datacenters.

Latest Vmware products would be used for all proposed solutions. vCnter Single Sign-On Multisite would be configured along with vCenter Servers in linked mode. Which would not only help the current environment by providing better visibility throughout the Datacenters but also provide robust base for other solutions like vCloud Director and Business Continuity & Disaster Recovery.



vCenter Single Sign-On is a new feature of vSphere 5.1 that is not just an authentication broker but also a security token exchange providing a more secure way of accessing your vSphere solutions. Multisite deployments are where a local replica is maintained at remote sites of the primary vCenter Single SIgn-On instance. vCenter Servers are reconfigured to use the local vCenter SIngle SIgn-On service and reduce authentication requests across the WAN. Multisite deployments are actually required to maintain Linked Mode configurations where roles, permissions and licenses are replicated between linked vCenter servers.



Primary Datacenter

Conceptual Architecture Overview Diagram	

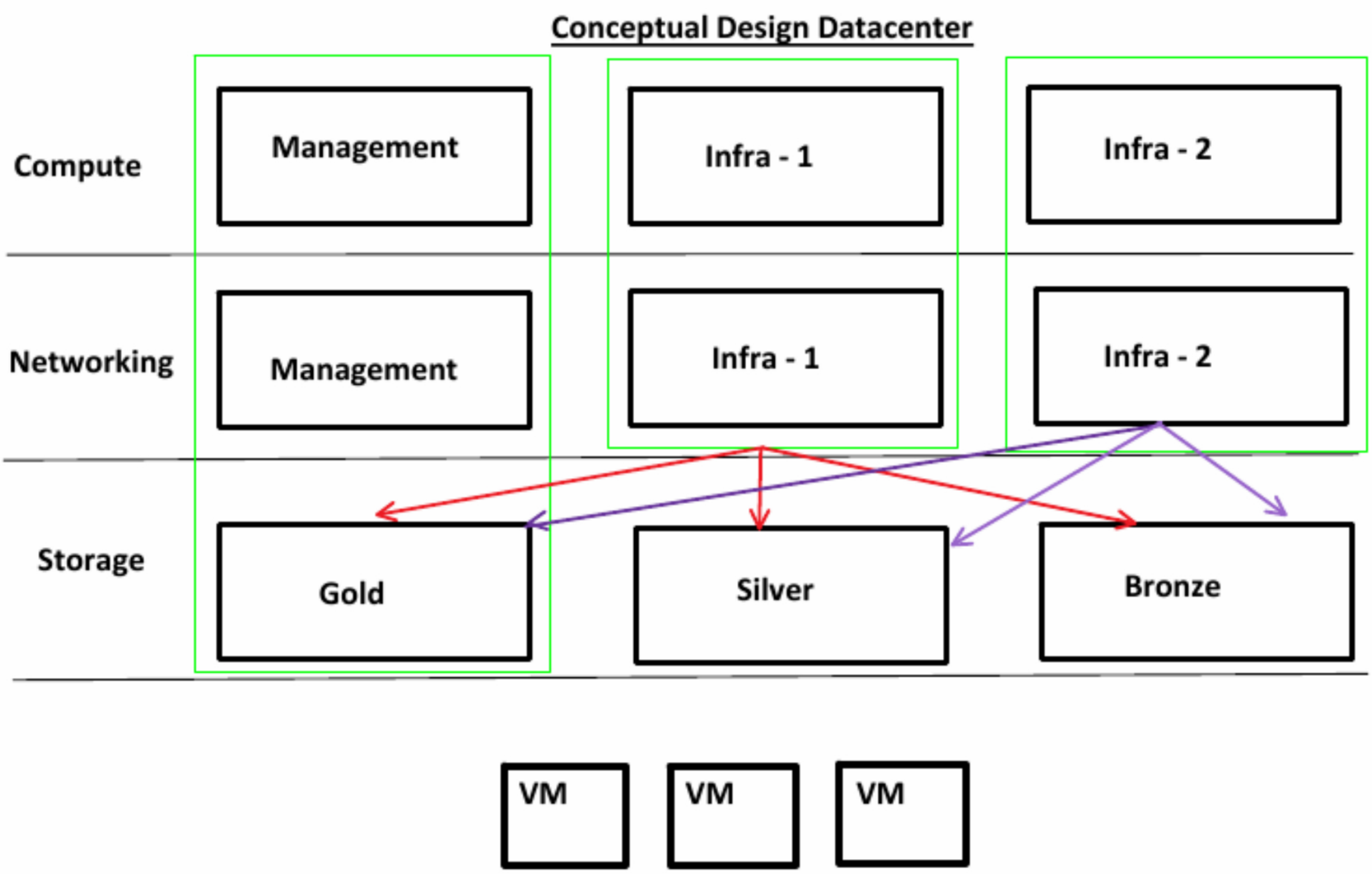
The major requirement at Primary Datacenter is to host 5000 Virtual Servers with keeping in mind that only 5 years old hardware is available. Also keeping in mind that the same infrastructure would be scaled out in future. So the Design has to accommodate future hardware addition and compatibility for other products like SRM or vCloud Director.

As ESXi and vCenter are base of virtual infrastructure, and any Vmware product/appliance addition has to communicate to vCenter Server and ESXi hosts. There are 4 major building blocks whose design decision would impact any other design decision

Compute
Networking
Storage
Security

Every Datacenter has been designed with very strong compute, storage and networking configurations which meets the Technical and Operational requirements. Now to benefit new features provided with vSphere 5.1 we would follow Vmware's best practices, so that we could utilize all the 4 resources more efficiently and optimally. We would be creating resource pools at each level i.e., in DRS cluster, in networking (NIOC network pools), in Storage (Gold, Silver and Bronze).

Below is the high level overview.



Compute Sizing and Scaling

VMware recommends using a building block approach for compute resources for this vSphere 5 environment. By using this approach, a consistent experience can be guaranteed. Ideally the sizing of each Virtual Machine and ESXi host depends on the evaluation of existing environment.

In our case we would assume the Virtual Machine are sharing equal load throughout the Datacenter and are of same size in terms of CPU and Memory. Ideally this is not the case, every Virtual Machine will have a different load and accordingly they will be distributed on different clusters and pools. For the sake of calculations we would assume all the 5000 Virtual Servers are identical in terms of CPU and Memory utilization.

As per the functional requirement, we need to have 5000 Virtual Servers in the Primary Site. Let's assume that all the 5000 Virtual Servers have the same type of load and have the same resource utilization. Below is the table which provides the assumed values for CPU and Memory, depending on that we would calculate the required number of hosts.

For **5000 Virtual Servers**, the required amount of CPU is **2300000 Mhz** and Memory is **5328000 MB**. For memory we are also considering the Advanced memory technique provided by VMware for better and optimal memory utilization. The Advanced memory techniques like Memory Sharing, Memory ballooning etc.

The below table summarizes the CPU and memory utilization on Virtual Server

Attribute	**Specification**
Average number of vCPU per VM	2
Average CPU Mhz	2300 Mhz
Average CPU Utilization Mhz	15% (345 Mhz)
Peak CPU utilization Mhz	20% (460 Mhz)
For 5000 Virtual Servers	460 x 5000 = **2300000 Mhz**
Average amount of RAM per VM	2048 MB
Average Memory Utilization MB	45% (922 MB)
Peak memory Utilization MB	65% (1332 MB)
For 5000 Virtual Servers	5000 x 1332 = 6660000 MB
Assuming Memory Sharing benefits	20% = **5328000 MB**
Table:1	

Using the above assumptions for CPU and Memory of 5000 Virtual Servers, we can now derive the high-level CPU and RAM requirements that an ESXi host must deliver. Due to constraint, where we have to use the hardware only available till April 2008, we have selected HP Proliant DL580 G5 Server.
The following tables detail the high-level CPU and memory specifications which would be used to calculate the total number of Servers required to host all 5000 Virtual Servers with some buffer compute resources in case if any Virtual Servers demands more.

Attribute	**Specification**
Number CPU (sockets) per host	4
Number of cores per CPU (Intel)	6
Mhz of CPU core	2670 Mhz
Total CPU Mhz per CPU	2670 x 6 = 16020 Mhz
Total CPU Mhz per Host	16020 x 4 = **64080 Mhz**
Maximum Host CPU Mhz utilization	80%
Available CPU Mhz per Host	**51264 Mhz**
Total RAM per host	256000 MB
Maximum Host RAM utilization	80%
Available RAM MB per host	**204800 MB**
Table:2	

Using the high-level CPU and memory specifications detailed in the above tables (Table 1 & 2), we have derived the minimum number of ESXi hosts required from the perspectives of both CPU and memory. The minimum number of hosts is the higher of the two values.

Type	Total Peak Resource Required	Available resource per host	Total Host Required
CPU	2300000 Mhz	51264 Mhz	**45**
RAM	5328000 MB	204800 MB	**27**
Table:3			

To provide vCenter Server's distributed services to all 5000 Virtual Servers, we need to create HA and DRS cluster, and as per the configuration maximums guide, Hosts per cluster is limited to 32 host. Moving further, we need minimum of 45 hosts, let's not forget about that the customer is anticipating growth. i.e., he would be adding more Virtual Servers as and when he gets more hardware. Let's assume 10% growth in the environment and we need to factor the availability requirements. Hence, we would divide the total number of hosts into 2 clusters where we would also get the option to categorize the Virtual Servers depending on whether they are CPU, Memory or Disk intensive i.e., with the help pools created at different levels.

With 10% anticipated growth the total number of hosts (10% of 45) would be 49.5 = 50.

Let's create 2 clusters with 25 hosts each with N+2 Availability Requirements, hence each cluster will have27 hosts.

Network and Storage:

The servers are limited with 1 Gib speed network adaptors and each server have one onboard dual port Network adaptor (NC373i Multifunction). To provide redundancy and availability we would add 2 quad-port add-on Network Adaptors (HP NC364T PCI Express Quad Port Server Adapter). Total there are 10 Network Adaptors on all 54 ESXi hosts.

These HP DL580 G5 servers are shipped with 4 internal Hard driver (HP 72GB 6G SAS 15K SFF DP ENT HDD) configured with Raid (1+0). Which gives total usable disk space around 144 GB after raid calculations. ESXi would be installed in the local storage and all the Virtual Servers would be stored on FC / NFS SAN (shared storage).

For calculation, it is assumed that the Virtual Servers have same amount of storage space i.e., 30 GB. Hence the total required storage for 5000 Virtual Servers would 150TB. We have a limit of 300 TB for all the 3 Datacenter, including rest of 1500 Virtual Servers, 3000 Virtual Desktops and Application Delivery for 1500 devices.

Host Design & Configuration

As we have finalized there would be 54 ESXi hosts for managing 5000 Virtual Servers. Also, we need to a separate management duster which consists of all the management appliances used to manage the complete Datacenter. To start with, below is the selected Server's complete specification. The HP Proliant DL580 G5 servers are shipped with local storage (Usable 144 GB) and it is used to boot ESXi. All the 3 hosts in the management cluster and 54 hosts in 2 Infrastructure clusters, will have the same Server configuration. Standardizing physical configuration throughout the Datacenter is critical and helps in minimizing the complexities. The Management (upgrade / patching) becomes much easier and can be automated.

Selected Platform:

Attribute	**Specification**
Vendor	HP
Model	Prolian DL80 G5
Number of CPU Sockets	4
Number of CPU Cores	6
CPU Speed	2.67 Ghz
Memory	256 GB
Storage Controller	HP Smart Array P400i/512 MB BBWC Controller
Number of network adaptor ports	10
Network adaptor vendor(s)	Intel and HP
Network adaptor model(s)	1 x GbE NC373i Multifunction 2 Ports
	2 x HP NC364T PCI Express Quad Port Server Adapter
Network adaptor speed	Gigabit
Installation destination	Autodeploy - Stateful
VMware ESXi server version	ESXi 5.1
Table:4	

The Management Cluster will consists of 3 ESXi hosts, which would have critical machines like vCenter Server, DB, AD, DNS, DHCP, Auto Deploy, vShield. We would use that to manage the complete datacenter. We are leverages enough space in this cluster in term of computer resources in case if we had to add more management appliances like vCenter Operations Manager infuture.

Auto Deploy is to install ESXi on all the Infrastructure hosts quickly with same configuration on the all the hosts throughout the cluster. More information about Autodeploy is explained under vCenter Server Design.

Atleast one host which would be under Management cluster would be manually configured. Which would host AD, DNS, DHCP and VC to start with. Once we have all the hosts configured, we would make sure "Domain Name Service (DNS)" is configured on all the hosts across the Datacenter and is resolvable by both short name and fully qualified domain name using Forward and Reverse lookup.

Also, the Network Time Protocol (NTP) has to be configured on all ESXi hosts and should be configured to share the same time source as the VMware vCenter Server to ensure consistency of the overall vSphere solution.

Once we have first ESXi host installed and configured completely and added to vCenter Server. A "Host Profile" is created, which would be used with Auto Deploy server to rapid installation on hundreds of Servers.

Now we have total of 57 physical server in the primary Datacenter which would host all the 5000 Virtual Servers with adequate compute resources available, as we have room for atleast 20% resource on each host even if all Virtual Servers are running with peak utilization.

These physical servers are distributed on several racks. Each rack is backed up with two power distribution units (PDUs), each connected to separate legs of a distribution panel or entirely separate panels. Distribution panels are not connected to uninterrupted power supplies (UPS), as it is another major constraint.

vCenter Server Design

vCenter Server is installed on a Virtual Machine to benefit the various availability features and distributed Services. We wo uld have Database on Separate Virtual machine on Microsoft SQL 2008 R2. The specifications and configuration for the vCenter Server virtual machin e are detailed in the following table and are based on the recommendations provided in the "vCenter Server Requirements" section of the ESXi and vC enter installation documentation.

Attribute	**Specification**
Vendor	Vmware Virtual Machine
Model	Virtual Hardware version 9
Number of vCPUs	2
Memory	6 GB
Number of local drives	2
Total Usable Capacity	20 GB (C:\) and 40 GB (E:\)
Operating System	Microsoft Windows Server 2008 R2
Table: 5	

We will have the vCenter Server Database on a different Virtual Machine running Microsoft Windows Server 2008 R2.
The following table summarizes the configuration requirements for the vCenter Server Database:

Attribute	**Specification**
Vendor and Version	Microfost SQL 2008 R2 - SP2
Authentication Mode	SQL
vCenter Statistic level	1
Estimated Database Size	27.2 GB
Total Usable Capacity	20 GB (C:\) and 40 GB (E:\)
Table: 6	

We have used a tool called "VMware vCenter Server 4.x Database Sizing Calculator for Microsoft SQL Server" to estimate the Da tabase Size. Currently only vSphere 4.1 Database calculator was present.

	Number of Samples Collected Every 5 Minutes	**Potential DB Size in Gigabytes at the End of 1 Year**	**+15%**	**-15%**	**Space Required for Temporary DB**
Statistics Collection Level 1	96156	**27.2**	*31.3*	*23.2*	**27.2**
Statistics Collection Level 2	236182	**66.9**	*76.9*	*56.9*	**66.9**
Statistics Collection Level 3	536182	**151.9**	*174.7*	*129.1*	**151.9**
Statistics Collection Level 4	911261	**258.2**	*296.9*	*219.4*	**258.2**

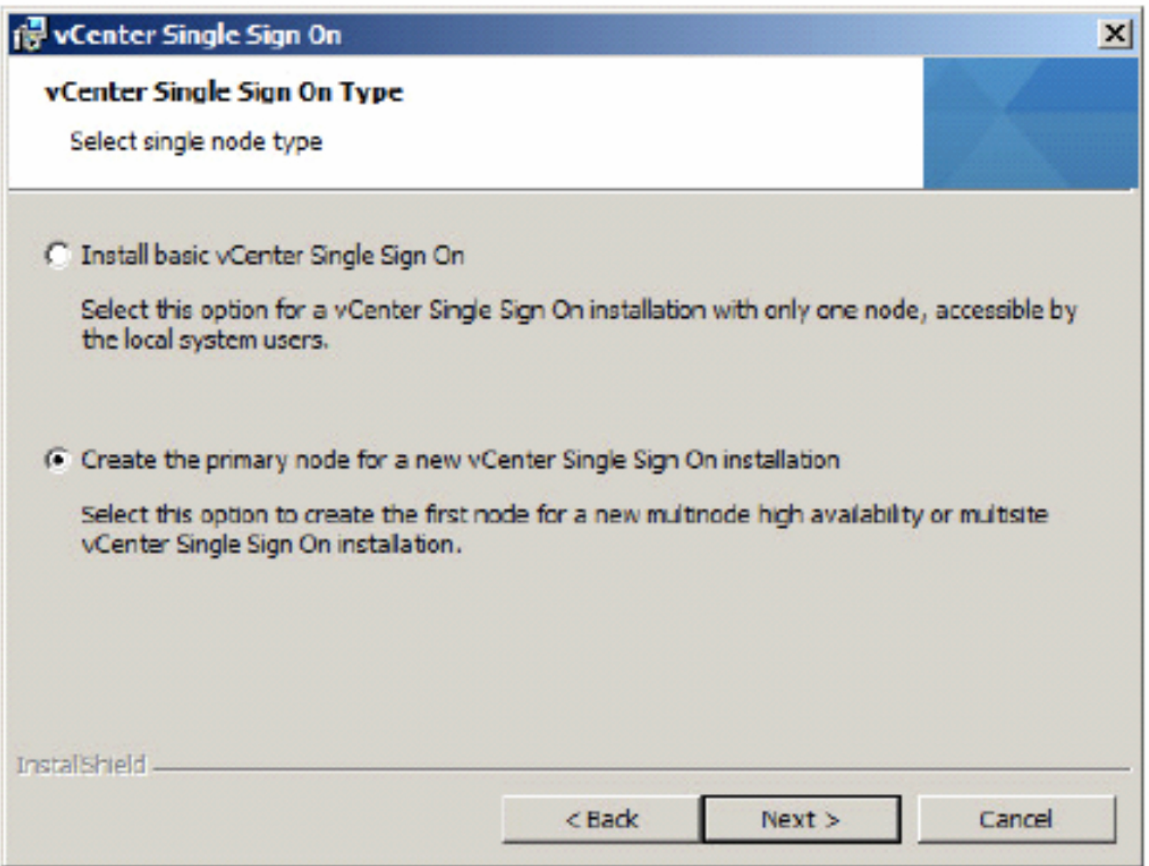
Table:7

Once we have Database set, we would install vCenter Server. As it is vSphere 5.1, we would installing the Single Sign On (SSO), vCenter Inventory Services and vCenter Server with manual Install on the same Virtual machine. As we would be having 3 Datacenter in separate l ocations, we would install vCenter Single Sign On with multisite option and vCenters in Linked Mode.

To Start with Single Sign-On (SSO) in multisite mode, initially SSO is installed separately on the same Virtual Machine as vCenter Server machine. During installation make sure "Create Primary node for a new vCenter Single Sign On installation" is selected. If we select " Basic" option then it will not let us add the secondary SSO instance.

<u>At Primary Site, install the primary Single Sign On node.</u>

1. In the Single Sign On installation wizard panel vCenter Single Sign On Deployment Type, select Create the primary node for a new vCenter Single Sign On installation.



2. In the panel that asks you to Select single node type, select Create the primary node for a new vCenter Single Sign On ins tallation.

3. Complete the Single Sign On installation wizard.

<u>At Secondary Site, install a secondary Single Sign On node, pointing to Primary Site.</u>

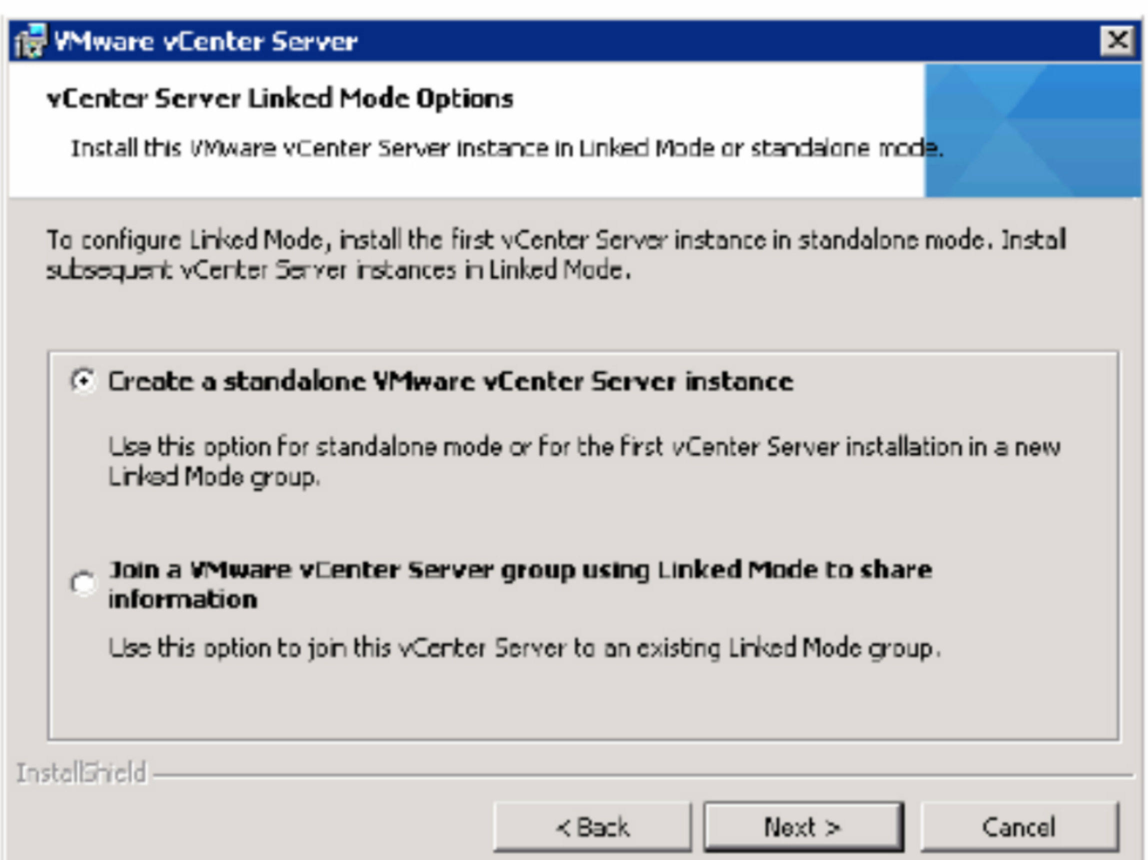
1. In the Single Sign On installation wizard panel vCenter Single Sign On Deployment Type, select Join an existing vCenter Si ngle Sign On installation.

2. For the node type, select Multisite, and point to the Single Sign On primary node that you created in step 1.
Enter the FQDN or IP address, Single Sign On HTTPS port, and the password admin@System -Domain for the primary Single Sign On node. Note: If Site A is a high-availability cluster, enter the address of the Site A load balancer.

3. Complete the Single Sign On installation wizard.

For Tertiary Site, we follow the same steps as we followed for the Secondary Site and we can point to either Primary or Secon dary Site.

Multisite deployment is useful when a single administrator needs to administer vCenter Server instances that are deployed on geographically dispersed sites. With SSO multisite configuration, even the vCenter Server is configured in linked mode along with the Secon dary and Tertiary Site. Hence during the configuration, we would chose "Create a Standalone vCenter Server Instance" and join this vCenter instance d uring installation of vCenter on Secondary and Tertiary site. With vCenter Servers in linked Mode, the Administrator from one site can view all vCe nter Server instances from a single vSphere Client or Web Client, manage the roles.



vSphere Auto Deploy

vSphere Auto Deploy can provision hundreds of physical hosts with ESXi software. You can specify the image to deploy and the hosts to provision with the image. Host profile is created using a reference ESXi host to apply to rest of the hosts. Below are steps needs to be fol lowed to configure Auto Deploy and configure image profile with ruleset and host profile.

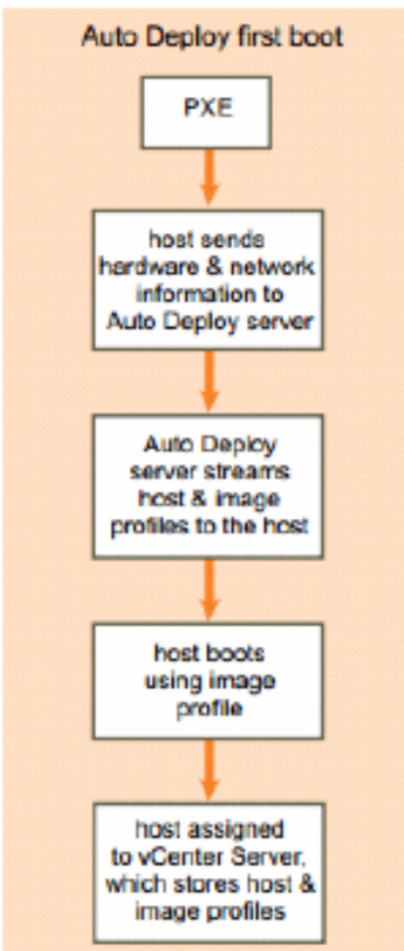
Auto Deploy is installed on a separate Windows Server 2008 R2 Virtual Machine.

DHCP server is setup to point to the TFTP server on which the TFTP ZIP file is located.

Each host is set to network boot or PXE boot.

Point to the ESXi image profile in public depot. Custom VIBs can be included with the base image, using the Image Builder Pow erCLI to create an image profile.

Write a rule that assigns an image profile to hosts.



The image that the Auto Deploy server provides to the host includes the host profile configuration that vCenter is responsibl e for maintaining. This host profile provides all the configuration details that the server needs beyond the base ESXi image.

The another objective of configuring Auto-Deploy is to have the ESXi installed on the local storage, as we would not just reply on Auto Deploy server in subsequent reboots.

Stateful Install: The stateful install mode only uses the Auto Deploy infrastructure the first time it boots to receive the image. That deplo yment is copied to the local storage. This feature was introduced in vSphere 5.1, i.e., Auto Deploy Stateful Install. After the initia l network boot, these hosts boot like other hosts on which ESXi is installed.

More details regarding the configuration of image profile and configuring ruleset can be found at vSphere Installation and Se tup.

Syslog and Dump collection

One of the NFS partition has been dedicated for collecting the syslog and core dumps in events of any kind of crash. More in formation about shared storage (FC / NFS) in the storage design section.

In our case we would set up Syslog and ESXi dump collector from the host profile which is used during Auto Deploy process.

Datacenter Design

Now that we have our vCenter up and running, lets configure the Datacenter objects and provide high availability and optimization. As mentioned, we would have three clusters as below

Cluster Name	Cluster Size	HA	DRS	DPM	EVC
Management	3	Enabled	Enabled	Enabled	Enabled
Infra-1	27	Enabled	Enabled	Enabled	Enabled
Infra-2	27	Enabled	Enabled	Enabled	Enabled
Table: 8					

vSphere High Availability

HA will be configured on all clusters to provide recovery of virtual machines in the event of an ESXi host failure. If an ESXi host fails, the virtual machines running on that server will go down but will be restarted on another host.

HA Cluster Settings	Configuration Value
Host Monitoring	Enabled
Admission Control	Prevent virtual machines from being powered on if they violate availability.
Admission Control Policy	Percentage of resources reserved:
	CPU : 8%
	Memory : 8%
Default Virtual Machine Restart Priority	Medium
Host Isolation Response	Shut Down
Virtual Machine Monitoring	Enabled
Virtual Machine Monitoring Sensitivity	Medium
Heartbeat Datastores	Select any of the cluster's datastores
Table: 9	

Design Considerations:

As we have made sure that resources are adequately available for all 5000 Virtual Servers even when they are running at their peak utilization. There is sufficient resources even if 2 servers go down for any reason. We are reserving 8% of CPU and Memory from the cluster, which is

27 * 51264 Mhz = 1384128
8% of total cluster resource = 110731 Mhz

Equivalent to resources of 2.16 Host.

The master host monitors the liveness of the slave hosts in the cluster. This communication is done through the exchange of network heartbeats every second. When the master host stops receiving these heartbeats from a slave host, it checks for host liveness before declaring the host to have failed. The liveness check that the master host performs is to determine whether the slave host is exchanging heartbeats with one of the datastores.

If Host Monitoring Status is disabled, host isolation responses are also suspended. A host determines that it is isolated when it is unable to communicate with the agents running on the other hosts and it is unable to ping its isolation addresses. When this occurs, the host executes its isolation response.

The Host Isolation Response is very important as if any of the ESXi host from this cluster goes network isolated, then the Virtual Machines from Isolated host will gracefully shut down and restarted on the good Hosts in the Cluster. DRS would assist in choosing the most suitable host for those Virtual Machines.

Note: To use the Shutdown VM setting, you must install VMware Tools in the guest operating system of the virtual machine.

Also, HA can disabled at the Virtual Machine level under
Heartbeat Datastores: Selection of the heartbeat datastores will be controlled by vCenter Server because it makes decisions based on the current infrastructure and because a reelection occurs when required.

Even vSphere Fault Tolerance option is available but current version supports 1 vCPU. There are other pre-requisites as mentioned in the below KB, which when met, FT can be configured. More information in the below KB

kb.vmware.com/kb/1013428

vSphere Distributed Resource Scheduler and VMware DPM

DRS is a great feature, which works at two levels. First, when you power on the Virtual Machine, it chooses the most appropriate host and registers the Virtual Machine on it. Second, whenever there is load imbalance, it vMotions the Virtual Machine automatically to the most appropriate host.

DRS Cluster Settings	**Configuration Value**
DRS	Enabled
Automation Level	Fully Automated
Migration Threshold	Moderate (Default)
Vmware DPM	Enabled
Automation Level	Fully Automated
Migration Threshold	Moderate (Default)
Enhanced vMotion Compatibility	Enabled
Swap File Location	Swap File Stored in the Same Directory as the Virtual Machine
Table : 10	

DRS Affinity and Anti-Affinity Rules : There are option to control the placement of virtual machines on hosts within a cluster. Both Affinity and Anti-Affinity rules are set between Virtual Machines, group of Virtual Machines or between groups of VMs and Hosts.

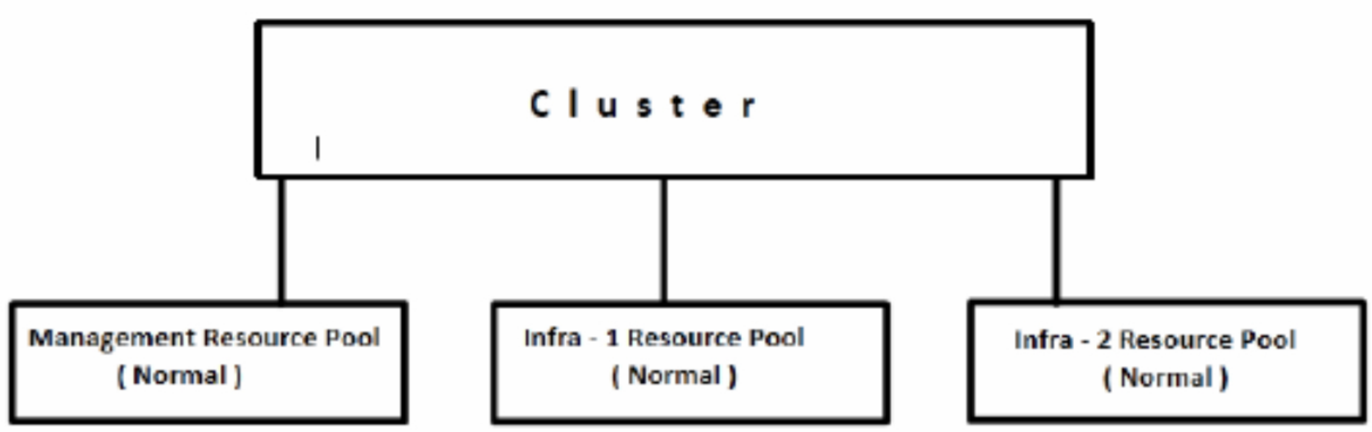
Vmware Distributed Power Management (DPM) also works in the DRS cluster, to reduce its power consumption by moving the physical host in Standby condition depending on the resource utilization. It monitors the Virtual Machines resource utilization and if there is low utilization like during off hours, it will automatically move the physical host in standby condition and whenever there is a requirement it automatically wakes up the host with the help of one of three power management protocols: Intelligent Platform Management Interface (IPMI), Hewlett-Packard Integrated Lights-Out (iLO), or Wake-On-LAN (WOL). So, if DPM has to move the host to standby, it will vMotion VMs to most appropriate host with the help DRS keeping VM's reservations if there are any and then moves the host to standby.

Resource Pools:

Resource pools allow you to delegate control over resources of a host (or a cluster), but the benefits are evident when you use resource pools to compartmentalize all resources in a cluster. If a host has been added to a cluster, you cannot create child resource pools of that host. If the cluster is enabled for DRS, you can create child resource pools of the cluster.

In our case we are creating 3 resource pools namely, Management, infra-1 and Infra-2. Currently as the loads are assumed to be same so all the resource pools are set to normal attributes. But these attributes can changed to segregate Virtual Machines depending on nature, for example, high CPU intensive or Memory intensive.

Currently there is no requirement to create Management resource pool in the Management cluster, but in future if there is need to delegate control over resources, 2-3 resource pools can be added.



Networking Design

The network layer encompasses all network communications between virtual machines, vSphere management layer and the physical network. The configuration are done keeping the Vmware's recommendations in mind. The ESXi host is configured with 10 uplinks (2 on-board and 8 add-on). VLAN is configured to segregate the traffic and to avoid mixing different kind of networks.

Physical Design :

The current physical environment consists of a pair of Cisco SGE2010P 48-port switches in a stacked configuration per rack. The ports on physical switch are configured to trunk mode and with Spanning Tree Protocol (STP) configured to PortFast. The Trunk port includes the VLAN IDs mentioned in dv PortGroups i.e., (VLAN - 10,20,30,40,50) and the ports which are configured for NFS are configured to etherchannel, which is for the Virtual Machines connected to NFS. Th e main objective to choose the EtherChannel is to use Netwok Adaptor's aggregated bandwidth. Hence, load balancing option for NFS port group is set to "Route based on IP Ha sh"

Distributed Network Switch:

Distributed Network Switch has been chosen over Stand Switch due to below benefits:

- To maintain consistency on all 57 hosts in 3 clusters.
- To benefit from additional features which are only available in Distributed Virtual Switch i.e., load balancing option - Route based on physical NIC load, configuration backup and restore, Network resource pools etc.
- As it's a pretty big environment the configuration can easily be pushed from vCenter Server.
- simplicity and ease of management

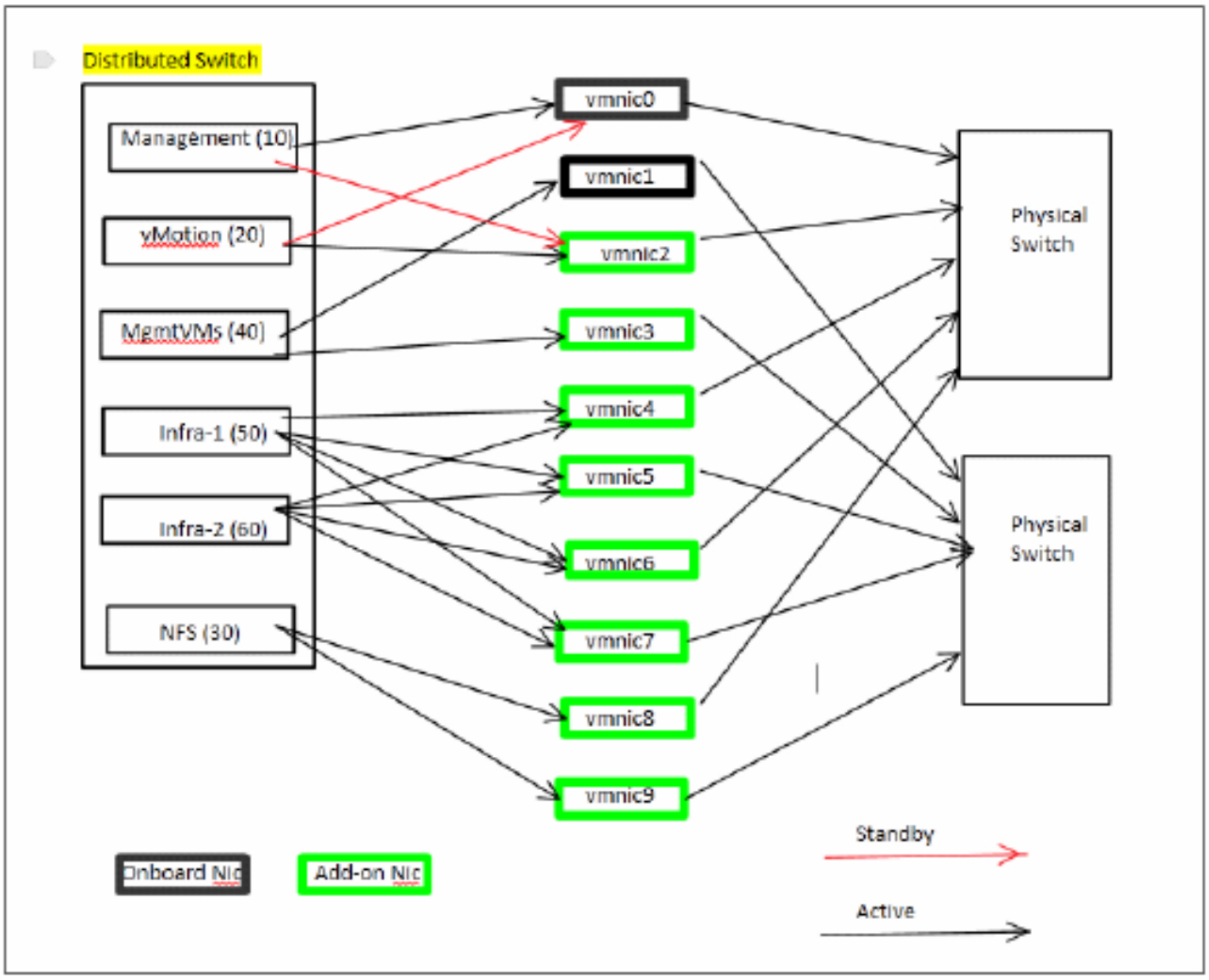
Five port groups have been configured to fulfil all network traffics and it is made sure that there is no single point of fai lure from end to end. Below table lists the five dvPortGroups.

Virtual Switch	Number of Ports	Physical Network Adaptor Card	DvPort Group (VLAN ID)
dvSwitch0	10	2 - onboard NC373i	Management (10)
		HP NC364T PCI Express Quad Port Server Adapter	vMotion (20)
			NFS (30)
			MgmtVMs (40)
			Infra-1 (50) Infra-2 (60)
Table : 11			

Table 12, presents the configured failover policies. For the dvSwitch and each of the dvPortgroups, the type of load balancin g is specified. Table also shows the way uplinks are configured where the on-board and add-on uplink are mixed. So, that if any one uplinks goes bad there won't be any downtime.

Virtual Switch	PortGroup Type	DvPort Group	Network Ports	Load Balancing
dvSwitch0	Vmkernel	Mangament (10)	dvUplink 0 (Active)	Route based on physical NIC load
			dvUplink 2 (Standby)	
dvSwitch0	VMkernel	vMotion (20)	dvUplink 2 (Active)	Route based on physical NIC load
			dvUplink 0 (Stabdby)	
dvSwitch0	Vmkernel	NFS (30)	dvUplink 8 (Active)	Route based on IP Hash
			dvUplink 9 (Active)	(Jumbo Frames - Etherchannel)
dvSwitch0	Virtual Machine	MgmtVMs (40)	dvUplink 1 (Active)	Route based on physical NIC load
			dvUplink 3 (Active)	
dvSwitch0	Virtual Machine	Infra-1 (50)	dvUplink 4, dvUplink 5	Route based on physical NIC load
			dvUplink 6, dvUplink 7	
dvSwitch0	Virtual Machine	Infra-2 (60)	dvUplink 4, dvUplink 5	Route based on physical NIC load
			dvUplink 6, dvUplink 7	
Table : 12				

The following diagram illustrates the dvSwitch configuration:



Note: NFS connection is also configured with Jumbo Frames (9000 Bytes), It is very important that the Jumbo Frames are configured end to end. At the Vmkernel, Virtual Switch , on respective Physical Network Adaptors, Physical Switch and on the Storage targets.

Design Considerations:

VMware recommends changing MAC address changes and forged transmits from the default "accept" to "reject." Setting MAC address changes to "reject" at the dvSwitch level protects against MAC address spoofing.

ESXi allows you to shape both inbound and outbound traffic on vSphere distributed switches. The traffic shaper restricts the network bandwidth available to any port, but may also be configured to temporarily allow "bursts" of traffic to flow through a port at higher speeds. A traffic shaping policy is defined by three characteristics: average bandwidth, peak bandwidth, and burst size.

Teaming and Failover policies allow you to determine how network traffic is distributed between adapters and how to re-route traffic in the event of an adapter failure.

Route based on physical NIC load — Choose an uplink based on the current loads of physical NICs. Most of the Load balancing options practically doesn't load balance fairly. There is always imbalanced in distributing the load to assigned uplinks. Out of all load balancing options, "Route based on physical NIC load does better job in equal load distribution.

Route based on ip hash — Choose an uplink based on a hash of the source and destination IP addresses of each packet. For non-IP packets, whatever is at those offsets is used to compute the hash. This is the only option which aggregates the Network Adaptor's speed while sending packets.

Network Failover Detection -

Link Status only – Relies solely on the link status that the network adapter provides. This option detects failures, such as cable pulls and physical switch power failures, but not configuration errors, such as a physical switch port being blocked by spanning tree or that is misconfigured to the wrong VLAN or cable pulls on the other side of a physical switch.

Notify Switches -

YES - whenever a virtual NIC is connected to the distributed switch or whenever that virtual NIC's traffic would be routed over a different physical NIC in the team because of a failover event, a notification is sent out over the network to update the lookup tables on physical switches. In almost all cases, this process is desirable for the lowest latency of failover occurrences and migrations with vMotion.

Failback -

YES - the adapter is returned to active duty immediately upon recovery, displacing the standby adapter that took over its slot, ifany.

Network I/O Control

The VDS (dvSwitch0) will be configured with NIOC enabled. After NIOC is enabled, traffic through that VDS is divided into Management, Infra-1, and Infra-2 traffic network resource pools. NIOC will prioritize traffic only when there is contention and it is purely for virtual machine traffic.

Network Resource Pool	Physical Adaptor Share	Host limit
Management	Normal (50)	Unlimited
Infra-1	Normal (50)	Unlimited
Infra-2	Normal (50)	Unlimited
Table : 13		

Network I/O Settings Explanation

Host limits – These are the upper limits of bandwidth that the network resource pool can use.

Physical adaptor shares – Shares assigned to a network resource pool determine the total available bandwidth guaranteed to the traffic associated with that network resource pool.

High – This sets the shares for this resource pool to 100.

Normal – This sets the shares for this resource pool to 50.

Low – This sets the shares for this resource pool to 25.

Custom – This is a specific number of shares, from 1 to 100, for this network resource pool.

Storage Design

Both Fibre Channel and NFS protocols are used for our environment so that the Virtual Machines are segregated depending on t he amount of IOPS generated, space requirement, speed and criticality. The Fibre Channel speed is limited to 4 Gig. Hence the hardware used here Fibre Channel HBA and Fabric has maximum speed of 4 Gig. In the design for this environment, NetApp is the storage vendor that has been selected, which is NetApp FAS3040 and it supports Fibre Channel, iSCSI and NFS protocol.

Datastore sizing is not an easy task and is unique to each individual organization and practically it depends on the IOPS cal culations. Depending on the IOPS requirement of the Virtual Machines the appropriate hard drives (Hard drive type and Speed) and raid level is chosen considering RAID factor (Read and Write & Sequen tial / Random).

In our case we would calculate the size of Datastores depending upon the storage requirement of the Virtual Machines. There i s a limit of 300 TB of storage provided and which needs to be justly shared among 3 Datacenter, such that it fulfill the storage requirements for all the Virtual Servers and Virtual Desktops in all the 3 Datacenters keeping atleast 20% of free space for future growth, Swap files and Snapshots.

As per our assumption, each Virtual Server is provided with 30 GB of Virtual Disk.
For 5000 Virtual Server

5000 x 30 = 150000 GB

Keeping 20% Free space

20% of 150000 = 30000 GB

Storage required for 5000 Virtual Server = **180 TB**

Also providing 10 TB for the Management Virtual Machines

Hence Primary Datacenter requires **190 TB** of Storage from 300 TB

Physical Design:

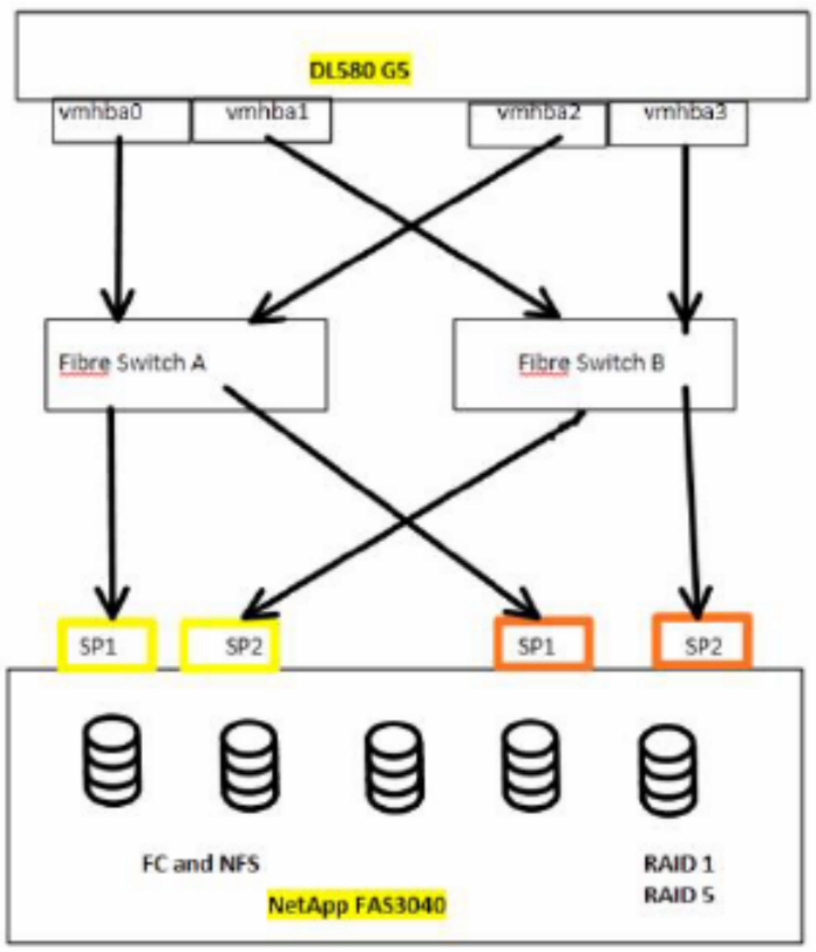
The chosen storage array to be used is the NetApp FAS3040. The following tables provide detailed specifications for the array s intended for use in this vSphere design

Attribute	**Specifications**
Storage Type	Fibre Channel / NFS
Array Type	NetApp FAS3040
Release Date	2007 Feb
Firmware	Data ONTAP 7.3.5.1
Flash Cache	1 GB
Onboard FC ports	8
Frame Size	Jumbo (9000) only for NFS
Number of Switches	2 (Redundant)
Number of Ports Per Host Per Switch	4
Table : 14	

Below is the logical design which consists dual port FC HBA (HP Qlogic FC1242 Dual Channel 4 GB PCIe) connected to DL580 G5 S erver.

2 x Brocade 5000 32 port 4 GB Fibre Channel Switch

As the NetApp FAS3040 is the Active-Active array, the default PSP chosen by vmkernel would Fixed. With the below design all the single point failure possibiliti es are nullified.



NetApp FAS3040 supports upto 336TB RAW and 336 HDDs. Below Table summarizes the Hard Drive type Raid type configured

Raid Type	Number of HDDs	HDD Size	HDD speed	Usable Space
Raid 1	186	600 GB	1500 RPM	55.8 TB
Raid 5	150	1000 GB	1500 RPM	138 TB
Table: 15				

Further 38 TB would be used as NAS as the NetApp FAS3040 supports both FC and NFS protocol. So, we now have

Raid 1 - 55.8 TB - FC

Raid 5 - 100 TB - FC

Raid 5 - 38 TB - NFS

Further these LUN are further formatted as summarized in the below Table

Resource Pool	Datastore Name	Raid Level	Protocol	Datastore Size	15% Headroom	Usable Datastore Size	VMs per Datastore
Silver	Management	Raid 5	FC	10 TB	1.5 TB	NA	NA
Silver	Infra01	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425
Silver	Infra02	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425
Silver	Infra03	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425
Silver	Infra04	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425
Silver	Infra05	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425

Silver	Infra06	Raid 5	FC	15 TB	2.25 TB	12.75 TB	425
Gold	Infra07	Raid 1	FC	15 TB	2.25 TB	12.75 TB	425
Gold	Infra08	Raid 1	FC	15 TB	2.25 TB	12.75 TB	425
Gold	Infra09	Raid 1	FC	15 TB	2.25 TB	12.75 TB	425
Gold	Infra10	Raid 1	FC	10.8 TB	1.62 TB	9.18 TB	306
Bronze	nfs01	Raid 5	NFS	15 TB	2.25 TB	12.75 TB	425
Bronze	nfs02	Raid 5	NFS	15 TB	2.25 TB	12.75 TB	425
Bronze	VMs_ISO	Raid 5	NFS	5 TB	0.75 TB	4.25 TB	19
Bronze	Log collector	Raid 5	NFS	3 TB	NA	NA	NA
Total				**193.8 TB**			**5000 VMs**
Table : 16							

Profile-Driven Storage :

Matching the SLA requirements of virtual machines with the appropriate Datastore can achieved using Profile - Driven Storage. Virtual machine storage profiles can be used during provisioning, cloning and VMware vSphere® Storage vMotion to ensure that only those datastores that are compliant with the vi rtual machine storage profile are presented.

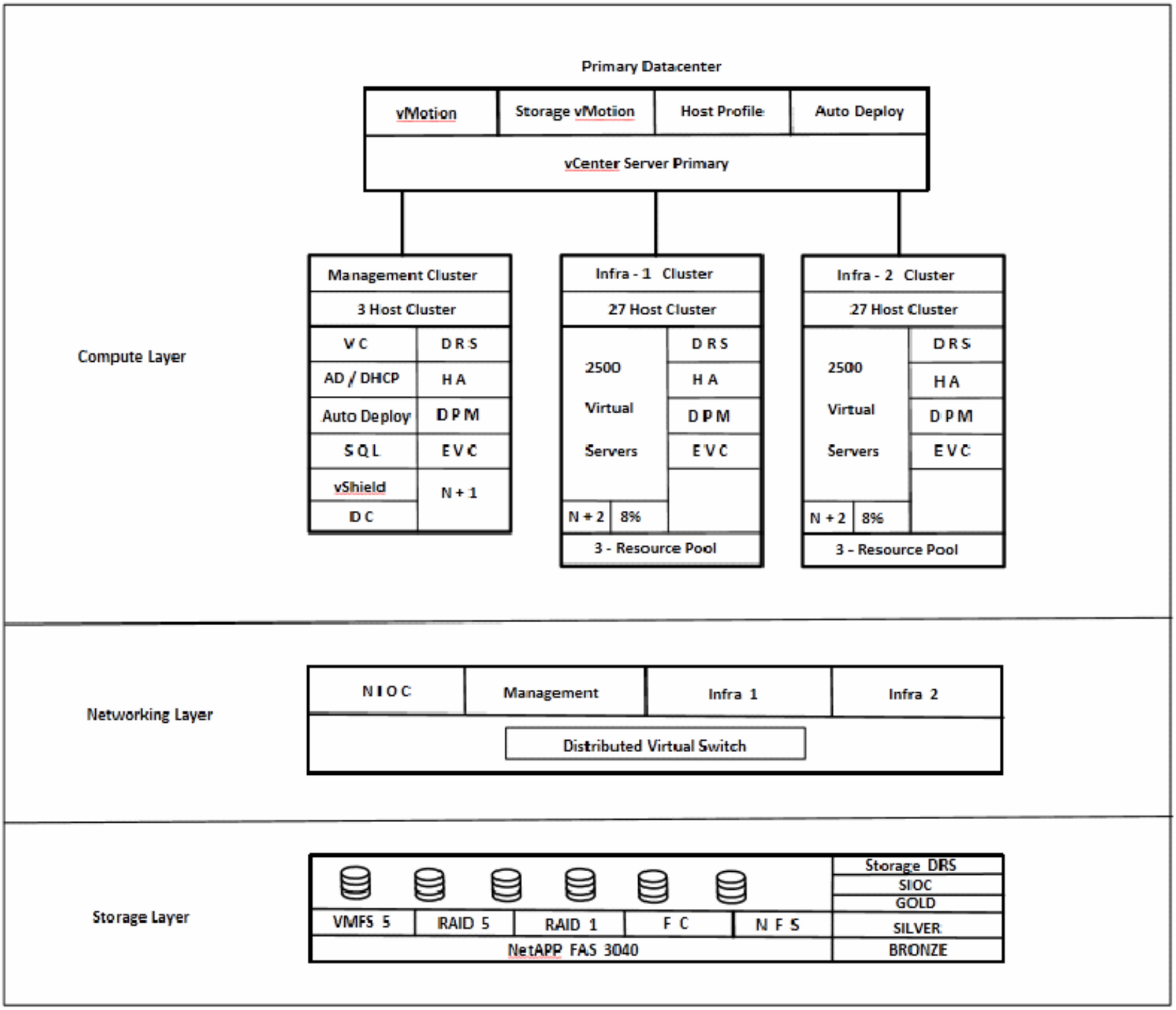
In the above table the resource pools are defined depending on the properties of underlying storage.

Storage I/O Control

SIOC is configured at Datastores and it works on the basis IOPS and space utilization on Datastore. Now if there any critical VMs which are high Disk IO intensive, then the disk shares can be set to high and this VM is given priority depending on the share value only during contentions.

Detailed Primary Datacenter Architecture Diagram

Below is complete Datacenter design with all the proposed solutions.



Secondary Datacenter

The Functional requirement for the Secondary Datacenter is to host atleast 1000 Virtual Servers. The Design would be exactly same as the Primary Datacenter just that the compute, networking and Storage value would alter. Only the difference is captured in the section, rest everything would be same as th e Primary Datacenter.

Even the Secondary Datacenter has the same set of assumptions about Virtual Servers load and size.

Hence, the vCenter Single Sign-On is configured as secondary instance and vCenter Server is configured in linked mode with the Primary vCenter Server. Over all the difference between Primary and Secondary Datacenter are listed below

1. Secondary Datacenter has 1 Management Cluster and 1 Infra Cluster consists of 11 hosts.
2. Percentage of resources reserved for Infra HA cluster is 10 %, which provides single host failure tolerance.
3. Different SAN - NetApp FAS2050
4. Different Storage calculations

Rest all the design configurations are same as Primary Datacenter. We would be covering only the differences to complete the Secondary Datacenter Design.

Compute Sizing and Scaling

As the Secondary Datacenter would host 1000 Virtual Servers, the cluster size would be smaller. Below are calculation with

Attribute	**Specification**
Average number of vCPU per VM	2
Average CPU Mhz	2300 Mhz
Average CPU Utilization Mhz	15% (345 Mhz)
Peak CPU utilization Mhz	20% (460 Mhz)
For 1000 Virtual Servers	460 x 1000 = **460000 Mhz**
Average amount of RAM per VM	2048 MB
Average Memory Utilization MB	45% (922 MB)
Peak memory Utilization MB	65% (1332 MB)
For 1000 Virtual Servers	1000 x 1332 = 1332000 MB
Assuming Memory Sharing benefits	20% = **1065600 MB**
Table:1	

The following tables detail the high-level CPU and memory specifications which would be used to calculate the total number of Servers required to host all 1000 Virtual Servers with some buffer compute resources in case if any Virtual Servers demands more.

Attribute	**Specification**
Number CPU (sockets) per host	4
Number of cores per CPU (Intel)	6
Mhz of CPU core	2670 Mhz
Total CPU Mhz per CPU	2670 x 6 = 16020 Mhz
Total CPU Mhz per Host	16020 x 4 = **64080 Mhz**
Maximum Host CPU Mhz utilization	80%
Available CPU Mhz per Host	**51264 Mhz**
Total RAM per host	256000 MB
Maximum Host RAM utilization	80%
Available RAM MB per host	**204800 MB**
Table:2	

Using the high-level CPU and memory specifications detailed in the above tables (Table 1 & 2), we have derived the minimum number of ESXi ho sts required from the perspectives of both CPU and memory. The minimum number of hosts is the higher of the two values.

Type	**Total Peak Resource Required**	**Available resource per host**	**Total Host Required**
CPU	**460000** Mhz	51264 Mhz	**9**
RAM	**1065600** MB	204800 MB	**6**
Table:3			

[illegible]	[illegible]	[illegible]	[illegible]
RAM	**1065600** MB	204800 MB	**6**
Table:3			

With 10% anticipated growth the total number of hosts (10% of 9) would be 9.9 = 10.

With N+1 Availability Requirement, the cluster size would be **11**.

Datacenter Design

Cluster Name	**Cluster Size**	**HA**	**DRS**	**DPM**	**EVC**
Management	3	Enabled	Enabled	Enabled	Enabled
Infra-1	11	Enabled	Enabled	Enabled	Enabled

vSphere High Availability

HA Cluster Settings	**Configuration Value**
Host Monitoring	Enabled
Admission Control	Prevent virtual machines from being powered on if they violate availability.
Admission Control Policy	Percentage of resources reserved:
	CPU : 10%
	Memory : 10%
Default Virtual Machine Restart Priority	Medium
Host Isolation Response	Shut Down
Virtual Machine Monitoring	Enabled
Virtual Machine Monitoring Sensitivity	Medium
Heartbeat Datastores	Select any of the cluster's datastores
Table: 9	

We are reserving 10% of CPU and Memory from the cluster, which is

11 x 51264 Mhz = 563904
10% of total cluster resource = 56390 Mhz
Which is equivalent to resources of 1.09 Host.

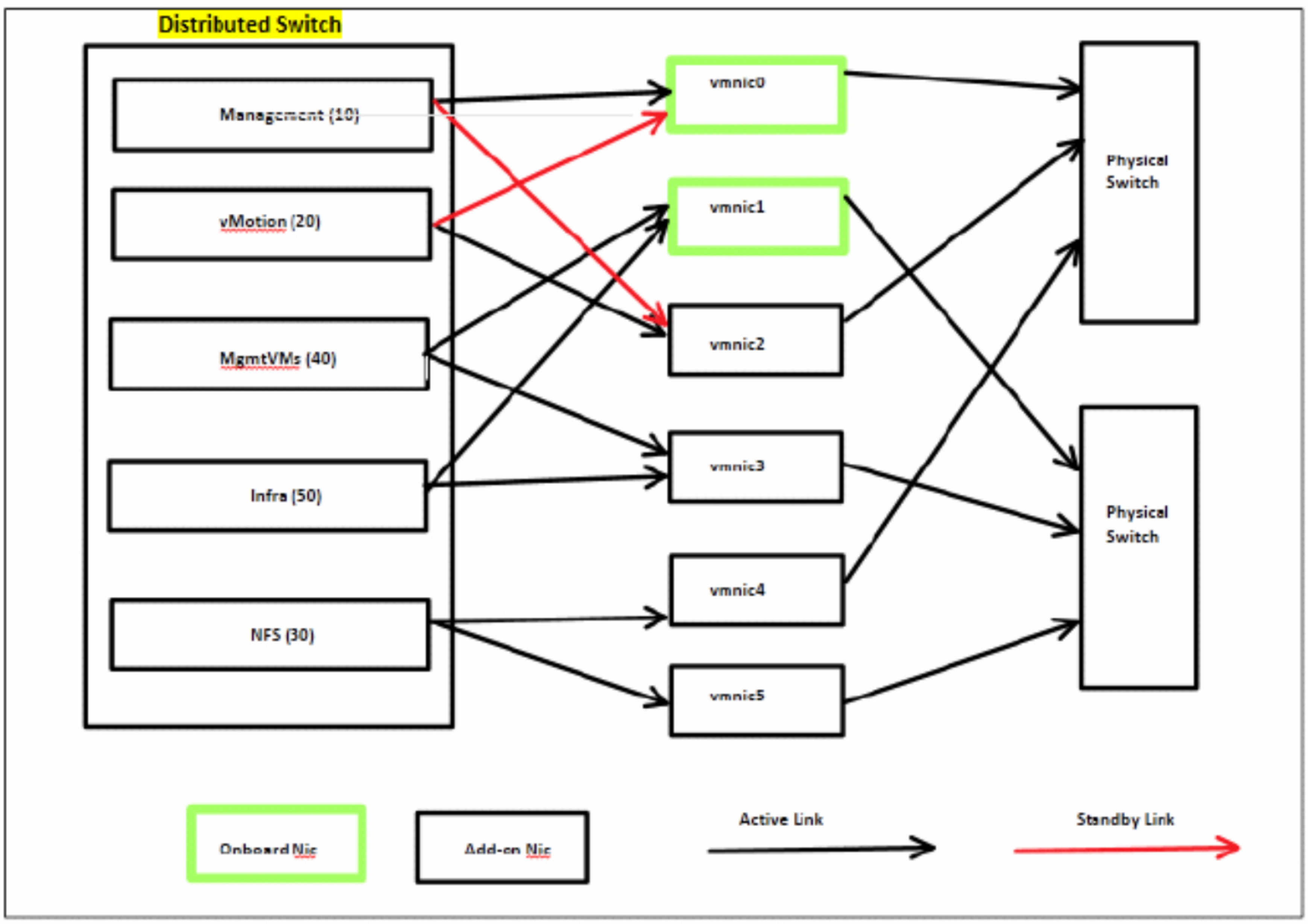
No Changes in DRS configuration settings

Networking Design

Virtual Switch	**Number of Ports**	**Physical Network Adaptor Card**	**DvPort Group (VLAN ID)**
dvSwitch0	6	2 - onboard NC373i	Management (10)
		1 - HP NC364T PCI Express Quad Port Server Adapter	vMotion (20)
			NFS (30)
			MgmtVMs (40)
			Infra-1 (50)
Table : 11			

Virtual Switch	PortGroup Type	DvPort Group	Network Ports	Load Balancing
dvSwitch0	Vmkernel	Mangament (10)	dvUplink 0 (Active)	Route based on physical NIC load
			dvUplink 2 (Standby)	
dvSwitch0	VMkernel	vMotion (20)	dvUplink 2 (Active)	Route based on physical NIC load
			dvUplink 0 (Stabdby)	
dvSwitch0	Vmkernel	NFS (30)	dvUplink 4 (Active)	Route based on IP Hash
			dvUplink 5 (Active)	(Jumbo Frames - Etherchannel)
dvSwitch0	Virtual Machine	MgmtVMs (40)	dvUplink 1 (Active)	Route based on physical NIC load
			dvUplink 3 (Active)	
dvSwitch0	Virtual Machine	Infra-1 (50)	dvUplink 1 (Active)	Route based on physical NIC load
			dvUplink 3, (Active)	

The following diagram illustrates the dvSwitch configuration:



Storage Design

As per our assumption, each Virtual Server is provided with 30 GB of Virtual Disk.
For 1000 Virtual Server

1000 x 30 = 30000 GB

Keeping 20% Free space

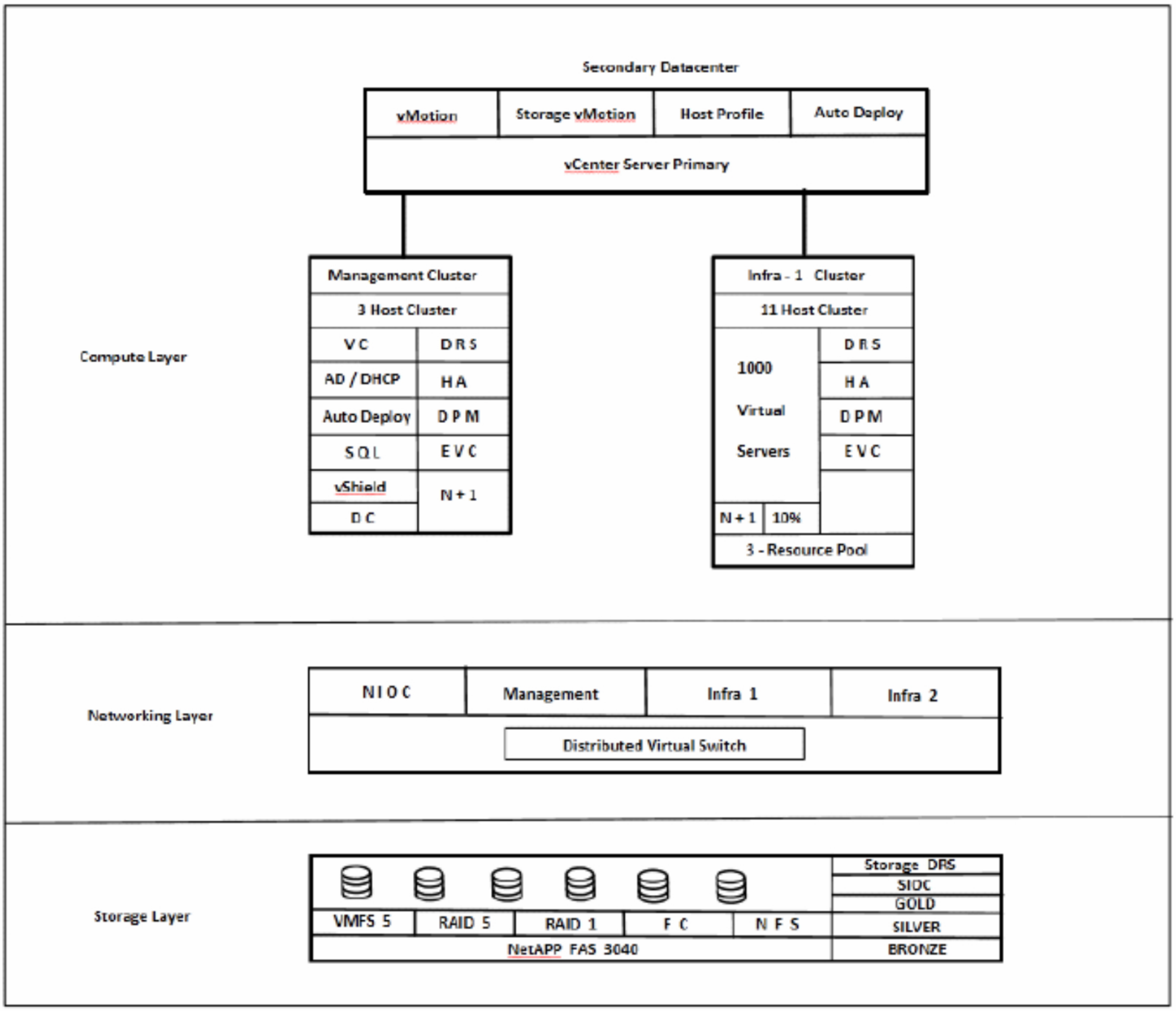
20% of 30000 = 6000 GB

Storage required for 1000 Virtual Server = **36 TB**

Also providing 8 TB for the Management Virtual Machines

Hence Primary Datacenter requires **44 TB** of Storage.

Detailed Secondary Datacenter Architecture Diagram



Tertiary Datacenter

The Tertiary Datacenter needs host atleast 500 Virtual Servers. Apart from that there is another functional requirement where we need add a solution to host 3000 Virtual Desktops and Application Delivery on 1500 devices. We have chosen the Tertiary Datacenter to host the 3000 Virtual Desktops and Application Delivery on 1500 devices.

Let's first divide this Datacenter into two parts:

Part 1 - Hosts 500 Virtual Server, again the design would be exactly same as Primary and Secondary Datacenters, only the Cluster size, Storage and Networking configuration changes.

Part 2 - Here we would be adding a new Solution to fulfill the other 2 requirements, i.e., hosting 3000 Virtual Desktops and Application Delivery on 1500 devices.

Part 2 is again divided into 2 stages

Stage 1 - Deploying Vmware Horizon View to address the requirement of hosting 3000 Virtual Desktops.

Stage 2 - Adding Vmware Horizon Workspace to Vmware Horizon View to address the requirement of Application Delivery on 1500 devices

Tertiary Datacenter - Part -1

The Functional requirement for the Tertiary Datacenter is to host atleast 500 Virtual Servers. The Design would be exactly same as the Primary Datacenter just that the compute, networking and Storage value would alter. Only the difference is captured in the section, rest everything would be same as the Primary Datacenter.

Even the Tertiary Datacenter has the same set of assumptions about Virtual Servers load and size.

The vCenter Single Sign-On is configured as secondary instance and vCenter Server is configured in linked mode with the Primary or the Secondary vCenter Server. Overall the difference between Primary and Tertiary Datacenter are listed below

1. Secondary Datacenter has 1 Management Cluster and 1 Infra Cluster consists of 7 hosts.
2. Percentage of resources reserved for Infra HA cluster is 15 %, which provides single host failure tolerance.
3. Different SAN - NetApp FAS2050
4. Different Storage calculations

Rest all the design configurations are same as Primary Datacenter. We would be covering only the differences to complete the Secondary Datacenter Design.

Compute Sizing and Scaling

The Tertiary Datacenter would host 500 Virtual Servers, the cluster size would be smaller.

Attribute	**Specification**
Average number of vCPU per VM	2
Average CPU Mhz	2300 Mhz
Average CPU Utilization Mhz	15% (345 Mhz)
Peak CPU utilization Mhz	20% (460 Mhz)
For 500 Virtual Servers	460 x 500 = **230,000 Mhz**
Average amount of RAM per VM	2048 MB
Average Memory Utilization MB	45% (922 MB)
Peak memory Utilization MB	65% (1332 MB)
For 500 Virtual Servers	500 x 1332 = 666000 MB
Assuming Memory Sharing benefits	20% = **532800 MB**
Table:1	

The following tables detail the high-level CPU and memory specifications which would be used to calculate the total number of Servers required to host all 500 Virtual Servers with some buffer compute resources in case if any Virtual Servers demands more.

Attribute	**Specification**
Number CPU (sockets) per host	4
Number of cores per CPU (Intel)	6
Mhz of CPU core	2670 Mhz
Total CPU Mhz per CPU	2670 x 6 = 16020 Mhz
Total CPU Mhz per Host	16020 x 4 = **64080 Mhz**
Maximum Host CPU Mhz utilization	80%
Available CPU Mhz per Host	**51264 Mhz**
Total RAM per host	256000 MB
Maximum Host RAM utilization	80%
Available RAM MB per host	**204800 MB**
Table:2	

Using the high-level CPU and memory specifications detailed in the above tables (Table 1 & 2), we have derived the minimum number of ESXi hosts required from the perspectives of both CPU and memory. The minimum number of hosts is the higher of the two values.

Type	Total Peak Resource Required	Available resource per host	Total Host Required
CPU	**230,000** Mhz	51264 Mhz	**5**
RAM	**532800** MB	204800 MB	**3**
Table:3			

With 10% anticipated growth the total number of hosts (10% of 5) would be 5.5 = 6.

With N+1 Availability Requirement, the cluster size would be **7**.

Datacenter Design

Cluster Name	Cluster Size	HA	DRS	DPM	EVC
Management	3	Enabled	Enabled	Enabled	Enabled
Infra-1	7	Enabled	Enabled	Enabled	Enabled

vSphere High Availability

HA Cluster Settings	Configuration Value
Host Monitoring	Enabled
Admission Control	Prevent virtual machines from being powered on if they violate availability.
Admission Control Policy	Percentage of resources reserved:
	CPU : 15%
	Memory : 15%
Default Virtual Machine Restart Priority	Medium
Host Isolation Response	Shut Down
Virtual Machine Monitoring	Enabled
Virtual Machine Monitoring Sensitivity	Medium
Heartbeat Datastores	Select any of the cluster's datastores
Table: 9	

We are reserving 15% of CPU and Memory from the cluster, which is

7 x 51264 Mhz = 358848
15% of total cluster resource = 53828 Mhz
Which is equivalent to resources of 1.05 Host.

No Changes in DRS configuration settings

Stage -1 Desktop Virtualization

We need to get 3000 Virtual Desktop full access. For Virtual Desktops, we would using Vmware Horizon View 5.2. Vmware Horizon View is the latest version and has lot of new features and enhancements. The features which would utilizing is explained in the future sections.

We would have the complete VDI on Tertiary Datacenter along with 500 Virtual Servers managed by single vCenter Server. Information about Compute, Storage, Networking and clusters are explained in the respective sections. As we logically separating our View environment from Virtual Servers, it is important to understand the Components of Vmware Horizon View and how they would be participating the deployment and designing.

Vmware Horizon View Conponents:

1. Horizon View Connection Server:
   Horizon View Connection Server is the broker for client connections. It authenticates and directs incoming user desktop requests. Earlier called View Connection Server.

2. Horizon View Composer Server:
   Horizon View Composer is an optional service that you install only if you plan to deploy multiple linked-clone desktops from a single centralized base image. Linked-clone desktop images optimize your use of storage space. View Composer is a feature of View Connection Server, but its service operates directly on virtual machines managed by vCenter.

3. Horizon View Security Server:
   A Horizon View Security Server provides an extra layer of security for external Internet users who use a View Connection Server to access your internal network. The Security Server handles SSL functions.

4. VMware ThinApp:
   software that creates virtualized applications. In a Horizon View implementation, these virtual packages reside on a ThinApprepository, which is a network share. The administrator can copy a full ThinApp package from the repository to the virtual desktop.

5. Horizon View Agent:
   Horizon View Agent must be installed on the virtual machines managed by vCenter Server so View Connection Server can communicate with them. View Agent assists with session management, single sign-on, and device redirection

6. Horizon View Client:
   Horizon View Client is installed on all endpoint devices. Users run View Client to:
   - Connect to the View Connection Server or a Security Server
   - Log in to their Horizon View desktops in the datacenter
   - Edit the list of servers they connect to

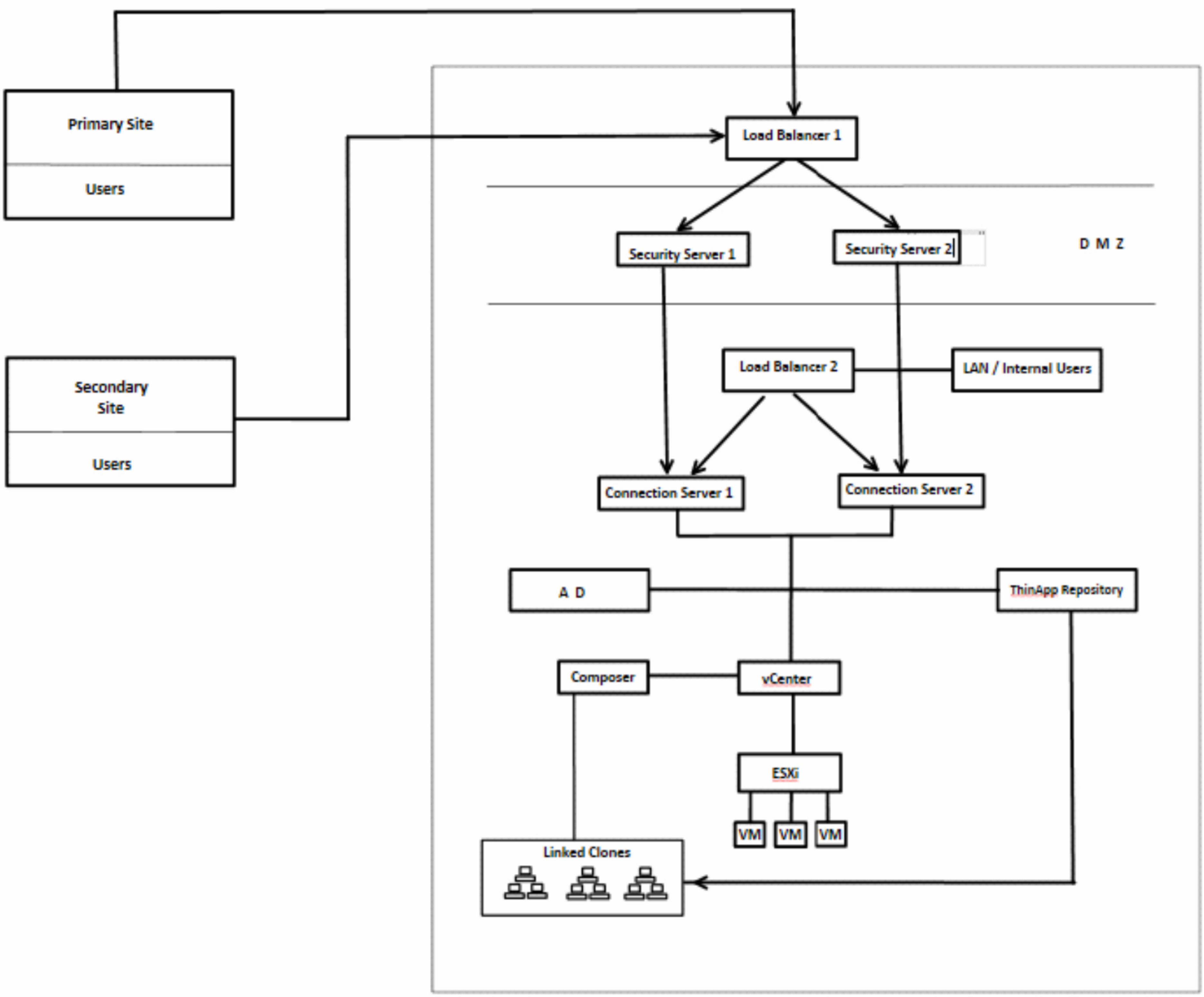
7. Horizon View Persona Management:
   Horizon View Persona Management provides for persistent, dynamic user profiles across user sessions on different desktops. User profile data is downloaded as needed to speed up login and logout time. New user settings are sent up to the user profile repository automatically during desktop use.

Architecture Overview Tertiary Datacenter - View

Vmware Horizon View 5.2 would deployed in Tertiary Datacenter. View Virtual Desktops would have complete access, i.e., Intern al user (Tertiary site), external users (Users from Primary and Secondary site)

Requests from Internal users goes to the Load Balancer 2, which then connects to available View Connection Server and then re aches the respective Virtual Desktop after all the authentications are passed. Similarly when an External user tries to connect to their Virtual Desktop, the req uest first hits the Load Balancer 1 and then the available Security Server (Which is in DMZ). Then Security Server passes the request to respective registered Connection Server. Then reaches the respective Virtual Desktop after all the authentications are passed.

Tertiary Site - Stage 1 - Desktop Virtualization



Vmware Horizon View Components

View Configurations:

1. View Connection server is installed on a Separate Virtual Machine Running Server 2008 R2.
2. vCenter Server is registered with View Connection Server in the View Administrator portal.
3. Second Connection server is installed, Replica Server.
4. Vmware View Composer is installed on a separate Virtual Machine Running Server 2008 R2.
5. 2 Security Servers are installed and registered with respective connection Server.
6. Windows 7 and Winodws XP master Images are created and configured with all required

Vmware View Pools

There are a total of six ways in which virtual desktops can be provisioned and managed with VMware View:

• Manual desktop pool with dedicated assignment
• Manual desktop pool with floating assignment
• Automated desktop pool, leveraging VMware full clones with dedicated assignment
• Automated desktop pool, leveraging VMware full clones with floating assignment
• Automated desktop pool, leveraging VMware linked clones with dedicated assignment
• Automated desktop pool, leveraging VMware linked clones with floating assignment

As per our requirement, we need to have full access to 3000 Virtual Desktops. Let's further segregate these 3000 Virtual Desktops to different department depending on nature of work.

Let's assume the requirement dictate a need for the following mix of desktop types:

Percentage	**Total Users**	**Pool TypeProvisioning Method**	**Desktop Data Persistance**	**User Assignment**	**User Type**
4%	150	Automated Desktop Pool	Non-persistent	Floating	Kiosks, Part-Time Workers
40%	1200	Automated Desktop Pool	Persistent	Dedicated	Human Resources, Analysts, R&D, Regular Employees
20%	600	Automated Desktop Pool	Persistent	Dedicated	Software Developers
35%	1050	Automated Desktop Pool	Non-persistent	Floating	Call Center, Help Desk Representatives
1%	30	Manual Desktop Pool	Persistent	Dedicated	Management staff
TOTAL					
100%	3000				

Sizing and Scaling

Wednesday, August 7, 2013 2:44 PM

As we have divided the 3000 Virtual Desktop users into 5 different pools depending on their nature of work, we would estimate the resources required pool-wise and the total number of Virtual Desktops per ESXi host.

Below are Master Image specification for all the 5 Pools, using which Required number of hosts are calculated

Pool 1 - Internal Dept. Pool

Pool 2 - Guest Pool

Pool 3 - Power User

Pool 4 - Software Dev Pool

Pool5 - Support Center Pool

Internal Dept. Pool	
Attribute	**Specification**
Operating system	32-bit Windows 7 or later (with the latest service pack)
RAM	1GB
Virtual CPU	1
System disk capacity	24GB
User data capacity (as a persistent disk)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic SAS (the default)
Virtual network adapter	VMXNET 3
Average CPU Mhz	1000 Mhz
Peak CPU utilization Mhz	45% (450 Mhz)
Peak Memory Uilization MB	70% (717 MB)
For 1200 Virtual Desktops	
Required CPU in Mhz	540000 Mhz
Required Memory in MB	860400 MB
Available CPU Mhz per Host	51264 Mhz
Available RAM MB per host	204800 MB
Total Number of hosts required	11

Guest Pool

Attribute	**Specification**
Operating system	32-bit Windows XP (with the latest service pack)
RAM	512MB
Virtual CPU	1
System disk capacity	16GB
User data capacity (as a persistent disk)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic Parallel (not the default)
Virtual network adapter	Flexible (the default)
Average CPU Mhz	1000 Mhz
Peak CPU utilization Mhz	35% (350 Mhz)
Peak Memory Uilization MB	55% (564 MB)
For 150 Virtual Desktops	
Required CPU in Mhz	52500 Mhz
Required Memory in MB	84600 MB
Available CPU Mhz per Host	**51264 Mhz**
Available RAM MB per host	**204800 MB**
Total Number of hosts required	1

Power-User	

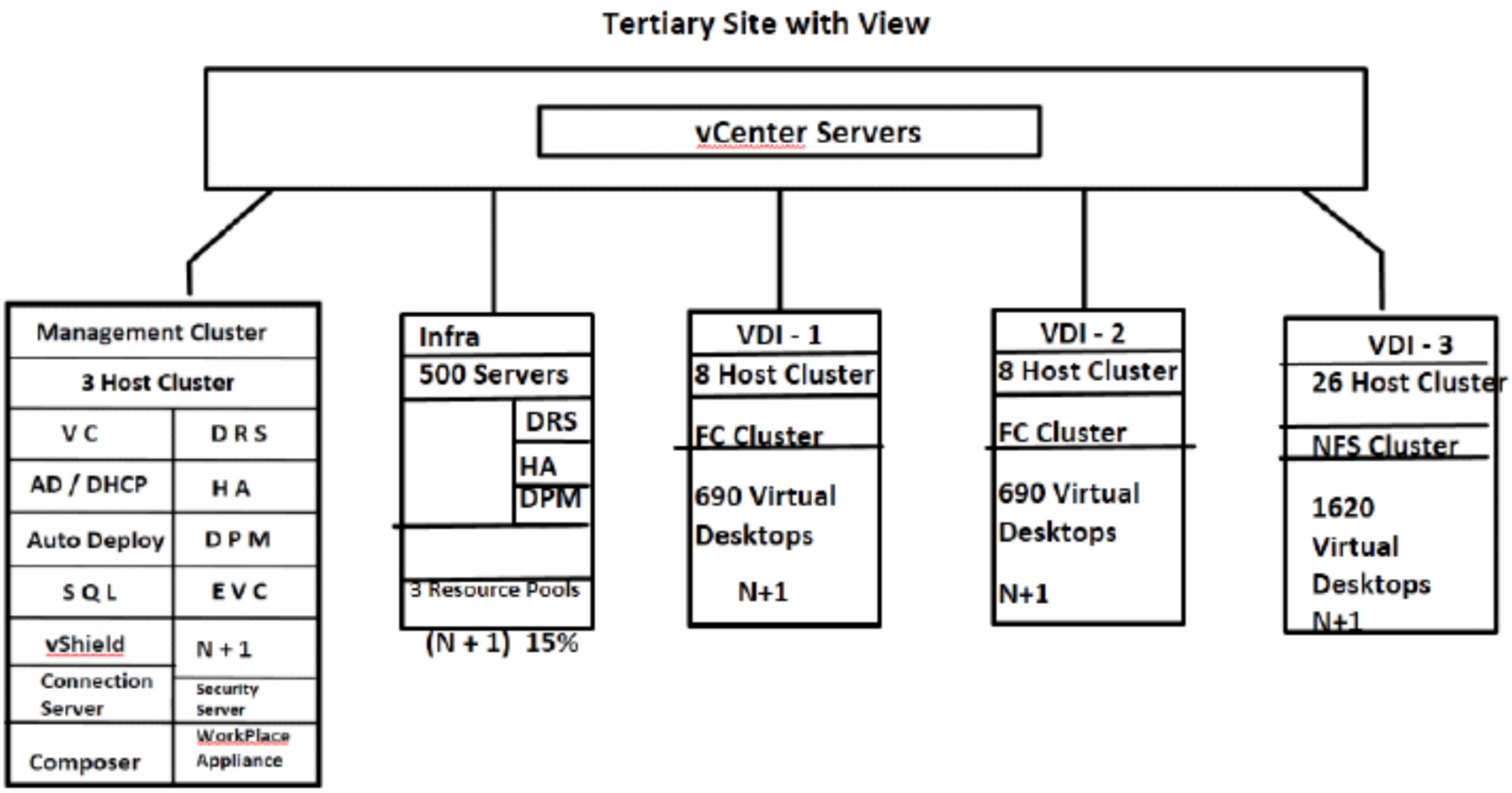
Software Dev Pool	
Attribute	**Specification**
Operating system	32-bit Windows 7 or later (with the latest service pack)
RAM	2GB
Virtual CPU	2
System disk capacity	24GB
User data capacity (as a persistent disk)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic SAS (the default)
Virtual network adapter	VMXNET 3
Average CPU Mhz	2100 Mhz
Peak CPU utilization Mhz	55% (1155 Mhz)
Peak Memory Uilization MB	65% (1332 MB)
For 600 Virtual Desktops	
Required CPU in Mhz	693000 Mhz
Required Memory in MB	799200 MB
Available CPU Mhz per Host	51264 Mhz
Available RAM MB per host	204800 MB
Total Number of hosts Required	14

Support Center Pool	
Attribute	**Specification**
Operating system	32-bit Windows 7 or later (with the latest service pack)
RAM	1GB
Virtual CPU	1
System disk capacity	24GB
User data capacity (as a persistent disk)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic SAS (the default)
Virtual network adapter	VMXNET 3
Average CPU Mhz	1000 Mhz
Peak CPU utilization Mhz	45% (450 Mhz)
Peak Memory Uilization MB	70% (717 MB)
For 1050 Virtual Desktops	
Required CPU in Mhz	472500 Mhz
Required Memory in MB	752850 MB
Available CPU Mhz per Host	51264 Mhz
Available RAM MB per host	204800 MB
Total Number of hosts Required	10

Attribute	Specification
Operating system	32-bit Windows 7 or later (with the latest service pack)
RAM	2GB
Virtual CPU	2
System disk capacity	24GB
User data capacity (as a persistent disk)	5GB (starting point)
Virtual SCSI adapter type	LSI Logic SAS (the default)
Virtual network adapter	VMXNET 3
Average CPU Mhz	2100 Mhz
Peak CPU utilization Mhz	55% (1155 Mhz)
Peak Memory Uilization MB	65% (1332 MB)
For 30 Virtual Desktops	
Required CPU in Mhz	34650 Mhz
Required Memory in MB	39960 MB
Available CPU Mhz per Host	**51264 Mhz**
Available RAM MB per host	**204800 MB**
Total Number of hosts required	**0.67**

Cluster Configuration

Vmware View 5.2 has a limitation of 8 hosts per HA/DRS cluster. But with the current version the NFS configured cluster has a limitation of 32 hosts.



Stage -2 Application Delivery

Conceptual Architecture Overview