Release 1.0 for Dell PowerEdge Blade Servers, Force10 Switches, and Compellent Storage Center
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July 2012

Revision History

<table>
<thead>
<tr>
<th>Revision</th>
<th>Description</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A00</td>
<td>Initial Version</td>
<td>July 2012</td>
</tr>
</tbody>
</table>
1 Introduction

The Dell vStart 50 for VDI– Citrix XenDesktop 5.6 solution is a virtualization infrastructure solution that has been designed and validated by Dell Engineering. It is delivered racked, cabled, and ready to be integrated into your datacenter. The Dell vStart 50 for VDI– Rack Citrix XenDesktop 5.6 configuration includes Dell PowerEdge R620 servers running VMware® ESXi™, Dell EqualLogic PS4100X iSCSI storage, Dell PowerConnect switches, and a Dell PowerEdge R420 server that manages the solution by hosting VMware vCenter™ Server and Dell management tools, with Citrix XenDesktop 5.6 delivering the virtual desktop sessions.

The configurations also include Dell Management and Dell EqualLogic Host Integration Tools for VMware Edition (HIT/VE) Plug-ins for VMware vCenter Server. VMware ESXi 5.0 is the supported hypervisor. The solution can either be configured with PowerConnect 7024 or PowerConnect 6224 switches.

2 Audience

IT administrators and IT managers, who have purchased or are, planning to purchase a vStart configuration, can use this document to understand the component details of the solution.
3 Overview

This section provides a high-level product overview of the VMware vSphere, Dell PowerEdge rack servers, PowerConnect 7024 or PowerConnect 6224 switches, and Dell EqualLogic PS4100X iSCSI storage.

To provide the highest service levels for the most critical components of the solution, the management stacks and database services have been designed into dedicated and highly available solutions fully supported by Dell, VMware and Microsoft. This also provides an added benefit of increased user densities and centralized management services for multiple stacks.

The Solution Overview, below, provides a summary of the solution which will be deployed for the DVS vStart Rack solution.

![Solution Overview Diagram]

**Figure 3: Solution Overview**

The diagram above does not detail the shared infrastructure components which are leveraged by the environment.
3.1 Solution Summary

The following table summarizes the components for the Dell vStart 50 for VDI configuration. Storage expansion options are available for customers who require additional storage capacity, throughput, or bandwidth. As such, the EqualLogic PS4100X quantities will increment by one if the storage expansion option is selected. The solution with one additional storage array is called vStart 50+. For more information about the storage expansion option, please consult with your Dell Sales representative.

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PowerEdge R620 Servers</td>
<td>2</td>
</tr>
<tr>
<td>VMware ESXi</td>
<td>3</td>
</tr>
<tr>
<td>EqualLogic PS4100X</td>
<td>1 + (1 optional)</td>
</tr>
</tbody>
</table>
### Table 1: Solution Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESXi Cluster</td>
<td>PowerEdge R620 servers running VMware ESXi Embedded</td>
<td>Host virtual machines (VMs)</td>
</tr>
<tr>
<td>iSCSI Storage</td>
<td>EqualLogic PS4100X with 24 x 300 GB 10K RPM 2.5&quot; SAS Drives</td>
<td>Provide shared storage for the ESXi cluster to host the VMs</td>
</tr>
<tr>
<td>Management Server</td>
<td>PowerEdge R420 server running VMware ESXi 5.0</td>
<td>Host VMware vCenter Server and EqualLogic SAN HQ along with the Citrix XD management VM’s</td>
</tr>
<tr>
<td>LAN Traffic Switches</td>
<td>PowerConnect 7024 or 6224 switches</td>
<td>Support VM, vMotion, Management, and Out-of-Band Management traffic</td>
</tr>
<tr>
<td>SAN Traffic Switches</td>
<td>PowerConnect 7024 or 6224 switches</td>
<td>Support iSCSI data and iSCSI management traffic</td>
</tr>
<tr>
<td>Dell Management Plug-in for VMware vCenter</td>
<td>Dell virtual appliance hosted on the ESXi Cluster</td>
<td>Enables hardware monitoring, inventory, firmware updates, bare metal deployment of hypervisors, and warranty retrieval, all integrated into the vCenter Server user interface</td>
</tr>
</tbody>
</table>

Table 1 below describes the key solution components and the roles served.
3.2 VMware vSphere 5

VMware vSphere 5 includes the ESXi™ hypervisor as well as vCenter™ Server which is used to configure and manage VMware hosts. Key capabilities for the ESXi Enterprise Plus license level include:

- **VMware vMotion**: VMware vMotion technology provides real-time migration of running virtual machines (VM) from one host to another with no disruption or downtime.

- **VMware High Availability (HA)**: VMware HA provides high availability at the VM level. Upon host failure, VMware HA automatically re-starts VMs on other physical hosts running ESXi. VMware vSphere 5 uses Fault Domain Manager (FDM) for High Availability.

- **VMware Distributed Resource Scheduler (DRS) and VMware Distributed Power Management (DPM)**: VMware DRS technology enables vMotion to automatically achieve load balancing according to resource requirements. When VMs in a DRS cluster need fewer resources, such as during nights and weekends, DPM consolidates workloads onto fewer hosts and powers off the rest to reduce power consumption.

- **VMware vCenter Update Manager**: VMware vCenter Update Manager automates patch management, enforcing compliance to patch standards for VMware ESXi hosts.

- **VMware Storage vMotion™**: VMware Storage vMotion enables real-time migration of running VM disks from one storage array to another with no disruption or downtime. It minimizes service disruptions due to planned storage downtime previously incurred for rebalancing or retiring storage arrays.

- **Host Profiles**: Host Profiles standardize and simplify the deployment and management of VMware ESXi host configurations. They capture and store validated configuration information, including host compliance, networking, storage, and security settings.

For more information on VMware vSphere, see [www.vmware.com/products/vsphere](http://www.vmware.com/products/vsphere).

3.3 Citrix XenDesktop 5.6

The solution is based on Citrix XenDesktop. Citrix XenDesktop provides a complete end-to-end solution that delivers Microsoft Windows 7 virtual desktops to users on a wide variety of endpoint devices. Virtual desktops are dynamically assembled on demand, providing users with pristine, yet personalised, desktops each time they log on.

Citrix XenDesktop provides a complete virtual desktop delivery system by integrating several distributed components with advanced configuration tools that simplify the creation and real-time management of the virtual desktop infrastructure. These are discussed in further detail later in the document.

The core XenDesktop components include:

- XenDesktop Controller (DC)
- Citrix Provisioning Server (PVS)
- XenDesktop Farm Database
- Virtual Desktop Agent (VDA)
3.4 PowerEdge R620 for ESXi Cluster

The Dell PowerEdge R620 uses Intel® Xeon® E5 2600 series processors and Intel chipset architecture in a 1U rack mount form factor. The R620 supports up to ten 2.5” drives. There is also an option for an LCD on the front of the server for system health monitoring, alerting, and basic management configuration. The server features two CPU sockets and 24 memory DIMM slots supporting 2, 4, 8, 16 or 32GB DIMMs to meet the varying memory density demands of a virtualized infrastructure. The 10 local disks are configured for RAID10 and host the virtual desktop sessions.

Local Tier 1 Compute Host – PowerEdge R620
- 2 x Intel Xeon E5-2690 Processor (2.9Ghz)
- 192GB Memory (12 x 16GB DIMMs @ 1600Mhz)
- VMware vSphere 5 on internal SD
- 10 x 146GB SAS 6Gbps 15k Disks
- PERC H710 Integrated RAID Controller – RAID10
- Broadcom 5720 1Gb QP NDC (LAN)
- Broadcom 5720 1Gb QP NIC (LAN)
- iDRAC7 Enterprise w/ vFlash, 8GB SD
- 2 x 750W PSUs

3.5 EqualLogic PS4100 for iSCSI Storage

The Dell EqualLogic PS4100 is a virtualized iSCSI SAN that combines intelligence and automation with fault tolerance to provide simplified administration, rapid deployment, enterprise performance and reliability, and seamless scalability. The storage architecture delivers a self-optimizing SAN that is simple to manage and has an all-inclusive software suite to help reduce Total Cost of Ownership (TCO). In the Dell vStart 50 for VDI the PS4100X uses 10,000 RPM Serial Attached SCSI (SAS) 2.5” form factor disk drives to provide capacity and performance for a range of applications.
3.6 PowerConnect 7024 or 6224 for LAN and SAN Traffic

At the heart of the solutions network configuration are four Dell PowerConnect 7024 or 6224 switches. These managed Layer 3 Gigabit Ethernet switches offer the enterprise-class level of performance required for this configuration. The LAN switches use a stacked configuration that enables connection redundancy and added bandwidth where required. Additionally, the 10Gb uplink enables design and implementation flexibility needed by advanced users. LAN and SAN switches are physically and logically separated per best practices to support security and network traffic segmentation. VLANs are implemented to support solution management, security, and network traffic segmentation, and routing is leveraged to provide flexible connectivity.

3.7 Dell Hardware and Storage Management integrated into vCenter

Dell Management Plug-in for VMware vCenter is included in the solution. This enables customers to:

- Get deep-level detail from Dell servers for inventory, monitoring and alerting — all from within vCenter
- Apply BIOS and Firmware updates to Dell servers from within vCenter
- Automatically perform Dell-recommended vCenter actions based on Dell hardware alerts
- Access Dell hardware warranty information online
- Rapidly deploy new bare metal hosts using Profile features

EqualLogic HIT/VE Plug-in for vCenter is also included in the solution. HIT/VE enables customers to:

- Create and manage Smart Copies and Smart Clones of VI objects
- Schedule creation of Smart Copies and Smart Clones
- Provision new datastores and expand existing datastores
- Create and deploy Virtual Desktops (This is outside the scope of this solution, and requires additional software.)

For more information on Dell Management Plug-in for VMware vCenter see the Dell Management Plug-in web page. For more information about the Dell EqualLogic HIT/VE Plug-in for VMware vCenter see http://www.dellstorage.com/WorkArea/DownloadAsset.aspx?id=1616&terms=HIT%2fVE.
3.8 PowerEdge R420 Management Server

The Dell PowerEdge R420 uses Intel Xeon E5-2600 series processors and Intel chipset architecture in a 1U rack mount form factor. These servers support up to six 2.5” drives and provide the option for an LCD located in the front of the server for system health monitoring, alerting, and basic management configuration. An AC power meter and ambient temperature thermometer are built into the server, both of which can be monitored on this display without any software tools. The server features two CPU sockets and 24 memory DIMM slots.

<table>
<thead>
<tr>
<th>Shared Tier 1 Mgmt Host – PowerEdge R420</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x Intel Xeon E5-2470 Processor (2.3Ghz)</td>
</tr>
<tr>
<td>96GB Memory (6 x 16GB DIMMs @ 1600Mhz)</td>
</tr>
<tr>
<td>VMware vSphere 5 on internal SD</td>
</tr>
<tr>
<td>Diskless</td>
</tr>
<tr>
<td>Broadcom 57800  2 x 10Gb SFP+ + 2 x 1Gb NDC</td>
</tr>
<tr>
<td>1 x Broadcom 5720 1Gb DP NIC (LAN)</td>
</tr>
<tr>
<td>1 x Intel X520 2 x 10Gb SFP+ DP NIC (iSCSI)</td>
</tr>
<tr>
<td>iDRAC7 Enterprise w/ vFlash, 8GB SD</td>
</tr>
<tr>
<td>2 x 550W PSUs</td>
</tr>
</tbody>
</table>

For more information, see the PowerEdge R420 guides at [Dell.com/PowerEdge](http://Dell.com/PowerEdge).
4 Design Principles

The following principles are central to the design and architecture of DVS vStart Solution.

1. **Redundancy with no single point-of-failure**: Redundancy is incorporated in every aspect of the solution, including server high availability features, networking, and storage.

2. **Management**: Provide integrated management using VMware vCenter, Dell Management Plug-in VMware vCenter, Dell OpenManage Essentials, and Compellent plug-in for VMware vCenter.

3. **Cloud Enabled**: The solution includes VIS Creator, which enables customers to manage their virtualization infrastructure as a private cloud. The private cloud can in turn be connected to Dell vCloud using VMware vCloud Connector.

4. **Integration into an existing data center**: This architecture assumes that there is an existing 10 Gb Ethernet infrastructure with which to integrate.

5. **Hardware configuration for virtualization**: This solution is designed for virtualization for most general cases. Each blade server is configured with appropriate processor, memory, host bus, and network adapters as required for virtualization.

6. **Racked, Cabled and Ready to be Deployed**: vStart is available partially racked, cabled, and delivered to the customer site, ready for deployment. Components are configured and racked to optimize airflow and thermals. Based on customer needs, different rack sizes and configurations are available to support various datacenter requirements.

7. **Power, Cooling, and Weight Considerations**: DVS vStart solution is configured with Power Distribution Units (PDUs) to meet the power requirements of the components as well as regional constraints. Power consumed, cooling required, and information regarding rack weight are provided to enable customers to plan for the solution.

8. **Flexible configurations**: DVS vStart is pre-configured to suit most customer needs for a virtualized infrastructure. The solution also supports additional options, such as configuring racks, server processors, server memory, and storage, based on customer needs.
5 Reference Architecture

This solution consists of a PowerEdge R620 servers running VMware ESXi with PowerConnect switches and Equallogic PS4100X array(s). Below provides high-level reference architecture for the solution. The figure shows high-level logical connectivity between various components. Subsequent sections provide more detailed connectivity information.

Figure 2. DVS vStart Network Topology (Logical View)
6 Network Architecture

The LAN includes two PowerConnect 7024 or 6224 switches which support the VM, Management, vMotion, and OOB traffic. These traffic types are logically separated through the use of VLANs. The two switches are stacked together, which forms a single logical switch and provides a 48Gb stack bandwidth between the two PC6224 switches, or 64Gb stack bandwidth between the two PC7024 switches. The solution provides four 1Gb uplinks from each switch to link into an existing core network infrastructure. If the core network infrastructure supports 10Gb Ethernet, then 10Gb uplink modules may be added to each switch; however, this option is beyond the scope of this document.

6.1 Traffic Isolation using VLANs

The traffic on the LAN is separated into four VLANs: one VLAN each for Management, vMotion, VM, and Out-of-Band Management (OOB) traffic. VLAN tagging for the OOB traffic is performed by the PowerConnect switches. Table 2 below provides VLAN and Subnet examples. For the other traffic types, the tagging is performed in the virtual switch by the ESXi hypervisor. Routing between VLANs is dependent on the specific customer requirements and is not included in this document. Consult with your Dell Sales and Services representatives if you have questions about routing or require assistance implementing in your environment. If desired, the PowerConnect switches can be configured to provide the routing function.

<table>
<thead>
<tr>
<th>Traffic Type</th>
<th>Sample VLAN</th>
<th>Sample Subnet</th>
</tr>
</thead>
<tbody>
<tr>
<td>OOB</td>
<td>10</td>
<td>192.168.10.X</td>
</tr>
<tr>
<td>Management</td>
<td>20</td>
<td>192.168.20.X</td>
</tr>
<tr>
<td>vMotion</td>
<td>30</td>
<td>192.168.30.X</td>
</tr>
<tr>
<td>VM</td>
<td>100</td>
<td>192.168.100.X</td>
</tr>
</tbody>
</table>

Additional VLANs can be implemented for VM traffic, if required.

6.2 PowerEdge R620 LAN Connectivity

Each PowerEdge R620 has eight 1Gb ports, of which four are dedicated for LAN traffic. In addition, the iDRAC7 OOB interface is connected to the LAN switches. Figure 5 shows the connectivity of Server 1 to the LAN switches.
The other PowerEdge R620 server follows the same connectivity pattern to the LAN switches with the exception that each server uses a unique set of physical ports on the switches.

6.3 PowerEdge R620 LAN Virtual Switch Configuration

For each PowerEdge R620, a single ESXi virtual switch is created to support all LAN traffic. Unique port groups are then created for management and VM traffic. In addition, VMkernel interfaces are defined for management and vMotion traffic. Each port group and VMkernel interface is configured to tag with the appropriate VLAN. The Management port group is utilized by the Dell Management Plug-in and the EqualLogic HIT/VE Plug-in for VMware vCenter.

Figure 7 is a screenshot taken in vCenter Server of the LAN virtual switch on Server 1. Note the vmnics and how they correlate to the physical adapters as shown in Figure 6. “Mgmt Network” is a Virtual Machine Port Group, which allows VMs to communicate on the management network, and “Mgmt” is a VMKernel port, which allows the ESXi kernel to communicate with the management network.
6.4 Load Balancing and Failover

Load balancing enables sharing network traffic between the physical network ports in a team, thereby generating higher throughput. The VMware virtual switch has three options to configure load balancing:

- Route based on the originating virtual switch port ID
- Route based on source MAC hash
- Route based on IP hash

The default load balancing configuration of route based on the originating virtual switch port ID is recommended. This setting enables multiple VMs to use different physical adapter ports to transmit and receive traffic without requiring additional physical switch configuration.

The Management and vMotion networks each have only one port ID or MAC address. Hence, these networks will each use only one physical adapter port for communicating unless there is a failover to another physical adapter port.

Table 5 notes any required configuration changes that should be explicitly made to the port group configuration.

<table>
<thead>
<tr>
<th>Port Group</th>
<th>VMKernel Ports</th>
<th>Configuration Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mgmt</td>
<td>vmnic0: active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vmnic2, vmnic4, vmnic6: standby</td>
<td></td>
</tr>
<tr>
<td></td>
<td>management traffic: enabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>failback: no</td>
<td></td>
</tr>
<tr>
<td>vMotion</td>
<td>vmnic4: active</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vmnic0, vmnic2, vmnic6: standby</td>
<td></td>
</tr>
<tr>
<td></td>
<td>vMotion: enabled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>failback: no</td>
<td></td>
</tr>
</tbody>
</table>
While the configurations explored in the section above along with Table 5 depict a robust and fault tolerant ESXi network design, customers can implement an additional level of resiliency by implementing VMware HA. More information on setting up VMware HA can be found in VMware High Availability (HA): Deployment Best Practices for vSphere 4.1 and vSphere High Availability Deployment Best Practices for vSphere 5.0.
7 Storage Architecture

A RAID 10 volume across 10 x 146GB 15k SAS drives on each R620 hosts the linked clone and replicas for the VDI sessions.

A Storage pool is created for PS4100x to reside in, this is used to store management VM’s, user home and profile directories, and SQL, additional arrays can be added for scalability.

RAID 50 is used for each LUN (Volume), configured with a maximum size of 500GB in line with best practice with the exception of the LUN presented for file storage (Homes and Profile directories) which were configured as 1024GB. This configuration ensures that there is at least 10% of each array available for system overhead which is required for optimal performance.

The space required for each desktop has been calculated as follows for the shared disk image machines;

- Page File (1.5x RAM to a maximum of 4GB) + Temporary Session Data + VMware Swap File (1x non-reserved RAM)
  - Basic - (1x1.5) + 1 +0.5 = 3.0GB
  - Standard - (1.5x1.5) + 1 + 0.5 = 3.75 GB
  - Premium - 4 + 1 + 1 = 6.0GB

The table below identifies the volume configuration on the Equallogic PS4100X Tier 2 storage

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Size (GB)</th>
<th>Storage Array</th>
<th>Purpose</th>
<th>File System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td>500</td>
<td>Tier 2</td>
<td>vCenter, XD broker roles, File and SQL</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>PVS</td>
<td>100</td>
<td>Tier 2</td>
<td>PVS vDisks</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>User Data</td>
<td>2048</td>
<td>Tier 2</td>
<td>File Server/ NAS</td>
<td>NTFS</td>
</tr>
<tr>
<td>User Profiles</td>
<td>20</td>
<td>Tier 2</td>
<td>User profiles</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>SQL DATA</td>
<td>100</td>
<td>Tier 2</td>
<td>SQL</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>SQL LOGS</td>
<td>100</td>
<td>Tier 2</td>
<td>SQL</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>TempDB Data</td>
<td>5</td>
<td>Tier 2</td>
<td>SQL</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>TempDB Logs</td>
<td>5</td>
<td>Tier 2</td>
<td>SQL</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>SQL Witness</td>
<td>1</td>
<td>Tier 2</td>
<td>SQL (optional)</td>
<td>VMFS 5</td>
</tr>
<tr>
<td>Templates/ ISO</td>
<td>200</td>
<td>Tier 2</td>
<td>ISO storage (optional)</td>
<td>VMFS 5</td>
</tr>
</tbody>
</table>
The diagram below shows the high level layout of Tier 1 and Tier 2 storage

With a 24 drive chassis full of 300GB SAS drives, the PS4100X array delivers 7.2 Terabyte (TB) of iSCSI-based storage built on fully-redundant, hot-swappable enterprise hardware. Scale out capacity and performance is provided by adding additional arrays. Built-in software functionality includes automated load balancing, snapshots and replication, multi-path I/O, and consistency sets. SAN HQ is also available for Multi-SAN historical performance monitoring.

Advanced data protection features such as Auto Replication and Auto-Snapshot Manager (ASM) also come standard. The ASM integrates with VMware vCenter and VMware’s native snapshot technology to provide intelligent and consistent snapshots.

EqualLogic also provides a Multipath Extension Module (MEM) for VMware vSphere to enable MPIO for the iSCSI storage. EqualLogic MEM offers:

- Ease of installation and iSCSI configuration in ESXi servers
- Increased bandwidth
- Reduced network latency
- Automatic load balancing across multiple active paths
• Automatic connection management
• Automatic failure detection and failover
• Multiple connections to a single iSCSI target

For more information on EqualLogic MEM, refer to the technical report Configuring and Installing the EqualLogic Multipathing Extension Module for VMware vSphere 4.1 and PS Series SANs and Configuring and Installing the EqualLogic Multipathing Extension Module for VMware vSphere 5 and PS Series SANs.

7.1 Storage Expansion Options

This section provides an overview for the Dell vStart 50 for VDI storage expansion options.

As previously shown in Figure 1 above, the Dell vStart 50 for VDI comes with one PS4100X array. For customers whose VM profiles and workloads require additional storage capacity or IOPS, an additional PS4100 array can be added as an upgrade for existing vStart 50’s with one array (vStart 50+). For customers who are considering purchasing a vStart 50, the option for two PS arrays is available.

Dell vStart 50 for VDI Storage Expansion Options

<table>
<thead>
<tr>
<th>vStart Model</th>
<th>vStart 50: Base vStart Storage Array Configuration</th>
<th>vStart 50+: With Storage Expansion Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>vStart 50</td>
<td>1 x PS4100X</td>
<td>2 x PS4100 Series Arrays</td>
</tr>
</tbody>
</table>

It’s important to note that adding an additional storage array will not require customers to purchase additional PowerConnect switches, management servers, or software since the vStart architecture was designed with storage and host expansion in mind.
# Management Infrastructure

There is a PowerEdge R420 server used for management infrastructure. The management server connects across the iSCSI network to the Equallogic PS4100X where a volume hosts the Management VM's for the stack. Note that the Equallogic storage is shared between management cluster and compute cluster. The Equallogic storage must be sized so that sufficient bandwidth is allocated for both the management VMs, databases and user profiles.

The R420 server runs VMware ESXi 5.0 hypervisor and is part of a unique vSphere Cluster. VMware High Availability can be enabled in that cluster to provide HA for virtual machines by adding an additional management host. The following management components are installed as virtual machines in the management infrastructure as illustrated in:

- VMware vCenter Server (Equallogic Plugin for vCenter is installed along with VMware vCenter client)
- XenDesktop 5.6 (Further detail on XD components below)

## XenDesktop 5.6

The solution is based on Citrix XenDesktop. Citrix XenDesktop provides a complete end-to-end solution that delivers Microsoft Windows 7 virtual desktops to users on a wide variety of endpoint devices. Virtual desktops are dynamically assembled on demand, providing users with pristine, yet personalised, desktops each time they log on.

Citrix XenDesktop provides a complete virtual desktop delivery system by integrating several distributed components with advanced configuration tools that simplify the creation and real-time management of the virtual desktop infrastructure.

The core components of XenDesktop are:

- XenDesktop Controller
  - Installed on servers in the data centre, the controller authenticates users, manages the assembly of users' virtual desktop environments, and brokers connections between users and their virtual desktops.

- Citrix Provisioning Server
  - The Provisioning Services infrastructure is based on software-streaming technology. This technology allows computers to be provisioned and re-provisioned in real-time from a single shared-disk image. In doing so, Enterprise 6020 administrators can completely eliminate the need to manage and patch individual systems. Instead, all image management is done on the master image. This greatly reduces the amount of storage required compared to other methods of creating virtual desktops. The Provisioning Server runs on a virtual instance of Windows Server 2008 R2 SP1 on the Management Server(s).

- XenDesktop Database
  - A Microsoft SQL database that hosts configuration and session information and as a result should be hosted on a resilient database platform.

- Virtual Desktop Agent
The Virtual Desktop Agent (VDA) is installed on every virtual desktop and enables the direct connection between the virtual desktop and users’ endpoint devices. This connection is made using the Citrix ICA (Independent Computing Architecture) protocol. Click [HERE](#) for more information on Citrix XenDesktop.

The communication flow for XenDesktop 5.6 is shown below.

### 8.1.1 Citrix Personal vDisk Technology

Citrix Personal vDisk (PVD) provides the ability to allow users to store persistent data in a per user container within a XenDesktop environment. PVD works with Provisioning server or Machine Creation Services and appears as an option when setting up a new catalog in Desktop Studio. The size of the personal vdisk is specified when configuring the desktop catalog and should be set at 10GB minimum on Tier 2 storage. This reserve may need to be higher for more intensive workloads that store more data. Consideration should be paid not only to the Tier 2 capacity impacts of PVD, but also the IOPS and virtualization host CPU increase. ~25% additional CPU and +2 IOPS is required per user with PVD. To calculate density impact, the user type density per host should be divided by 1.25 (example: 120 / 1.25
for basic users with PVD and 10 IOPS vs 8 with no PVD). See section 7.3.4 for more information on sizing and scaling with Citrix PVD.

By design, PVD creates a User Workspace consisting of a personal vdisk that is split between user personalization and application data, with the default split being 50/50. If a user manages to fill their entire personal vdisk, it is possible to increase the size of a personal vdisk after the virtual desktop has been assigned by utilizing the XenDesktop Desktop Director.

This technology uses set of Kernel mode drivers that load during the Windows boot process. These drivers allow most applications to work in a seamless manner with the personal vdisk attached. Exceptions to this are applications that operate or install components prior to the loading of the Citrix PVD drivers. Specifically, certain device driver installers or Anti-virus software may not work properly if installed within the personal vdisk. Based on the core Windows level operation of the filter driver, an overhead is added as part of the calculation used to determine write processes should be routed to the base desktop or the personal vdisk. This has been validated as part of the testing conducted in this document.

It has not been observed but is expected that a substantial growth in the amount of user personalization and application data, will have an effect on server scalability and performance. Additionally, applications that are registry intensive can also be expected to have a degrading effect on scalability and performance.

8.1.2 Citrix Profile Manager

Citrix Profile Management is a component of the XenDesktop suite which is used to manage user profiles and minimise many of the issues associated with traditional Windows Roaming profiles in an environment where users may have their profile open on multiple devices at the same time. The profile management toolset has two components, the profile management agent which is installed on any device where the user profiles will be managed by the toolset, which will be the virtual desktops. The second component is a Group Policy Administrative Template, which is imported to a group policy which is assigned to an organisational unit within active directory which contains the devices upon which the user profiles will be managed.

In order to further optimise the profile management folders within the user profile that can be used to store data will be redirected the users’ home drive. The folder redirection will be managed via group policy objects within Active Directory. The following folders will be redirected;

- Contacts
- Downloads
- Favorites
- Links
8.1.3 Provisioning Services 6.1

Citrix Provisioning Services is the infrastructure component that provides operating system streaming technology. It allows administrators to create virtual disks that represent a computer hard drive, and then relocate that vdisk onto the Provisioning Server, or on a storage device that is accessible to the Provisioning Server.

Once the vdisk is available, the target device no longer needs its local hard drive to operate; it boots directly across the network. The Provisioning Server streams the contents of the vdisk to the target device on demand, in real time, and the target device behaves as if it is running from its local drive.

8.1.4 Provisioning Services Networking Dependencies

Network services include a DHCP service, BOOTP service, Pre-boot Execution Environment (PXE) service, and a TFTP service. These services can be used during the boot process to retrieve IP addresses, and locate and download the boot program from the Provisioning Server to the target device.

8.1.5 SQL Server 2008 R2 SP1

The Citrix and VMware databases will be hosted by a single dedicated SQL 2008 R2 SP1 Server VM in the management tier. Care should be taken during database setup to ensure that SQL data, logs, and TempDB are properly separated onto their respective volumes. Create all Databases that will be required for:

- Citrix XenDesktop
- Provisioning Server
- VMware vCenter
- VMware vCenter Update Manager (optional)

Initial placement of all databases into a single SQL instance is fine unless performance becomes an issue, in which case database should be separated into separate named instances. Enable auto-growth for each DB. See evolutionary section below for more information. Best practices defined by Citrix and VMware should be adhered to, to ensure optimal database performance. The EqualLogic PS series arrays utilize a default RAID stripe size of 64K. To provide optimal performance, disk partitions should be configured to begin from a sector boundary divisible by 64K. Disks to be used by SQL Server should be aligned with a 1024K offset and then formatted with a 64K file allocation unit size (data, logs, and tempdb).

All clustered services are summarized in below:

<table>
<thead>
<tr>
<th>Role</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>FileShare “Homes”</td>
<td>Homes Share for end users i.e. their data location</td>
</tr>
<tr>
<td>FileShare “Profiles”</td>
<td>User Profiles Share</td>
</tr>
</tbody>
</table>
### 8.1.6 VMware vCenter and SQL

The vCenter 4.1 VM used in the stack will start as a single Windows 2008 R2 VM, residing on the Management Virtual Infrastructure ESXi Server. This VM will have a hardware configuration as outlined in section 4.1.1 and it will connect to SQL Server to provide its database.

This database for vCenter will reside on the virtual SQL server running SQL 2008 R2.

Also, VMware Converter will be installed on the VCenter server to facilitate importing OVF or Virtual Machines from other Virtual Environments for management purposes. All licensing for the VMware products will also be installed on this vCenter Server, the following is the license requirement.

- 4 CPU x VSphere 4 Standard
- 1 x vCenter Server 4 Standard

‘Gold Image’ VM’s will be generated for each base Operating System required within the bundle. Also, Customization Scripts will be added to vCenter to ensure all cloning activity from these VM’s produce VM’s with new SID and also licensing, naming convention and some default network settings etc.

Lastly, vCenter will have to obtain its own SSL certificate, either from a root certificate authority or via an OpenSSL tool. This is required for the XenDesktop Desktop Delivery Controller to connect via the web to vCenter.

### 8.1.7 Citrix License Server

The Citrix License Server is an essential component at any Citrix-based solution. Every Citrix product environment must have at least one shared or dedicated license server. License servers are computers that are either partly or completely dedicated to storing and managing licenses. Citrix products request licenses from a license server when users attempt to connect.

The Citrix License server component requires minimal system resources; the resource requirements are so minimal that there is no hardware requirements above those required by the operating system used to host the service. The License Server must be version 11.9 or newer and will be based on Windows Server 2008 R2 SP1 running as a virtual machine on the first management server.

### 8.1.8 Citrix Web Interface Server

The Web Interface provides users with simple and controlled access to XenDesktop virtual desktops. Users access their resources through a standard Web browser or through the Citrix online plug-in. The Web Interface employs Java and .NET technology executed on a Web server to dynamically create an HTML depiction of server farms for XenApp Web sites. Users are presented with all the resources (applications, content, and desktops) published in the server farm(s) made available. Stand-alone Web Interface sites can be utilized or they can be integrated into a corporate portal.
8.1.9 Windows File Services

Windows File Services are used to store user profile and home drive data. Unless an advanced user profile abstraction tool is used, profiles and user data should be controlled using the folder redirection and profile management tools native to Windows and administered via Windows Group Policy and Citrix User Profile Manager. If an optional FS7500 NAS head is used, the File Services role will be migrated to the NAS and the virtual file server instance(s) removed. See section 11 for more details on the FS7500.

8.1.10 Citrix Desktop Receiver

The Citrix Desktop Receiver is a client-based plug-in that is installed on the user’s endpoint device. This is to be used in-conjunction with Citrix XenDesktop when the user requires the ability to interact with their local desktop as well as the XenDesktop. This package provides the toolbar functionality, allowing the user to pan and scale their XenDesktop inside their local desktop. When a user logs into a Web Interface site to access XenDesktop, the Web Interface site can detect that the Citrix Desktop Receiver is absent from endpoint devices, and automatically prompt users to download and install it from the site.

8.1.11 Citrix Netscaler VPX

The Netscaler platform should be leveraged >1000 users to provide load balancing capabilities for the Citrix Web Interface and XML services. Since these appliances have the ability to provide secure remote access to the Citrix XenDesktop environment their inclusion in the solution provides the ability for the solution to be upgraded in the future if this functionality is required.

The Netscaler virtual appliance can be optionally configured in a High availability pair, as an active/passive cluster. The appliances will provide load balancing services for the following XenDesktop components:

- Citrix Web Interface
- XenDesktop XML service
- Provisioning Services TFTP service

Since the appliances will be deployed on the same VLAN as the services they will provide load balancing services to each appliance will be configured with a dedicated Netscaler IP address (NSIP) and Subnet IP address (SNIP). The Virtual Server IP addresses (VIP) that are used for load balancing will be initially configured on the primary appliance in the cluster however, these addresses and all related configuration will be automatically copied to the secondary appliance once the High availability feature is enabled. In the event that the primary appliance is unavailable the secondary appliance will detect that its partner is offline and will automatically promote itself to primary status and deliver the Virtual servers.

All services should be configured using the standard setup wizard once the Netscaler VPX 200 license is installed, this will allow the administrator to configure the System Time, NSIP and SNIP address, in addition the wizard will allow the administrator to specify that the appliances are load balancing XenDesktop at which point the IP addresses of the two web interface servers and the XML Brokers (XenDesktop Controllers) will be required. It should be noted that the Web interface servers should be installed prior to any port changes for the XML service however the XML port changes should be completed on both the Web Interface configuration and the XenDesktop Controller prior to configuring the Netscaler appliance. Once the XML load balancing is configured the administrator will be required to change the XenDesktop farm configuration parameters on the Web Interface servers to ensure that the load balanced XML service is at the top of the server list, with the “real” servers configured as lower priority servers and that the server list is not be used for load balancing.

8.1.12 Windows Active Directory Integration

Windows Active Directory integration for XenDesktop 5.0 is required for authentication services only, unlike previous versions where the controllers were discovered using Service Principle names which were maintained as object in the Active Directory structure.
9  Enterprise Zero Client and Thin Client Recommendations

Wyse Thin and Zero Client devices and software provide superior security, reliability and energy efficiency when compared to a traditional PC. Wyse desktop devices and software help streamline the delivery of Citrix infrastructure to millions of users around the world. Thin Clients create a more secure environment that minimizes or eliminates exposure to data loss, viruses and malware. By utilizing thin clients as the access device for end user, deployments can benefit from centralized management and complete control of all endpoints. Since thin clients eliminate components with high failure rates, deployments can expect reduced costs and improved reliability over the life of a desktop virtualization deployment.

9.1 Wyse Xenith Pro

Wyse Xenith Pro is the next-generation zero client for Citrix HDX and Citrix XenDesktop, delivering ultimate performance, security and simplicity. The Wyse Xenith Pro features a true Zero Engine architecture which offers industry leading security and performance. With a powerful AMD G-series processor, Xenith Pro is up to three times faster than competing devices. This additional computing horsepower allows dazzling HD multimedia delivery without overtaxing your server or network. The Wyse Xenith Pro requires zero configuration and management—your Citrix XenDesktop server configures it out-of-the-box to your preferences for plug-and-play speed and ease of use. Completely virus and malware immune, the Xenith Pro draws under 14 watts of power in full operation, far lower than traditional PC’s.

Click HERE for more information on the Wyse Xenith Pro.

Display recommendations for the Xenith Pro are listed below

The U3011 shown above supports 2560x1600, VGA, DVI, DP and USB. Other options include the P2212H with 1920x1080, VGA, DVI and USB, and the E2213 with 1680x1050, VGA and DVI.
9.2 Wyse T10

The Wyse T10 sets the new standard for affordable thin clients. Providing an exceptional user experience, the T10 features the incredibly fast Wyse ThinOS, for environments in which security is critical. Boot up in just seconds and log in securely to the network. The T10 delivers a superior Citrix and Microsoft user experience, along with the usability and management features traditionally found in premium thin clients. The T10 delivers outstanding performance based on its system-on-a-chip (SoC) design, and a built-in media processor delivers smooth multimedia, bi-directional audio and Flash playback. Flexible mounting options let you position the T10 vertically or horizontally on your desk, on the wall or behind your display. Using about 7 watts of power in full operation, the T10 creates very little heat for a greener, more comfortable working environment.

Click [HERE](#) for more information on the Wyse T10.

Display recommendations for the T10 are listed below

The P2412H shown above supports 1920x1080, VGA, DVI and USB. Other options include the E2213 with 1680x1050, VGA and DVI, and the E1913 with 1440x900, VGA and DVI.
10 Scalability

As customer VDI needs grow, so does the depth and breadth of the DVS vStart solution. The various management components of the stack exist as virtual server instances running on physical servers. This provides tremendous flexibility when adding resources to the solution while keeping the existing components intact and untouched. This also adds a level of resiliency in being able to backup copies of the server virtual images. The following tables gives an overview of Dell’s recommended scaling of management components.

Based on the best practices from Citrix and DVS Engineering validation work the following scaling guidelines have been established for the virtual management infrastructure and the hosts.

<table>
<thead>
<tr>
<th>User Type</th>
<th>XD 5.6 (2.7GHz) User Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>145</td>
</tr>
<tr>
<td>Standard</td>
<td>116</td>
</tr>
<tr>
<td>Premium</td>
<td>95</td>
</tr>
</tbody>
</table>

Based on the DVS Engineering validation work, the per host density numbers below provide an idea of the number of users each host can accommodate. The Basic, Standard and Premium user workloads are generated by LoginVSI (from Login Consultants), the intensity of activity and applications increases as you go up through the workloads, giving real world relevance to the validation. There is of course always a ratio of basic, standard or premium users so actual densities will vary in production.
11 Delivery Model

The solution will be racked, cabled, and delivered to the customer site, ready for deployment. Dell Services will deploy and configure the solution based upon the architecture developed and validated by Dell Engineering, while meeting the customer’s business and technical needs. The final turn-key virtualization infrastructure solution will be available for customer’s use. For more details or questions about the delivery model, consult with your Dell Sales representative. Figure 2 shows the configuration in a Dell 24U rack (front side only) with all of the components.

Figure 1. Dell vStart 50 for VDI Racked Configuration

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1 In certain unique and limited circumstances Dell may not be able to deliver a pre-built vStart, and will have to assemble the vStart at the customer’s site. Please consult with your Dell Sales and Services team for more information.