

Pano System Deployment Scenarios

Solution Brief

To help with planning and budgeting your Pano System deployments this solution brief models eight deployment scenarios for 100 Zero Client seats and Desktop Virtual Machines (DVMs), each with different virtualization platform components. An Excel model for these scenarios can be downloaded at www.panologic.com/brief/deploymentscenarios/model.

Scenario #1: Pano System on vSphere 4 Essentials

Characteristics

Endpoint Devices	Pano Zero Clients
Connection Broker	Pano Controller (VDB or Full Roles)
DVM Provisioning	Pano Controller assisted by vCenter Server from vSphere 4 Essentials.
Hypervisor	VMware ESX or ESXi from vSphere 4 Essentials.
Storage Optimization	No storage deduplication – only full cloning of DVM images. Works best with mostly assigned rather than pooled desktop populations.

Strengths

Cost per User	Lowest cost at \$608 / user.
Ease of Deployment	Least complex to buy and deploy, provides all needed functionality but limited to only 3 servers (2 CPUs each) or roughly 240 users or DVMs. Includes 1 year of subscription updates for software.
VMware Licenses	Cannot be mixed with VMware View or server-based licenses.

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
vSphere 4 Essentials bundle (up to 3 ESX/vSphere servers)	1	\$ 495	\$ 495
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 60,795
Deployment Cost per User			\$ 608

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #2: Pano System on vSphere/vCenter Server

Characteristics

Endpoint Devices	Pano Zero Clients
Connection Broker	Pano Controller (VDB or Full Roles)
DVM Provisioning	Pano Controller assisted by vCenter Server.
Hypervisor	VMware ESX or ESXi from vSphere 4 Standard Edition.
Storage Optimization	No storage deduplication – only full cloning of DVM images. Works best with mostly assigned rather than pooled desktop populations.

Strengths

Cost per User	Third lowest cost at \$650 / user.
Ease of Deployment	Straight-forward to buy and deploy, provides all needed functionality while not limiting the size or scope of deployment growth.
VMware Licenses	Allows reuse of existing server-based licenses for vSphere/VI3 and vCenter Server from server virtualization projects. New licenses can be used for either VDI or server virtualization. Cannot be mixed with VMware View licenses.

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
vSphere 4 Standard Edition (licensed per server CPU)	4	\$ 795	\$ 3,180
vCenter 4 Foundation Edition (up to 3 ESX/vSphere servers)	1	\$ 1,495	\$ 1,495
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 64,975
Deployment Cost per User			\$ 650

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #3: Pano System on View Enterprise Edition

Characteristics

Endpoint Devices	Supports both Pano Zero Clients and optionally hybrid endpoint populations that also include thin clients and PCs running View Client.
Connection Broker	Pano Controller (VDB or Full Roles) or Pano Controller (ZCC Role) plus View Connection Server for large deployments (>1,000) or if using hybrid endpoints (Panos mixed with PCs and Thin Clients).
DVM Provisioning	View Administrator assisted by vCenter for Desktops.
Hypervisor	VMware ESX or ESXi from VMware View Enterprise Edition.
Storage Optimization	No linked clones for storage deduplication – only full cloning of DVM images (use View Premier if storage optimization required).

Strengths

Cost per User	Sixth lowest cost at \$753 / user.
Ease of Deployment	View bundles all components needed for Pano System in one license. Added flexibility if optionally using View Connection Server as connection broker as it supports hybrid endpoint populations (with PCs or thin clients) or for deployments of over 1,000 users or endpoints.
VMware Licenses	Allows reuse of existing VMware View licenses but not of existing server-based licenses for vSphere/VI3 and vCenter Server (cannot combine the two license models). Cost-effective for large deployments which have a low duty cycle (e.g. 50% or less of DVMs or endpoints active at any time) as fewer View concurrent DVM licenses will be required.
Other Factors	Enterprise edition of View provides everything needed for Pano System.

Components and Costs *(modeled for 100 user deployment)*

Component	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
View 4 Enterprise Edition – includes vSphere for Desktops, vCenter for Desktops and View Connection Server (licensed per concurrent DVM, minimum of 100)	100	\$ 150	\$ 15,000
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 75,300
Deployment Cost per User			\$ 753

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #4: Pano System on View Premier Edition

Characteristics

Endpoint Devices	Supports both Pano Zero Clients and optionally hybrid endpoint populations that also include thin clients and PCs running View Client.
Connection Broker	Pano Controller (VDB or Full Roles) or Pano Controller (ZCC Role) plus View Connection Server for large deployments (>1,000) or if using hybrid endpoints (Panos mixed with PCs and Thin Clients).
DVM Provisioning	View Administrator assisted by vCenter for Desktops.
Hypervisor	VMware ESX or ESXi from VMware View Premier Edition.
Storage Optimization	Linked clones via View Composer, optimal with pooled desktop populations that can benefit from deduplication via a master image.

Strengths

Cost per User	Highest cost at \$853 / user.
Ease of Deployment	View bundles all components needed for Pano System in one license. Added flexibility if optionally using View Connection Server as connection broker as it supports hybrid endpoint populations (with PCs or thin clients) or for deployments of over 1,000 users or endpoints.
VMware Licenses	Allows reuse of existing VMware View licenses but not of existing server-based licenses for vSphere/VI3 and vCenter Server (cannot combine the two license models). Cost-effective for large deployments which have a low duty cycle (e.g. 50% or less of DVMs or endpoints active at any time) as fewer View concurrent DVM licenses will be required.
Other Factors	Only option that allows storage to be optimized by optionally using View Composer for deduplication of master images via linked clones.

Components and Costs *(modeled for 100 user deployment)*

Component	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
View 4 Premier Edition – includes vSphere for Desktops, vCenter for Desktops, View Connection Server and View Composer (licensed per concurrent DVM, minimum of 100)	100	\$ 250	\$ 25,000
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 85,300
Deployment Cost per User			\$ 853

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #5: Pano System on Hyper-V Server/SCVMM

Characteristics

Deployment Size	Recommended for up to 400 users provided a Pano Controller Scalability Group is configured or 200 users with single Pano Controller instance.
Endpoint Devices	Pano Zero Clients.
Connection Broker	Pano Controller (VDB or Full Roles).
Hypervisor	Hyper-V Server 2008 R2 (free download from Microsoft) – requires remote management using SCVMM.
DVM Provisioning	Pano Controller assisted by Microsoft System Center Virtual Machine Manager (SCVMM) via Pano SCVMM Connector.
Storage Optimization	No storage deduplication – only full cloning of DVM images – works best with mostly assigned rather than pooled desktop populations.

Strengths

Cost per User	Second lowest cost at \$622 / user.
Ease of Deployment	Additional Hyper-V servers can be added as deployment grows without any license costs. Windows Server used for SCVMM can also provide file sharing, Active Directory, and other infrastructure needs.
Microsoft Licenses	Allows easy and low-cost expansion of deployment size as additional hypervisor servers only incur the server hardware costs. Also allows leveraging existing Windows Server license (for SCVMM platform), Software License Assurance and other Microsoft support investments.
Other Factors	Support for Hyper-V platform added in 3.5 release of Pano System. Pano System requires SCVMM so deployment solely on free hypervisor platform not possible. However free Hyper-V Server is fully functional supporting up to 1 TB RAM and 64 processors per server.

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
Hyper-V Server 2008 R2 (free download from Microsoft)	2	\$ 0	\$ 0
Microsoft System Center Virtual Machine Manager	1	\$ 869	\$ 869
Windows Server 2008 R2 Standard version (required to serve as a platform for SCVMM)	1	\$ 1,029	\$ 1,029
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 62,198
Deployment Cost per User			\$ 622

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #6: Pano System on Microsoft Hyper-V/SCVMM

Characteristics

Deployment Size	Recommended for up to 400 users provided a Pano Controller Scalability Group is configured or 200 users with single Pano Controller instance.
Endpoint Devices	Pano Zero Clients.
Connection Broker	Pano Controller (VDB or Full Roles).
Hypervisor	Hyper-V from Windows Server 2008 R2 Enterprise version.
DVM Provisioning	Pano Controller assisted by Microsoft System Center Virtual Machine Manager (SCVMM) via Pano SCVMM Connector
Storage Optimization	No storage deduplication – only full cloning of DVM images – works best with mostly assigned rather than pooled desktop populations

Strengths

Cost per User	Fourth lowest cost at \$692 / user.
Ease of Deployment	Windows Server provides complete server infrastructure including storage, authentication, and hypervisor – allowing virtual desktops to be managed within a common back-end IT infrastructure.
Microsoft Licenses	Allows reuse of Windows Server licenses and leveraging Software License Assurance and other Microsoft licensing and support investments.
Other Factors	Support for Hyper-V platform added in 3.5 release of Pano System. Other versions of Windows Server could be used in place of the Enterprise version including Standard (\$1,029/server but limited to 32 GB RAM) and Data Center (\$2,999 per server CPU).

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
Windows Server 2008 R2 Enterprise – provides Hyper-V	2	\$ 3,999	\$ 7,998
Microsoft System Center Virtual Machine Manager	1	\$ 869	\$ 869
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 69,167
Deployment Cost per User			\$ 692

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #7: Pano System on Citrix XenDesktop 4/5

Characteristics

Endpoint Devices	Pano Zero Clients.
Connection Broker	Pano Controller (ZCC Role) along with XenDesktop Desktop Delivery Controller.
Hypervisor	XenServer included in XenDesktop 4/5
DVM Provisioning	XenDesktop with optional Citrix Provisioning Services.
Storage Optimization	No storage deduplication – only full cloning of DVM images – works best with mostly assigned rather than pooled desktop populations

Strengths

Cost per User	Fifth lowest cost at \$698 / user.
Ease of Deployment	Simplest Citrix-based deployment model. XenDesktop 4/5 available in both the low cost VDI Edition and in higher cost and more comprehensive Enterprise and Platinum Editions that provide added infrastructure components.
Citrix Licenses	Allows reuse of Citrix XenDesktop licenses that might have been purchased for application virtualization or other VDI projects.
Other Factors	Limited to a single Citrix Desktop Delivery Controller via a single Pano Controller instances. For added availability or scalability, can add a load balancer like NetScaler to support multiple instances (see scenario in next page).

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
XenDesktop 4/5 VDI Edition including XenServer	100	\$ 95	\$ 9,500
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 69,800
Deployment Cost per User			\$ 698

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Scenario #8: Pano System on XenDesktop 4/5 with NetScaler

Characteristics

Endpoint Devices	Pano Zero Clients.
Connection Broker	Pano Controller (ZCC Role) along with XenDesktop Desktop Delivery Controller, higher availability and scalability via multiple instances load balanced by NetScaler.
Hypervisor	XenServer included in XenDesktop 4/5.
DVM Provisioning	XenDesktop with optional Citrix Provisioning Services.
Storage Optimization	No storage deduplication – only full cloning of DVM images – works best with mostly assigned rather than pooled desktop populations

Strengths

Cost per User	Seventh highest cost at \$848 / user.
Ease of Deployment	XenDesktop 4/5 available in both the low cost VDI Edition and in higher cost and more comprehensive Enterprise and Platinum Editions that provide added infrastructure components.
Citrix Licenses	Allows reuse of Citrix XenDesktop or NetScaler licenses or appliances that might have been purchased for application virtualization or web load balancing.
Other Factors	NetScaler can be used for other load balancing for more costly editions or higher bandwidth tiers may be required.

Components and Costs *(modeled for 100 user deployment)*

Components	# Required	Price Each	Total Cost
Pano System with Pano Zero Client and Pano Controller	100	\$ 389	\$ 38,900
XenDesktop 4/5 VDI Edition including XenServer	100	\$ 225	\$ 22,500
Citrix NetScaler VPX 9.2 Standard, 10 Mbps bandwidth tier	1	\$ 2,000	\$ 2,000
Windows Virtual Desktop Access license (annual)	100	\$ 100	\$ 10,000
Server Hardware (eight cores, 48 GB RAM each)	2	\$ 5,700	\$ 11,400
Total Deployment Costs for 100 Users			\$ 84,800
Deployment Cost per User			\$ 848

(Note: prices shown are list prices without any discounts applied; maintenance & support fees are excluded)

Factors for All Scenarios

Factors used to model components and costs across all scenarios:	
Deployment Size Modeled	100 users or seats.
User Workloads	Knowledge or task workers, light workload, max 80% Duty Cycle (only 80% or DVMs are powered-on simultaneously).
Server Hardware Configuration	Standard 1U or 2U servers with dual quad-core CPUs, 48 GB RAM, and local direct attached storage using seven 146 GB 10K SAS drives per server, for an estimated cost of \$ 5,700 per server.

Platform Licenses and Prices

License Requirements/List Prices for Platform Software Components	
VMware vSphere 4 (server CPU license)	\$795 per server CPU for Standard Edition of vSphere which includes ESX and ESXi. Each license supports 1 CPU with up to 6 cores and 256 GB RAM. Can be used for either server or desktop OS virtualization but server CPU-based licenses cannot be co-mingled on the same servers with VMware View.
VMware vCenter Server Standard (server license)	\$1,495 for Foundation Edition of vCenter Server limited to 3 hosts or servers with up to two CPUs each. Also available in Foundation Edition for \$4,995 for unlimited hosts. Cannot be co-mingled with vCenter licenses from View.
VMware View 4.x Enterprise and Premier (per concurrent DVM)	\$150 (Enterprise) or \$250 (Premier) per concurrent DVM (for VDI use only). Includes vSphere 4 for Desktops and vCenter for Desktops. View licenses cannot be co-mingled with server-based vSphere or vCenter Server licenses.
Microsoft Windows Server 2008 R2 Enterprise (server license)	\$ 3,999 per server for Enterprise version with Hyper-V role as a standard feature. Can have use to 2TB of RAM and up to eight multi-core CPUs. Also available in Standard (\$1,029/server, limited to 32 GB RAM) and Data Center (\$2,999/server CPU) versions.
Microsoft Hyper-V Server 2008 R2 (server license)	Free download from Microsoft , no CALs or product key required. Supports up to 1 TB RAM and 64 logical processors per server. Must be managed via local command-line interface or remotely using SCVMM.
Microsoft System Center Virtual Machine Manager (SCVMM)	\$869 per installation – can manage multiple Hyper-V servers. Required for Pano System deployments and requires a Windows Server operating system as a supporting platform.
Citrix XenDesktop 4 or 5 (named or concurrent users)	Available in 3 editions: VDI at \$95 (or \$195 per concurrent user), Enterprise at \$225, and Platinum at \$350 per named user. Includes XenServer hypervisor, XenDesktop Controller a, Machine Creation Services (XD5 only), and Citrix Provisioning Services.
Citrix NetScaler VPX 9.2 (server license by bandwidth tier)	Available in different hardware and virtual appliance configurations and bandwidth tiers from 10 Mbps to 1 Gbps, and in Standard, Enterprise and Platinum Editions ranging from \$2,000 to \$30,000 per server.
Microsoft VDA (per endpoint device per year)	\$100 annually per device subscription license. Pano endpoints, along with virtually all thin clients, require a VDA license as they are not eligible for Microsoft Software Assurance (SA). More information available on the Microsoft virtualization web page .

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For more information visit www.panologic.com or call 650-454-8940 | 877-677-PANO
Pano Logic, Inc. 2000 Seaport Blvd, Suite 200, Redwood City CA 94063