

VDI – New Desktop Strategy



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VDI: A New Desktop Strategy - Outline

- Development of Different Computing Models
- Management Strategies Respond to Limits of Each Model
- Features and Challenges of each Computing Model
- Analysis of Cost Elements within Computing Models
- VDI: Combining the Best of Previous Computing Models
- Business Drivers for Adoption of VDI
- VDI Architecture Components
- VDI Design Examples Meeting Different Needs
- Summary of VDI Roadmap
- Questions

History of Computing Models

- Execution Models
 - Centralized
 - Mainframe Computing
 - Server Based Computing
 - Distributed
 - The much loved PC
 - Clustered
 - High Performance Clustering
 - Grid Computing: Programs must be specially written
 - Single System Image Clustering: Applications migrate between nodes without special coding
- Decision Criteria for Model Selection
 - Cost Optimization : The Obvious costs
 - Functionality and Performance Optimization
 - Ease of Management

Centralized Computing

- Initially Expensive
 - Mainframes / Minis out of reach from all but larger companies and government.
- Limited Access to Computing for Consumers / Small Business
 - Dedicated Highly Skilled Programmers in limited supply
 - Required a High Level of Management for Operational Readiness
- Constrained Software Diversity and Scope
 - Limited Commercial Software
 - Most Software Customer Crafted to Needs of Owners
- Supplanted in Popularity by Economics of Distributed Computing and Growth of x86 Popularity

Growth of Distributed Computing

- Contributing Factors
 - Advances in Microprocessor Design
 - Consumer and Business Demand
 - Affordable Solution for Individuals with Stand Alone Operation
 - Adoption of User Friendly Operating Systems and Improved Software Development Tools
- Impact on Software Development Assumptions
 - Assumed Exclusive Use
 - Programs Assume One User per PC
 - Use of Registry, File System, Assume Single User
 - Inefficient use of CPU / Memory doesn't affect others users
 - Leads to Lazy Programming and Designs that don't Scale

Distributed Computing: Management Challenges

- Massive Adoption of PC Leads to Challenges
 - IT Support Staff must touch the PC for upgrades and fixes too often.
 - Difficult to Create a Uniform Environment
 - Difficult to track the software and hardware inventory, esp. in global Companies.
 - Constant upgrades lead to diverse set of hardware requiring support.
- Responses to Management Challenges
 - Node Management Tools
 - Growth of networking allows centralized management of geographically disparate PCs
 - Server Based Computing
 - Return Program Execution to the Datacenter
 - Minimize Need to Modify User Access Devices

Development of x86 Server Based Computing

- Citrix Introduces Winframe Product Line in the Mid Nineties.
 - Users can maintain use of Windows software while sharing resources.
 - Administration can be performed in one location.
 - User access devices need not be powered on during upgrades.
 - User workspace can remain available despite hardware failures with use of Server Farm.
 - Microsoft Recognizes Growth Market, incorporating Citrix technology in and multi-user capabilities into Server Platforms.
 - Extended Management Tools from 3rd parties still necessary for Large Deployments of server based computing.

Problems with Terminal Server based Computing

■ Software Compatibility

- The majority of software assumes single-user environment.
- Multi-User means many more combinations of running applications.
 - IT cannot regression test all combinations.
 - Probability is higher that applications won't play nice.
 - Windows Kernel is placed under much more demanding workloads since vertical consolidation drives utilization higher inside the OS.

■ Performance Issues

- Better ROI on Terminal Server investments require high average utilization levels.
- High average utilization levels leave little CPU headroom for peak usage variance.
- Result: A few users generating larger than normal CPU load can significantly degrade host performance.
- Demanding Enterprise Applications often have volatile CPU loads creating problems for busy Terminal Server hosts

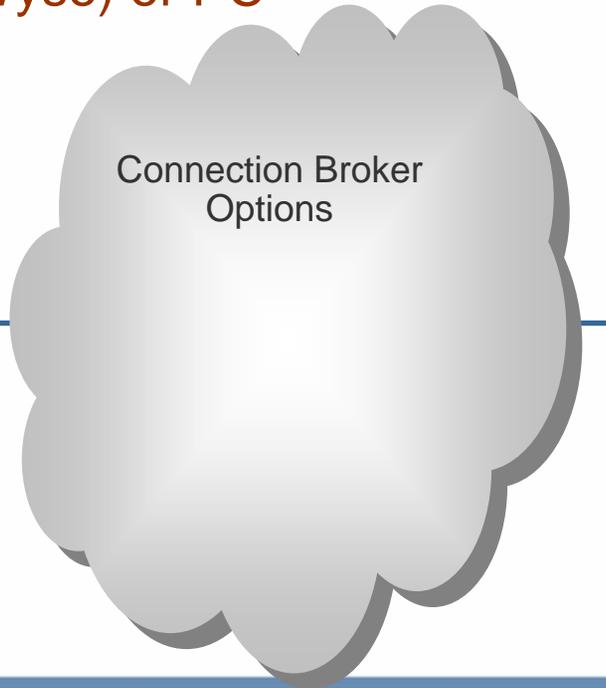
What is VDI?

VDI is a SOLUTION using current VMware products and complimentary 3rd party products to improve management of enterprise desktops.

Client Device
Thin Client (Wyse) or PC



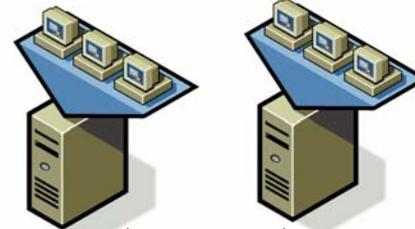
Connection Broker
Options



Virtual
Infrastructure



VirtualCenter
Server



ESX
Server
with
XP
Desktops



VDI: What Does it Offer?

- VDI Gives Each User their own Operating System
 - Firewalls the user from contention generated by the activity of other applications.
 - Removes the need to trust the stability of user sessions to a highly stressed operating system running untested combinations of software.
 - Achieves ROI without stacking CPU load inside the Operating System. VDI scales load horizontally across multiple CPUs and Hosts.
- Virtualized Citrix or Terminal Servers are NOT VDI.
 - VDI retains a one OS per user model in common with distributed computing
 - Being philosophical, a virtual terminal server with one active user session is temporarily a VDI desktop, until the second user logs in.
 - The escalating opportunity for application compatibility and performance conflicts found in Multi-User Operating Systems is addressed by VDI through user isolation.

VDI: Understanding the Math Behind VDI

- Desktop PC typically runs 5 to 10 applications together
- Terminal Server supporting 25 users runs roughly 125 applications together creating much more strain on the operating system.
 - User loads exert pressure on shared operating system resources such as queues, buffers, and device drivers.
 - Problems in drivers and even bugs in the operating system are more likely to manifest as components are pushed harder.
 - Often application software supporting several groups or a whole company are installed and run together.
 - Combination of more strain on the OS plus greater variety of application software creates opportunities for instability.
- Summary: VDI helps manage the mathematical pressure of various application combinations and mitigates risk by containing fatal conflicts to one user. The result is a user environment that is much more stable.

VDI: Delivering the Best of Centralized Computing

- Data Security: Keeping data in the datacenter assists compliance efforts and reduces risk of data theft.
- Reduced Hardware Expenditures:
 - Reduce client-side upgrade cycles
 - Flexible resource allocation of common resources across server and desktop sectors.
- Easier Management:
 - No need to touch each PC, load the network or perform complex scripting to keep the environment uniform.
 - Performance driven upgrades can be done centrally.
- Mobility: Today's workforce demands flexible working arrangements.
- High Performance: The datacenter provides the highest speeds in networking, storage, CPU and memory designs.

VDI: Delivering the Best of Distributed Computing

- End-User Isolation:
 - PC users are accustomed to their computers occasionally having problems but frequent instability is unacceptable.
 - PC users really dislike the actions of other users reducing their performance or productivity. VI3 balances performance expertly.
 - VDI delivers a “PC like” experience while using shared resources.
- Software Compatibility: The need to regression test applications is reduced to a mathematically manageable problem. Companies with thousands of applications needn't worry about testing all combinations that might run on the same Terminal Server Farm.
- Performance Volatility
 - VI3 scales in a nearly linear way on large servers.
 - VI3 ensures a consistent user experience by finding resources anywhere in a multi-machine cluster. Busy applications or users will no longer create frustration for other users.
- Addresses the Main Problems with Terminal Server Designs.

Innovations Introduced by VDI

- New Performance and Stability Benefits
 - Within the Windows kernel, program threads can sometimes consume excessive CPU by executing in kernel space long enough to unfairly impact other programs. Users in Multi-User operating systems may experience poor performance as their applications wait for CPU time.
 - The ESX hypervisor is able to halt virtual machines in a deterministic way every 10-12 milliseconds without regard to thread behavior inside the virtual machine. This guarantees that no user session can bypass resource sharing policies and ensures a more equitable treatment of user driven CPU loads.
 - Granular group based performance control using Resource Pools.
- No Downtime Maintenance
 - User sessions can be migrated with VMotion to other ESX hosts.
 - Upgrades no longer need to be done during off hours.

Innovations Introduced by VDI ...Continued

- Integrated Server and Desktop Processes
 - Operations within the Datacenter can take advantage of common resources to solve problems across server and desktop areas.
 - Business Continuity and Disaster Recovery can be built around a common strategy. This reduces cost and simplifies planning.
 - Reduced Headcount since fewer employees can handle a wider ranging workload and resolve problems across traditional barriers such as “Server Team / Desktop Team”
- Conservation of Licenses
 - Software licenses based on number of installs rather than concurrent usage can be effectively converted to a concurrent license model if a dynamic VDI provisioning tool is used for just in time provisioning and personalization.
- High Performance Desktop Experience
 - Deployed with complimentary 3rd party products, it is possible to create RAM based desktops with blazing performance that more than counters the latency introduced by remote access.
 - Data Caching Technology deployed with VDI opens new possibilities.
- Easy Application Management using Templates and Cloning features of VI3.

Key VDI Use Case: Developer Desktops

VDI enables organizations to provide local or offshore developers access to multiple environments.

Traditional Challenges

- Need multiple desktops
- Duplicate infrastructure

Key VDI Use Case: Developer Desktops

VDI enables organizations to provide local or offshore developers access to multiple environments.

Local
Developer



Remote
Developer

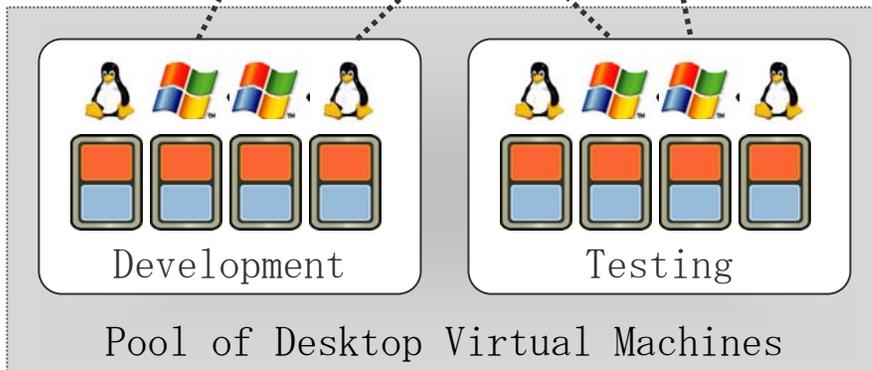


Traditional Challenges

- Need multiple desktops
- Duplicate infrastructure

Benefits of a VDI Solution

- Fewer PCs to manage
- Shared infrastructure
- Secure offshore development



Other Business Drivers and Use Cases

- **Extending PC Lifecycle:** Companies looking to avoid costly upgrades can convert PCs into VDI access points.
- **Pandemic Planning:** Companies that need a mechanism to serve complete desktops to employees in the event of city wide shutdown can leverage VDI. Traditional physical relocation strategies don't work during a pandemic since users must work remotely, away from each other.
- **Unifying IT Strategy:** Companies driving towards a simplified IT strategy that cuts across departments, and reduces the IT bloat can leverage VDI.
- **Performance Driven VDI:** Companies can leverage advanced VDI designs to solve previously unsolvable problems. VDI hosted applications can provide additional CPU power far in excess of what a single PC can deliver. Hybrid solutions can optimize the user experience by offloading applications that bog down the local PC to VDI desktops.
- **Thin-Client Deployments:** Companies wanting the savings attached to Thin-Client server based computing can leverage VDI. VDI allows centralization without the risks of Terminal Server designs.

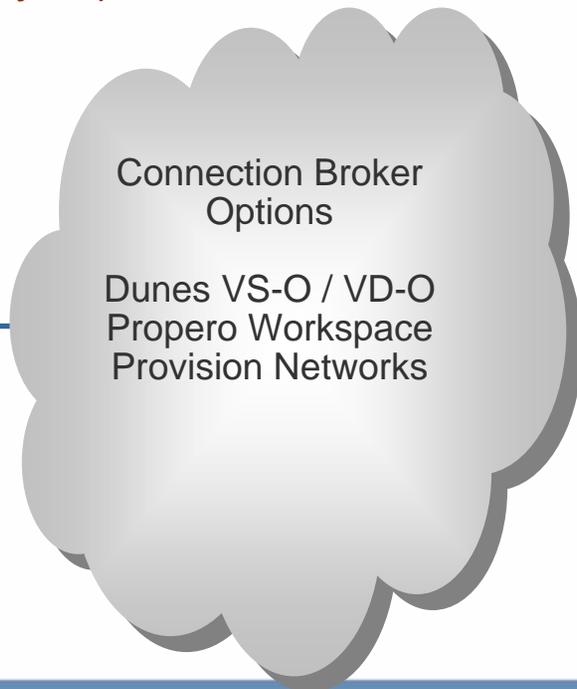
Design Components of a Complete VDI Solution

- Client Access Device: Thin-Client or PC. PCs can retain local execution of some applications and execute others using VDI or run a completely remote desktop. Thin-Client access devices such as industry leading WYSE S10 devices are a highly efficient, low cost alternate for access to VDI based solutions.
- Secure Access: Users needing access outside the corporate firewall need a VPN.
 - ▶ AEP Network's Netilla Security Platform provides a mature SSL-VPN Solution with the most extensive and advanced security features available in a hardened appliance.
 - ▶ Propero Workspace provides a server based SSL-VPN that includes many security features and connection broker functions. All components can run in virtual machines and the Propero solution can weather brief network outages without dropping connections.
 - ▶ Provision Networks provides an SSL-VPN solutions granting access to VDI resources and connection broker functions. All components can run in virtual machines.
 - ▶ 3SP SSL Explorer: A basic low cost SSL-VPN solution.
- Client Integrity Checking: A new trend in secure remote access is the ability to validate attributes of the connection device such as Virus updates, OS patches, personal firewall config.
 - ▶ AEP's NSP appliance includes advanced client integrity verification features. Embedded Sygate client allows precise control of endpoint integrity.

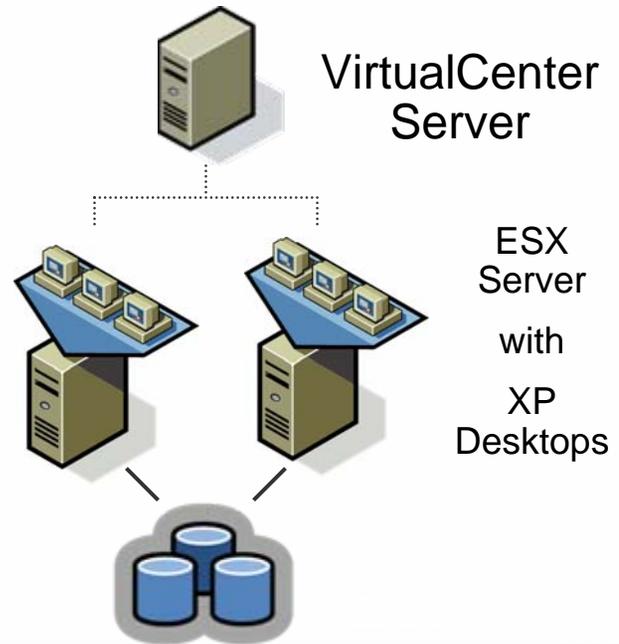
Design Components: The Connection Broker

Connection Broker: Routing User Session, Custom Workflow, and Resource Conservation.

Client Device
Thin Client (Wyse) or PC



Virtual
Infrastructure



Design Components: Broker Functions

■ Connection Brokering Functions

- Authentication: Authentication can be handled in front of the connection broker by access infrastructure and passed through or users may log into the connection broker directly.
- Entitlement: The connection broker presents approved resources based on entitlement policies. This may include one or more VDI desktops, VDI hosted applications, or even non-VDI resources that users need to use such as 3270, Web, Published Applications on Citrix.
- Smaller or limited scope deployments may not need connection brokering. If users are assigned their own Virtual Desktop on a dedicated Windows XP machine and no other resources are needed, there is less benefit from the broker component.
- Large deployments will benefit by freeing up memory and CPU cycles consumed by idling Virtual Desktops. They can be suspended or powered down and resumed when users reconnect.

Design Components: Leading Connection Brokers

- Dunes Technologies: Focus on Workflow Automation
 - Dunes VS-O provides extensive and sophisticated workflow automation for provisioning Virtual Desktops. Workflows involving multiple products, Virtual Center, and Directory Services combine to create simplified multi-stage provisioning workflows in the virtual environment.
 - Dunes VD-O provides a web portal from which users connect to Virtual Desktops and automates pooled management of Virtual desktops.
- Propero Workspace for VMware: Focus on Access Infrastructure and seamless connection of diverse back-end resources
 - Users can connect to desktops or applications which appear to be running locally on the taskbar. Flexible access to resources of all types including VDI, Citrix, Terminal Server, 3270, 5250, Web and more, in a single solution.
 - Combines Advanced Access Infrastructure (SSL-VPN) with connection broker functions. Allows connection to other networks via SOCKS for scenarios involving the support of remote client networks from a central location. Client resources are presented along with local resources in a unified web portal.
- Provision Networks Virtual Access Suite (VAS): Focus on Seamless Access.
 - Targeted to Windows Environments. Includes SSL-VPN, connection broker, and Seamless publishing of VDI hosted applications on the user desktop and start menu. Creates a well integrated hybrid desktop and allows web portal access from outside the firewall. Integrates directly with Windows.

Design Components: Boot Image Management

- Boot Image Management: Controlling Hard Drive Sprawl!
 - Gigabit networking between VDI desktops and servers provides a more efficient way to attach users to their Boot Image.
 - Shared storage is conserved for data with less duplication.
 - Using a single image for booting multiple machines makes patching and application management much easier.
- Ardenne Tools: Enterprise Boot Image Management
 - Using PXE boot, virtual machines are connected to a predefined boot image and machine name based on their MAC address and personalized on boot.
 - The C: drive is redirected to the network. Writes can be sent to a client-side RAM disk, Server-side RAM Disk, or Client-side hard drive.
- Linux Terminal Server Project: Shared Image for Linux Desktops
 - Diskless Desktops boot against a central distribution server.
 - Applications can be distributed from a central location.
 - Powerful low cost approach to VDI that leverages Open Source technologies.

Design Components: RAM Caching

- RAM Caching: Turbo Charge the VDI Desktop.
 - CPU speeds continue to advance in accordance with Moore's Law, doubling in speed roughly every 18 months.
 - Hard Drives have taken 10 years to double in performance.
 - Ram Caching is a way of moving data closer to the operating system, minimizing disk access.
- Problems with Ram Caching in Distributed Computing
 - Allocating dedicated RAM to each physical machine is too expensive to be justified in most companies.
 - Limited visibility of caching products and a failure to grasp the performance bottleneck created by hard disks.
- Caching with VDI
 - Balloon Driver can reclaim unused memory, freeing up memory for allocation to RAM cache.
 - Transparent memory page sharing on ESX stores common data only once. VDI desktops can retain benefits of caching with a modest amount of extra RAM especially on larger ESX hosts where the chance of duplicate memory pages is greater.

Design Components: RAM Caching – Design Options

- Block Cache Design – DataCore’s Uptempo & SuperSpeed’s SuperCache products.
 - Driver is installed under the file system that retains requested data blocks in RAM.
 - Blocks written to disk get instant commits back to the file system and data is de-staged periodically.
 - Data can be pre-fetched based on usage patterns.
 - Best Approach for 32bit OS.
- RAM Disk Design – Ardenne 4.1 RAM Disk Feature or SuperSpeed’s SuperVolume Product for use with non-Ardenne Virtual Desktops.
 - Partition Caching: This approach stages an entire disk partition in RAM. All reads come from RAM, writes de-stage as with Block cache designs.
 - Benefits: Eliminates the ‘cold hit’ factor of Block Caches.
 - Drawback: Consumes more RAM. Applicable to 64bit versions of Windows where greater than 4GB RAM can be allocated.
- VDI Application: Deploying either approach will greatly improve VDI performance by eliminating disk access latency, saving CPU cycles burned waiting for file I/O. Applications will launch much more quickly and remain responsive.
 - Partition cache of the boot volume and Installed applications will only be stored once. On a large ESX host dedicated to VDI many users can have RAM disk performance while ESX only stores cached partitions once in underlying RAM.

Design Components: Application Virtualization

- Application Virtualization: Microsoft Softricity - How it works.
 - Software installations are sequenced into data blocks that stream to the VDI desktop in the correct sequence to launch applications quickly.
 - Code blocks are stored in a local cache to avoid future streaming.
 - Applications are published to user groups from a central console resulting in icons appearing on the start menu and desktop.
 - Only a single program needs installation on the VDI desktop. This client coordinates all application launches and configuration of user sessions.
 - Application Virtualization is not a competing technology but rather compliments a VDI strategy.
- Synergy with VDI
 - Application Virtualization limits the number of departmental templates that need to be maintained, further simplifying user management and template inventory.
 - Paired with Ardence Boot Image Management, it is possible to control all enterprise desktops from a single, easily maintained image.
 - By streaming only enough code to launch applications, the size of a VDI disk image is greatly reduced which may assist those using partition caching strategies to enhance performance of the VDI desktop.

Sample VDI Deployments – Outsourced Development

■ Scenario 1: Outsourced Development

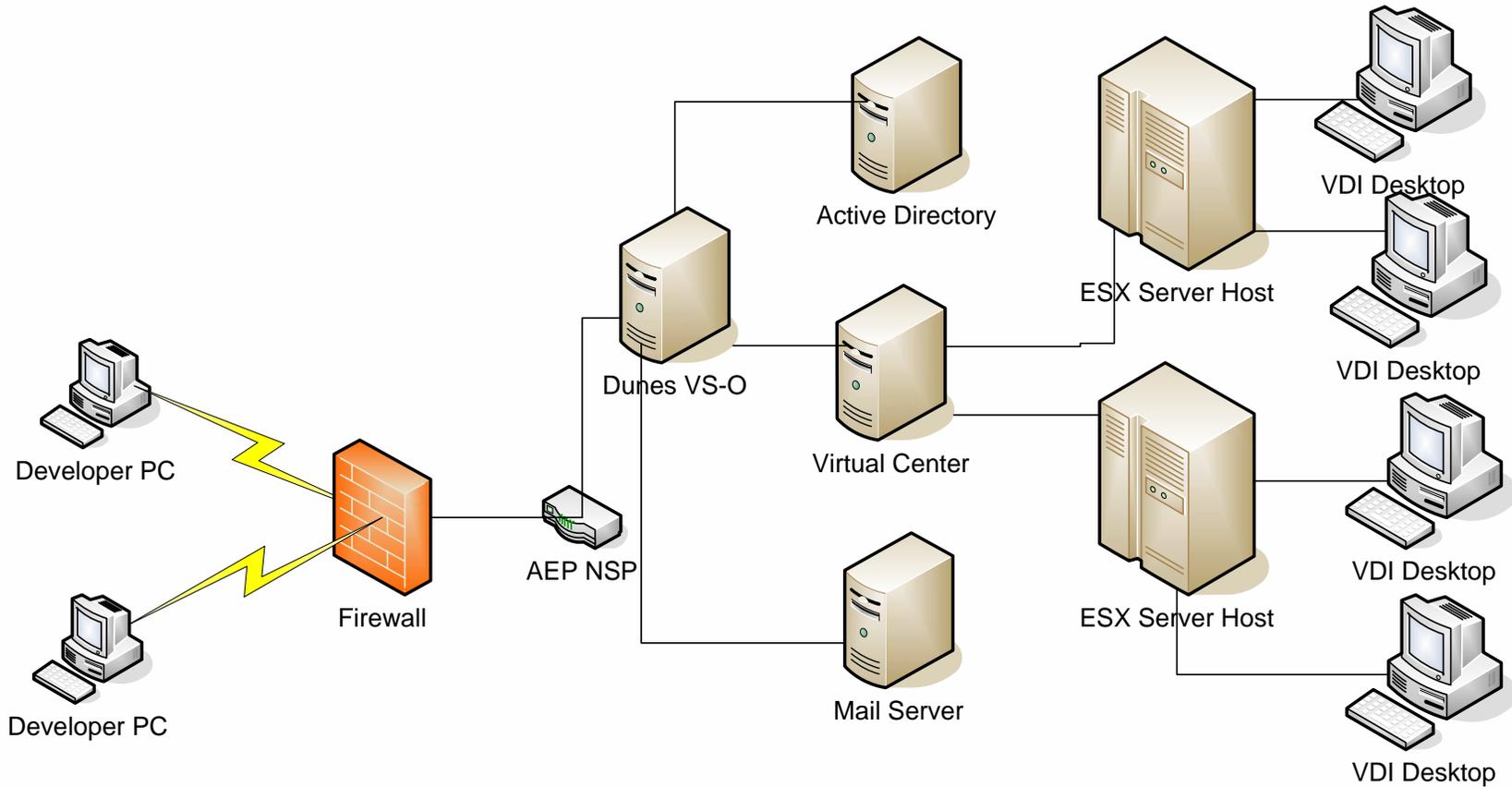
➤ Requirements:

- Developers need access to their own desktop from the Internet.
- Company wants advanced workflow automation to provision the virtual desktop, create user accounts, and email project manager when VDI desktop is ready.
- Company is concerned about desktops containing viruses and wants to check VDI user's local PCs for proof of current anti-virus before granting access.

➤ Solution: AEP's NSP appliance paired with DUNES VS-O / VD-O

- The NSP can validate user's local desktop attributes such as age of anti-virus signature file before granting VDI access.
- DUNES has the ability to create the needed custom workflow and provides a web portal for VDI access.

Sample VDI Deployments – Outsourced Development



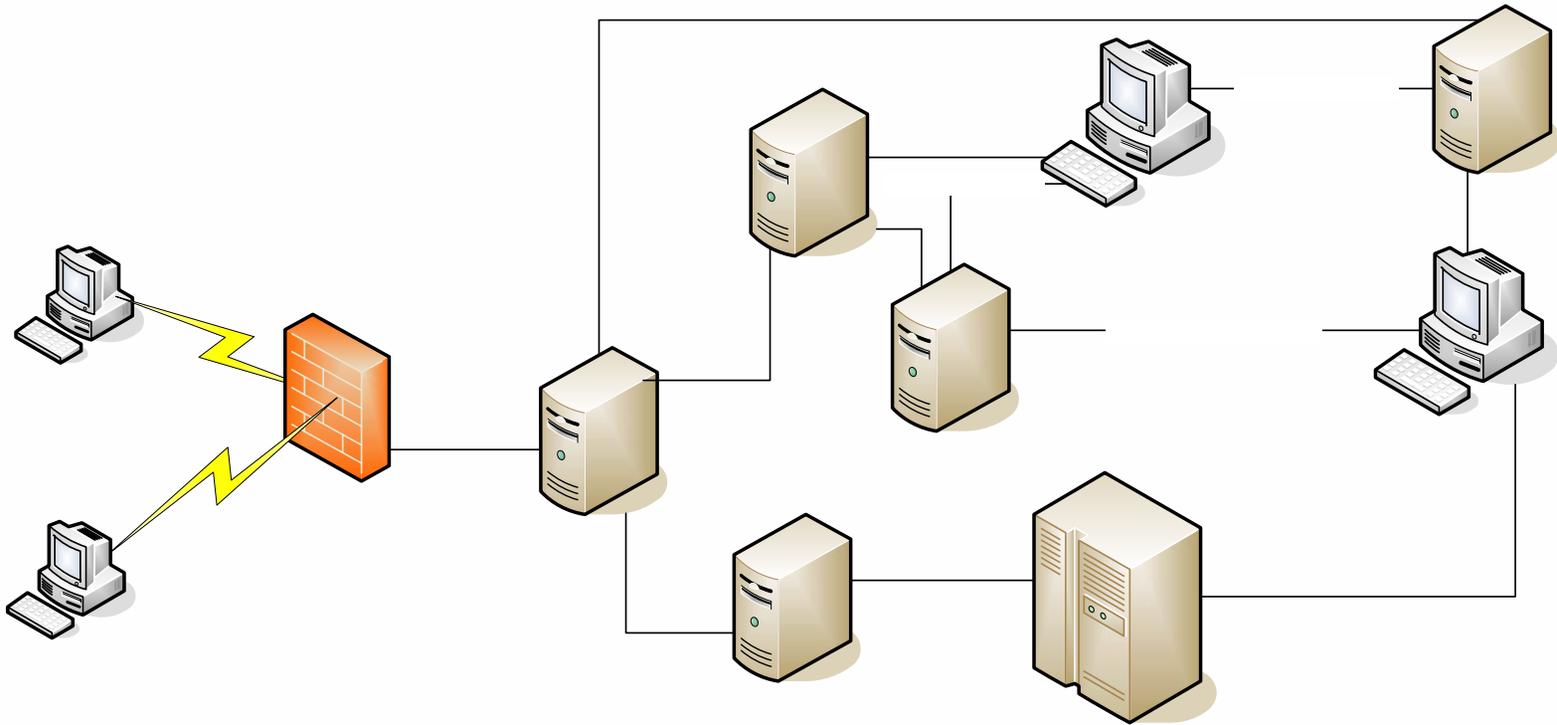
Sample VDI Deployments – Hybrid Resources

- Scenario 2: Support of Hybrid Resources and multiple clients
 - Requirements:
 - Support technicians for software vendor located around the world must provide support to a variety of clients.
 - Access to client networks must originate from within the software company's network.
 - Technicians need access to client workstations, mainframes, Terminal Servers and their own corporate desktops.
 - Solution: Propero Workspace for VMware
 - Propero's multi platform support for a wide variety of back-end resources facilitates access to both VDI desktops and the other platforms technicians must support.
 - Propero's Tunnel server can connect through to remote networks using SOCKS protocol for trusted access to client networks.

Sample VDI Deployments – Performance Driven

- Scenario 3: Application Virtualization, Local Apps and VDI hosted apps integrated with local desktop.
 - Requirements:
 - Multimedia company needs local execution of Video editing suite, but struggles with reduced productivity while demanding post production transformations executed on the local PC.
 - Company is looking for a software management strategy that avoids the need to touch PCs at the branch offices and also handles application deployment to VDI desktops without extra effort. Tools must seamlessly integrate with local desktop.
 - Solution: Microsoft Softricity, Provision Networks Virtual Access Suite.
 - Installation of Softricity client on local PC and Virtual Access Suite AppPortal client on local PC.
 - Softricity client handles local execution of video suite for fast editing. AppPortal provides an additional published icon to launch VDI hosted copy of video suite for post processing jobs. Softricity client inside VDI desktop handles launch of video suite on remote session.
 - Workers can now continue to perform editing functions while CPU intensive jobs execute on a V13 farm located elsewhere.
 - No extra sign-on needed for Softricity or AppPortal. Seamless to Users.

Sample VDI Deployments – Performance Driven



Summary

- VDI combines some of the best features of both Terminal Server based Desktops and stand alone PCs and defines a new server based computing model.
- VDI achieves its true potential when paired with 3rd party products to create a solution appropriate to the unique needs of each company.
- Key Features not found in other solutions:
 - User Isolation
 - Robust Resource Allocation
 - Common Resource Pool and Management Strategy for desktops and servers.
- The new desktop management model will move towards an optimal use of local execution, Terminal Server and VDI hosted applications. The stability and user isolation of VDI will give it a central role as companies increasingly seek the savings and features of centralized computing.

Questions and Discussion

- Questions?
- Virtual Questions?
- Hosted Questions?
- Local Questions?
- Terminal Questions?

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