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POINTOFVIEW

VIRTUALIZATION: NEW WAYS OF DELIVERING DESKTOP APPLICATIONS TO USERS

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Virtualization has become a driving force behind IT infrastructure plans and decisions. Businesses of all sizes are using server virtualization to reduce costs and to rationalize, consolidate, and manage their server infrastructures more effectively—with the latest opportunity being efficient delivery of applications to end users.

Since the dawn of the personal computer and client/server application architectures, organizations typically have made applications available to end users through a combination of:

1. Client software installed on the user desktop/laptop
2. Software installed on a server and presented to the user through a terminal server/Citrix-type framework (server-based computing), and/or
3. Various web-based application delivery mechanisms; for example, Java applets and Web 2.0-type applications.

New virtualization technologies solve some of the problems inherent the first two delivery methods above: client installations and server-based computing.

TRADITIONAL METHODS. TRADITIONAL PROBLEMS.

Companies have used the typical application delivery methods successfully for many years. Personal computers, combined with standard hardware and operating systems, provide a far better user experience than the legacy dumb terminal solutions of the pre-client/server era. The ever-expanding number of applications and increased complexity of the underlying operating system, however, have forced many businesses to reconsider their application deployment methods.

The technical issues of traditional deployments are further complicated by continual pressures to "do more with less" while maintaining or improving the user experience. The continuing evolution of distributed and mobile user requirements also has put pressure on IT architects to design solutions that are available, scalable, secure, and cost-effective.

PERSONAL COMPUTERS: GOOD FOR USERS BUT PROBLEMATIC FOR ADMINISTRATORS.

The modern personal computer is a marvel of hardware and software standards and capabilities. Relatively inexpensive hardware (compared to server-level hardware) and powerful applications have revolutionized business and significantly increased user productivity. This functionality comes with costs, though—above and beyond those associated with acquisition and support. Traditional workstation-based application deployment can present a variety of issues:

- The complexity of modern operating systems may result in frequent hardware/software incompatibilities across multiple generations of applications and utilities.
- New and updated applications may be difficult to deploy across a heterogeneous (different operating systems, hardware levels, etc.) workstation population.
- Companies need trained administrative personnel to manage the physical hardware lifecycle, including deployment, maintenance, upgrade, and disposal.
- Maintaining deployment images for many different combinations of hardware and software can be costly.
- Users store valuable data on unprotected local media.
- Computer workstations often are unsecured, evoking the maxim: "If the adversary has physical access to the computer, he has access to everything stored on it."

These issues create headaches for workstation and application administrators and frequently result in painful application deployments, especially during mass refresh cycles or hardware upgrades. Developers have created many utilities and workstation management frameworks to ease the pain, but the core problems persist.

SERVER-BASED COMPUTING: A PARTIAL FIX.

Server-based computing frameworks addressed these issues, as well as offering a solution for application incompatibilities with remote use and remote access. Products such as Citrix XenApp, Microsoft Terminal Services, and others provide a layer of abstraction between the client hardware and the running application. While not a complete regression to the legacy mainframe-terminal model, server-based computing retained several of the key advantages of a centralized approach, including:

- Standardized and centralized application installation.
- The ability to restrict data to secure, data center-based storage.
- Easier deployment of applications to branch offices and other similar locations with limited network connectivity.

While providing some benefits, server-based computing has its own set of challenges:

- Application and operating system incompatibility problems sometimes are amplified with the mixture of server operating systems and workstation applications.
- The shared nature of applications in a server-based computing environment introduces the possibility of one user corrupting applications or data used by many users.
- More advanced implementations involve added software and hardware costs.

NEW TECHNOLOGIES. NEW SOLUTIONS.

While providing a reliable environment for running applications, the old model of server deployment and management frequently introduced some unwanted side effects, including server sprawl and under-utilization of hardware resources. To solve these problems, companies adapted the virtualization concepts originally used in mainframe computing environments. Today, they are using these concepts to solve difficult application delivery issues.

Workstation virtualization: Overview.

At its most basic level, deploying workstations in a virtual infrastructure can be as simple as installing virtual machines with workstation operating systems and assigning them to users. The users then connect to the virtual desktops using existing workstation hardware and RDP or a similar protocol.

The major virtualization vendors have created dedicated software suites to solve several problems specific to virtual desktops, including:

Problem	Solved by
Providing extensive amounts of expensive shared storage.	Storage deduplication and optimization software.
Provisioning varying numbers of virtual desktop machines, inside and outside of the company firewall.	Connection broker.
Supporting user hardware requirements, including multiple monitors, and USB devices.	Advanced thin clients.
Managing the virtual workstation infrastructure centrally.	Dedicated virtual workstation management console and server.
Using virtual desktops in an offline or mobile device roaming scenario.	Virtual desktop offline modes.

Workstation Virtualization: Common Features.

There are two models of workstation virtualization:

- Running virtual machines on a central virtual machine host server, and
- Streaming virtual desktop images to client hardware.

The key difference between these models is the computing hardware on which the virtual workstations run. Both approaches have merit, and major workstation virtualization vendors support one or both methods.

Virtual workstations can be accessed using either standard personal computer hardware or thin clients. Both types of client hardware have their merits. Thin clients (or older personal computers) work well for normal office application-type workloads. Full workstations or more expensive thin clients may be required for a virtual desktop image streaming installation or for users who require multiple monitors or extensive peripheral support.

Dedicated workstation virtualization environments typically offer the following features, which mitigate the workstation virtualization-specific problems. When combined with the native features of a virtualization environment (shared storage, on-the-fly resource allocation, live migration of running virtual machines, etc.), the virtualization solution transforms traditional workstations into a highly flexible, scalable, manageable, and secure integrated system.

Feature	Description
Connection broker/virtual workstation provisioning	Assigns virtual workstations to requesting users. Controls the setup and tear down of virtual workstations as necessary. Can provide secure remote access for users outside of the organization's firewall.
Storage optimization	Works either alone or in concert with features of the storage system, allowing multiple virtual machines to share a common base disk image. Allows for storage of stateful, user-specific data for persistent virtual workstations. Provides a drastic reduction in the amount of storage required, and provides important image and patch management capabilities.
Virtualization platform	The standard, hypervisor-based virtualization platform, which hosts the virtual workstations.
Client software	Installed on the user workstation or thin client, to manage the interaction between the user hardware and the connection broker.
Management tools	Tools to manage the various system components.

Application Virtualization: Another Piece of the Puzzle.

Application virtualization involves the packaging of applications into "containers," or isolated run-time environments. The resulting stand-alone application packages do not modify the workstation operating system that runs them. Applications typically are "installed" into a self-contained form (depending on the framework used) and deployed either through a dedicated or pre-existing application deployment system. User customizations typically are supported through use of a "sandbox"—a dedicated storage area that holds the customizations and user-specific settings, applying them as needed.

The following features are typical of most application virtualization systems:

Feature	Description
Packaging/sequencing	Software to install the application and all of its supporting software into a form that can be used by the deployment system.
Application delivery	Delivers applications to the end-user, either through streaming on-demand, pre-installed, or a deployed-once basis.
Management console and server	Tools and framework to manage the application virtualization environment.
Client software	Software installed on the user hardware, providing access to the virtualized applications.

WORKSTATION AND APPLICATION VIRTUALIZATION: SOLVING THE ISSUES OF TRADITIONAL APPLICATION DEPLOYMENT METHODS.

Deployment of either workstation or application virtualization can solve some, but not all, of the problems of a traditional workstation deployment.

When deployed together, however, a virtual workstation and application environment meets all of the challenges presented by traditional workstation deployments (see the table in the adjacent column)—and reduces costs.

The combination of virtualization technologies offers many benefits. Most virtualization vendors are offering packages that combine their server, workstation, and application virtualization products into licensing bundles available at a significant cost savings. A particular vendor's solution is not always interoperable with that of another, but there are some cases where the point solution of one vendor (server virtualization platform, for example) can be combined with another vendor's offering to provide an optimal solution.

Traditional challenge	New solution
Complex operating systems, and new hardware incompatibilities.	Virtual workstations run on standard virtual "hardware," isolated from incompatibilities with the underlying physical hardware.
Personnel needed to address workstation hardware issues.	Using thin clients and session broker functionality results in a "plug-and-play" solution, with minimal administrative work required.
Local data storage and security problems.	All data is stored securely in the data center. For virtual desktops, nothing critical resides on local persistent storage.
Deploying applications across heterogeneous hardware and software populations.	Virtualized applications are not dependent on specific hardware or software revision levels.
Development costs and complexity due to multiple versions of hardware and software.	Virtual applications and desktops present a single target for development efforts, limiting the number of platforms for which the company must develop.
Server-based computing and workstation application incompatibilities.	Virtual applications and/or virtual desktops don't rely on server operating systems to host applications directly.
Lack of application and data isolation with traditional server-based computing.	A virtual application or desktop is run in its own "container" and cannot affect users on the same hardware.
The more advanced server-based computing implementations also involve additional software and hardware costs.	Depending on the mixture of technologies used, reductions to the server-based computing infrastructure are possible.

Implementation Scenario and Tips.

The array of tools and capabilities can seem daunting at first glance. To illustrate one of the many potential technical solutions, let's look at a specific scenario.

Mid-Sized Bank Corp (MSBC) is a regional bank, with 250 employees working across 15 branches. The bank has experienced a fair amount of growth in the past few years and is rapidly approaching the beginning of another client technology refresh cycle. Expansion outside of its headquarters city has created some issues, including:

- Performance problems connecting branch office end-users to centrally-located applications.
- Proliferation of local, unprotected data storage.
- Added costs of supporting computer workstations across a large geographic area with a small IT staff.
- The need to support a wide variety of applications across multiple generations of workstation hardware and operating systems.

These issues all affect the IT department's ability to meet existing service level agreements with its current staffing level. The bank's IT leadership would like to redesign the application delivery architecture with an eye towards solving the problems described on the previous page, while keeping a similar "look and feel" for the bank's users.

Requirements Gathering.

Given the broad objectives detailed above, MSBC set out to gather a detailed list of requirements, including:

- Applications to be supported.
- Specific user group requirements, including usage patterns, mobility, current challenges, and location.
- Client hardware requirements; for example, monitors and peripherals.
- Client access requirements; for example, local, remote, and detached.
- Operating system images to support.
- Physical location data, including network connectivity.
- Desired management features.
- Lower total cost of ownership, including support costs.

The bank sorted its users into three groups:

1. Client-facing; for example, tellers.
2. Internal support; for example, desk-bound workers tied to a single location.
3. Mobile/high-performance workers; for example, those who travel between branches or outside of company premises on a regular basis, or workers with special workstation performance requirements.

System Design.

Given the above requirements, MSBC's IT architecture staff designed a prototype application virtualization environment, including the following high-level features:

- Delivery of applications to the client-facing user group through a traditional terminal services/server-based computing infrastructure, to thin clients.
  - Provides the maximum amount of scalability, delivering a few key applications to a user population with similar requirements.
  - Uses diskless thin clients, which are easy to deploy and support.
- Use of a server room-based virtual desktop for the internal support group, with users accessing the virtual desktop with existing desktop machines pre-configured to access the virtual desktop infrastructure connection broker.
  - The solution uses existing client hardware to minimize capital acquisition costs.
  - User desktop profiles and data are stored in the server room, which is properly secured and backed up.
  - The dynamic profile management software provides profile and user-specific personalization.
  - The virtual desktop is compiled from a common "golden" master image for easier management and efficient use of expensive shared storage.

- Deployment of a hybrid application delivery system for the mobile worker group.
  - The virtual desktop is streamed to the user desktop hardware. Applications run locally on users' workstations for optimal performance.
  - A secured and backed-up central file server stores data.
  - The solution allows use of existing or new client hardware, including mobile users' laptops.
  - A web interface streams the required applications to mobile workstations, allowing secure remote access to key applications.
  - Mobile worker laptops are encrypted to prevent data loss in the event the hardware is lost or stolen.

System Piloting and Deployment

The bank initially deployed the new application delivery infrastructures and framework to a pilot group consisting of one bank branch. It planned subsequent deployments to coincide with the regularly scheduled workstation refresh cycle.

NEXT STEPS

The capabilities of the various workstation and application products are continually evolving, as competition within this technical area has increased significantly over the past two years. If your company is considering a change to its traditional application deployment methods, consider the following recommendations to jump-start the process:

1. Inventory your existing set of applications and client-facing technologies.
2. Research the capabilities of existing virtualization products and frameworks from multiple vendors.
3. Conduct a preliminary requirements-gathering project to determine high-level implementation and operational requirements.
4. Consider enlisting third-party assistance with the requirements-gathering project, utilizing a provider that has broad experience with the various solutions available.