



Desktop virtualization: A revolution in desktop computing for everyone

Moving to a desktop architecture that solves
problems instead of creating them.

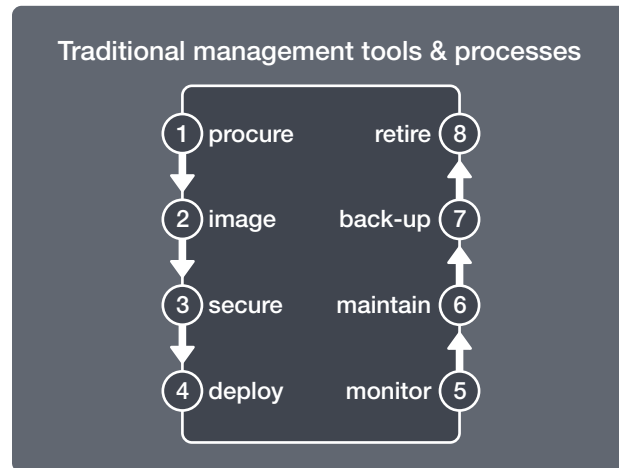
Why are so many IT organizations supporting 21st century enterprises with a decades-old desktop management strategy that is not working for IT or end users?

Individual desktops are assembled and hard-coded one-by-one on an ongoing basis. State-of-the-art networks carry information at close to light-speed—yet IT staff members need to go onsite visiting one PC after another to perform even the most basic maintenance tasks. While there’s no shortage of innovation to address fast-changing business requirements, actually rolling out new technologies can take months while burning quickly through scarce resources. In a business culture that prizes instant responsiveness and anytime, anywhere connectivity, employees remain all too dependent on a specific machine—and on the costly, labor-intensive IT processes that keep it running.

It’s no surprise that IT executives everywhere are looking for a better way—“the future of desktops.” Desktop virtualization technologies and solutions offer a fundamentally better approach to desktop architecture. Leading enterprises of all kinds are already using desktop virtualization to modernize IT, lower TCO, improve flexibility, streamline support, and enable innovation by freeing IT from the burdens of an outdated desktop model.

The old way: slow, expensive, and painful for users and IT alike

It’s hard to imagine a less efficient, more cumbersome way of provisioning desktops than traditional distributed computing.



- **Change is costly.** Applications are hard-coded into the operating system, making provisioning, updates, and management costly and time-consuming. Any kind of upgrade, such as the introduction of new operating systems or applications, is extremely slow and expensive; for example, Gartner estimates that the adoption of Windows® 7 later this year will cost organizations \$1,035 to \$1,930 per user.
- **Users and organizations lack flexibility.** Although enterprises increasingly value anytime, anywhere productivity, users are able to access their personalized desktops—including applications,

data, preferences, templates, macros, and other customizations—only through a single, specific device, strictly limiting their mobility.

- **Data is vulnerable.** With user data stored on locally on their main PC, employees who work remotely often rely on memory sticks, email, and other ad hoc methods to move their data from machine to machine, creating an ongoing security risk. USB keys and entire laptops are prone to loss and theft, and any PC—even one that never leaves the office—can be overridden with code easily available on the Web.
- **Support is complex and expensive.** The typical three-tier help desk model, with full engagement at each level, is costly and resource-intensive, contributing to high support costs. Endpoint management also poses a significant burden for IT, from inventory to provisioning to retirement, with specialized skills needed in every location and repetitive processes consuming valuable time and resources.
- **Poor asset leverage saps resources.** The need to refresh endpoints every three or four years ties up more than half of the typical IT budget, sapping resources that could otherwise be used for innovation.

Windows 7: an opportunity—and a necessity—to re-think desktop management

While the problems described above are nothing new, the need for a better approach is particularly relevant today with the coming introduction of Windows 7. While many organizations chose not to implement Windows Vista, its successor will be a must-do for the vast majority of Windows-based organizations. In fact, IDC estimates that, in 2010, Windows 7 will account for 49.5% of Windows operating systems bought by corporations, or nearly 58 million copies. <http://www.networkworld.com/news/2009/070709-windows7-rampup.html?fsrc=netflash-rss>

Simply biting the bullet and investing in a major desktop refresh would be a short-sighted and costly strategy. Instead, IT organizations should use their preparation for Windows 7 adoption as an opportunity to think through the way they've supported user desktops to date, and consider new and better approaches—especially when the potential exists to eliminate concerns about hardware and application compatibility, simplify implementation, and reduce the cost of the Windows 7 upgrade.

A Better Way: Desktop Virtualization

As the foundation of a new desktop architecture, desktop virtualization frees IT from many of the costs and constraints of traditional approaches. Management is centralized, eliminating the need for IT staff to travel from endpoint to endpoint, and the storage of all desktop images in a single location improves data security and simplifies backup and recovery. Since they can access their complete desktop environment on-demand, users are freed from reliance on a specific machine and gain tremendous flexibility and convenience in choosing when and where to work.

Still, not all desktop virtualization solutions are created alike. Many people think of desktop virtualization in terms of virtualized desktop infrastructure



(VDI), a model in which virtual desktops are hosted in the datacenter, but this is only one approach, and doesn't reflect the full range of desktop virtualization strategies. In VDI scenarios where a complete desktop image exists for each individual, updates and upgrades must still be performed on a user-by-user basis, and user experience can fall short of expectations. At roughly 20G per image, this approach also requires considerable storage capacity.

- It's also important to avoid a one-size-fits-all mentality about desktop virtualization strategies. There is no single "right" answer; depending on the requirements of the organization and its users, it may be appropriate to consider several options beyond Hosted VM-Based VDI desktops, including local streamed desktops, hosted shared desktops (i.e. terminal services), and local VM-based desktops (client-side virtualization)—or even to deploy more than one of these models within the same organization. Still, whichever course is followed, certain key requirements remain constant. Application virtualization is essential to improve portability, manageability, and compatibility. Also, to ensure effective adoption, IT should make strategic use of user experience optimization to deliver PC-like performance on the WAN and minimize bandwidth utilization on the LAN.

Single-image management: better results at a lower cost for users, IT, and the business

While VDI greatly simplifies and streamlines desktop management by decoupling the user desktop from the machine through which it is delivered, this is only the first step. By replacing individual, user-specific hosted desktops with a single instance each of the operating system and applications, and managing these separately from user settings, a desktop virtualization solution based on single-image management makes it possible for IT to support users and the business even more effectively. By freeing IT from one-to-one endpoint management, desktop virtualization makes it possible to implement new technologies far more quickly and cost-effectively. Again, think about the coming introduction of Windows 7—and the many service packs sure to follow: instead of trekking throughout the enterprise making sure each user's PC is completely up to date, IT need only maintain a single master image. Whether accessed by a few dozen users or thousands, the work performed on that image can be leveraged infinitely across the organization. In addition to becoming more responsive to the business, IT can stretch its budget further because the costs and staff resources required for each initiative are that much lower.

Decentralized traditional desktops	Desktop virtualization
Any changes are costly to make, whether small patches or OS migrations.	With single-image provisioning, patches and OS migrations can be performed instantly and made available to every user on next logon.
Users are tied to their physical desktops, limiting mobility and reducing remote worker effectiveness.	Users can access their virtual desktop from any endpoint, anywhere. The desktop experience is identical as the user moves from location to location.
As soon as it is accessed, corporate data instantly becomes local data which is vulnerable to data loss or interception.	All corporate data is locked up within the datacenter. No data is ever stored locally.
Individual PCs require individual attention when they fail and lose uniformity over time, making support complex.	IT no longer needs to support endpoints. A single desktop image is managed centrally in the data center.
Ongoing PC refresh is very costly in terms of both capital outlay and deployment effort.	The endpoint replacement cycle can be extended by 2 – 3 years since they are no longer running the desktop. New OS or applications can be applied by updating the virtual desktop image without going out to the users locations.

Centralized management: the power of one

In the traditional distributed computing model, IT must manage hundreds or thousands of desktops individually across the enterprise, and the burden of support increases in tandem with the size of the workforce: the more users you have, the more instances of each application and operating system you have to manage—and the more complex each desktop becomes.

With desktop virtualization based on single-image management, these numbers shrink to one: one copy of each application; one copy of Windows®; one point of management for the whole enterprise. This means that:

- Updates to applications and operating systems can be made once, then propagated instantly across all users in every location.
- IT has a single point of management for each desktop component in isolation from the others, eliminating the need to account for an infinite number of combinations in each user's desktop image.
- Unlike VDI, in which a separate desktop image is hosted for each user, single-image management involves minimal storage impact.

Any location, any device—same excellent user experience

No longer dependent on a single corporate-issued PC for their familiar applications and data, users can log into the same personalized environment from any location, using any device: a netbook, a personal computer at home, a rental, a loaner from a friend, an airport kiosk.

Freed from the need to always access the same personal device, users can become instantly productive at a moment's notice, improving business agility. If one machine goes down, they can switch seamlessly to a different



one and pick up exactly where they left off; meanwhile, a lost or stolen computer poses no security risk, since all data has remained centralized in the datacenter. Because most individual virtual machines are already running and waiting to be accessed, the majority of users find that overall logon is much faster than booting up a conventional system (15 seconds versus 15 minutes)—so the overall user experience actually improves.

Self-service desktops—on demand apps

A centralized desktop management model means more effective and easier to maintain applications without limiting the ability of end users to manage their own environment. With application virtualization, IT can control data access, manage fewer desktop images, eliminate system conflicts, and reduce application regression testing. Adding, updating and removing apps now become simple tasks since users can leverage a centralized self-service app store, enabling them to access applications instantly from anywhere.

Streamlined support

How many end user service calls result from local software conflicts, corrupt applications, and other endpoint-specific problems? With desktop virtualization, a single golden master image of each application and operating system remains in pristine condition, eliminating whole classes of problems. Support becomes far simpler, and many IT organizations can eliminate tier 1 service entirely and move toward a self-service model in which users are empowered to address the narrower range of problems that may still occur.

Innovation, not inventory management

With much of its traditional role shifted to the datacenter, the endpoint device becomes less an island of technology than a receiver for technology originating elsewhere, with much more limited local support needed. In this sense, it more closely resembles a standard office phone, and can now be managed in the same way: plug it in and walk away.

By simplifying endpoint management, IT can offload both the budget impact and the workload involved and increase its focus on more strategic functions like planning and innovation. In fact, the burden of endpoint ownership can even be passed all the way to employees themselves; desktop virtualization is ideally suited to support a “bring-your-own-computer” program in which users receive a stipend to purchase and support their own PC, then access their virtualized corporate desktop through the same computer they use in their personal life.

End-point longevity

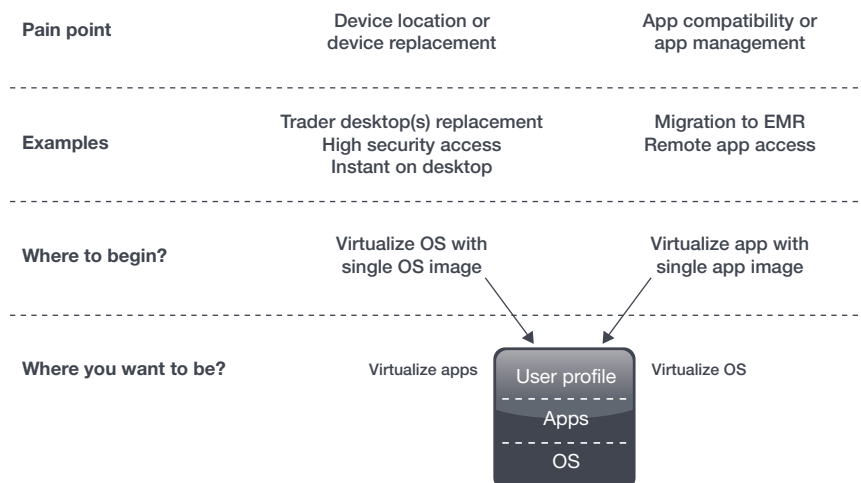
The standard endpoint refresh cycle of 3 – 4 years is costly and wasteful, with today’s state-of-the-art computer reduced all too soon to a waste disposal problem. By reducing client-side complexity and moving the maintenance of standard applications and operating systems to the datacenter, desktop virtualization lets you use the same endpoint twice as long while maintaining the same high level of performance.

Virtualizing desktops with XenDesktop

A leader in virtualization for 20 years, Citrix has developed a model for desktop virtualization which enables organizations to realize the full benefits of this transformational architecture today. Implemented in XenDesktop, the core of this model is single-image management: instead of creating, managing, and either hosting or streaming a complete desktop image for each user within the datacenter, IT maintains a single image of each operating system and application. Only user-specific data—which include favorites, templates, and documents—is maintained on a per-user basis. When a user logs on, the full virtual desktop—operating system, applications, and user-specific data—is assembled on-demand. With FlexCast™ delivery technology, XenDesktop can quickly and securely deliver these newly assembled desktops to any user in the enterprise, whether they are task workers, knowledge workers or mobile workers, in one of five different ways:

- **Local streamed desktops**, in which a centralized virtual desktop is installed in the datacenter, then delivered remotely for execution on the endpoint;
- **Hosted VM-based VDI desktops**, in which the virtualized desktop image is both hosted and run on virtual machines in the datacenter, and accessed remotely.
- **Hosted shared desktops**, in which the desktop is hosted on a Windows Server and shared among multiple remote users.
- **Hosted blade PC desktops**, which provide a hosted blade workstation for each power user, leveraging dedicated CPU, RAM and GPU resources.
- **Local VM-based desktops** extend the benefits of centralized, single-instance management to mobile workers that need to use their laptops offline. When they are able to connect to a suitable network, changes to the OS, apps and user data are automatically synchronized with the datacenter.

By combining both application virtualization and operating system virtualization within a single solution, XenDesktop provides the organization with a complete stack to realize the full benefits of this more modern desktop architecture.

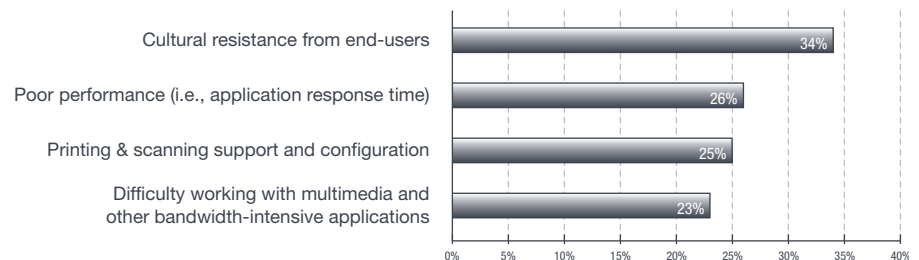


Practical, high-performance desktop virtualization

While XenDesktop’s model for single-image management offers compelling theoretical benefits, the test for any desktop virtualization solution is how well it performs in the field. Indeed, a recent survey (ESG, Sept. 2009) highlighted several common challenges that a VDI solution can involve, including:

- **Cultural resistance from end users.** Simply put, people hate when something they’re accustomed to is replaced by something new—especially when the new version isn’t clearly better.
- **Poor performance (i.e. application response time).** A few extra seconds can make the difference between successful adoption and user rebellion.
- **Printing & scanning support and configuration.** Without a way to ensure plug-and-play compatibility for local resources, IT can quickly become consumed in the kind of user-by-user management and troubleshooting that desktop virtualization was designed to eliminate.
- **Difficulty working with multimedia and other bandwidth-intensive applications.** To be effective as an enterprise-wide strategy, desktop virtualization must solve the needs of even the most demanding users—not just the simplest cases.

To date, what challenges—if any—have you experienced with your VDI solution? (Percent of respondents, N=99, multiple responses accepted)



Citrix overcomes practical and cultural obstacles like these through HDX, a set of network and display optimizations and performance boosting technologies which deliver the best performance over any network, including low bandwidth and high latency WAN connections.

- **HDX MediaStream** – Accelerates Flash by up to 10x over other desktop virtualization solutions and provides seamless playback of WMV, AVI, and other multimedia formats using both server-side and client-side optimizations.
- **HDX RealTime** – Delivers CD-quality audio and enhances real-time voice and video with webcam support, VoIP softphone compatibility, and bi-directional audio.

- **HDX 3D for Professional Graphics** – Extends desktop virtualization to advanced users of CAD/CAM and engineering applications, even over WAN connections, offering up to 12x performance compared to other solutions. This category also includes the Progressive Display feature, which applies advanced compression to optimize 2D graphics and improve performance up to 15X.
- **HDX Plug-n-Play** – Enables simple, seamless use of local resources, including USB peripherals, monitors, smartphones, and printers.
- **HDX Broadcast** – Ensures high performance of virtual desktops and applications over any network, including high-latency and low-bandwidth environments.
- **HDX IntelliCache** – Accelerates HDX experience of desktops and applications with advanced optimizations and caching for the Citrix delivery protocol. Uses less bandwidth and provides an outstanding experience for branch-office users.

Desktop virtualization: it's happening now

Supporting field personnel more effectively

Leicestershire Constabulary provides police services to the people of Leicester, Leicestershire, and Rutland in the UK, an area of more than 965 square miles and a population of nearly one million. In 2007, an internal work study identified significant opportunities to save time and increase the productivity of police officers through mobile access to data. At the time, the ability of officers to report information about crime quickly had been hampered by the need for the teams to return to an office to complete the paperwork. In fact, the standard practice was to use pen and paper at the scene of the crime, return to the office, and fax the information to the input bureau, which then filed the report.

By allowing such administrative tasks to be handled while out of the office, Leicestershire Constabulary found that it could increase officers' time on the streets by 30 percent. Mobile access would not only ensure greater productivity, but would also enhance public confidence by enabling officers to spend their time in the field, not pushing paper back at the office.

Leicestershire Constabulary decided to implement desktop virtualization with XenDesktop, an approach which allowed it to incorporate the force's legacy systems as well as notebook computers installed in its cars, which gave officers an experience similar to working from their desk. In this way, Citrix enabled Leicestershire Constabulary to become the first and only UK police force with the capability to input a full crime report directly from the scene. The result: a 30 percent productivity boost.

Cost-effectively Expanding Education Access

Arizona's Scottsdale Community College (SCC) is a two-year institution with 800 staff and about 11,000 students. Charged with a mandate to provide pervasive technology services to the community, SCC found that constant spending for new hardware made it difficult to invest in new technologies or educational software. Students unable to afford the

“We did not have to come up with new funding to finance this two-phase project; we simply redirected money that would have been spent on PC upgrades over those two years to pay for the Citrix solution. In the end, rather than having 500 new computers on campus that only benefit the students and employees who use them, we have provided a high-speed, highly available system that benefits every student and employee at our college.”

Dustin Fennell, CIO
Scottsdale Community College

software required for courses had no choice but to come on campus to use one of the school's PCs, an inconvenience which also hampered the school's efforts to expand enrollment to non-traditional learners such as working adults and online students.

The adoption of server, application, and desktop virtualization enabled SCC to achieve significant ROI. Moving forward, the college is **saving \$250,000 per year** that would have been spent on hardware refreshes, providing SCC the choice of saving that amount or applying it towards other strategic needs and technology innovations. In the face of current and anticipated statewide educational budget cuts, SCC is better positioned than other colleges and universities to continue adding new technology and access.

For the IT team, Citrix solutions have simplified administration, enhanced data security and kept staffing lean. Instead of buying and maintaining multiple versions of costly software such as AutoCAD, the school maintains a single version in the datacenter and delivers it via XenDesktop. One hundred virtual desktops are provisioned from two images of 10 GB each—compared with the terabyte of storage that would be required without Citrix.

Getting started

Desktop virtualization is already moving quickly to the top of many enterprise IT to-do lists. To learn more about the benefits it can deliver in your organization please visit www.citrix.com/XenDesktop.



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About Citrix

Citrix Systems, Inc. (NASDAQ:CTXS) is the leading provider of virtualization, networking and software as a service technologies for more than 230,000 organizations worldwide. Its Citrix Delivery Center, Citrix Cloud Center (C3) and Citrix Online Services product families radically simplify computing for millions of users, delivering applications as an on-demand service to any user, in any location on any device. Citrix customers include the world's largest Internet companies, 99 percent of *Fortune* Global 500 enterprises, and hundreds of thousands of small businesses and prosumers worldwide. Citrix partners with over 10,000 companies worldwide in more than 100 countries. Founded in 1989, annual revenue in 2008 was \$1.6 billion.

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