



Delivering IT to the Virtual Workforce

Citrix: an efficient and secure architecture
for successful workshifting

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Executive summary

More and more businesses are adopting a strategy called workshifting to accelerate business growth, offer optimal customer service, attract and retain a productive workforce and ensure seamless business continuity. Workshifting enables the right employees to work at the right time and place, even if that's not during standard business hours or in a traditional office.

Workshifting works for workers, enabling them more freedom than a 9 – 5 office routine. It also works for employers. They're no longer restricted to local labor pools, and they can readily shift workers—virtually or physically—from one office to another as needed, or move them closer to customers or project sites and also shift work amongst vendors. Organizations have found that workshifting can save them on facility, labor, and travel costs. They're also learning that it dramatically increases their agility, as they can allocate skilled personnel to wherever they're most needed—without the complications of a physical relocation.

The challenge for IT organizations is to meet corporate requirements for data protection and security while delivering desktops, applications, and online collaboration and support tools to virtual workers. In addition, IT must meet workers' requirements: they demand high service levels and ease of use, and often insist on devices of their own choosing. IT must deliver high definition across a wide range of devices to help ensure high productivity for these workers—all the while keeping costs and complexity low.

This paper provides a simple guide with a checklist that focuses on four key workshifting requirements:

1. Productivity and performance, to help people work efficiently
2. Collaboration and support, to help people work with others and quickly resolve technical problems
3. Security, to protect the organizations' data and intellectual property and adhere to compliance policies
4. Cost-efficiency, to lower IT costs and drive business costs down

Virtual workforce requirements checklist

Category	Need	Solution
Productivity and performance	A solution to simplify delivery of desktops and applications—allowing workers to quickly and easily get to the data they need without specialized training or machine setup.	Citrix® XenDesktop™ gives every user a headquarters-like computing experience regardless of device or location. IT manages corporate data centrally and makes it available to users anywhere, dramatically simplifying user support and training.
Collaboration and support	A way to communicate effectively with all colleagues, no matter where they're working. IT technicians must be able to support virtual workers and machines without on-site visits.	Citrix GoToMeeting® provides extensive online collaboration and interaction with others across the extended organization. Citrix GoToManage® and Citrix GoToAssist® allow IT technicians to remotely view and control a virtual worker's computer and IT infrastructure from anywhere.
Security	Protection for virtual worker devices, communication and environment—without moving data to local devices.	The Citrix infrastructure tightly controls access to corporate data to protect it from malicious threats and data loss. It helps IT manage corporate data centrally, encrypting delivery and auditing virtual worker sessions to meet compliance policies.
Efficiency	More intelligent use of resources to rein in costs of supporting the virtual workforce—rather than an entirely new IT infrastructure costing millions of dollars.	Citrix products help save hardware costs by optimizing servers for application processes and by offloading and optimizing expensive networking communication processes. They help simplify maintenance through optimization and standardization while focusing on build once, deliver anywhere scalability.

IT must meet all these requirements to support the productivity of virtual workers, ensure continuity of business operations and secure, protect and track corporate data.

This white paper describes how Citrix virtual computing can solve the implementation challenges of workshifting with a cost-effective virtual computing solution that frees your workforce and increases the agility of your business while maintaining IT control. The paper presents an architecture for centralizing IT resources and delivering them securely to any user on any device, anywhere, to support branch or remote office workers, remote workers, or non-employees.

Free your workforce and control your business

While workshifting offers significant benefits, the transformation to a virtual workforce model is complex. Your organization's plan must address issues of productivity, collaboration, security and efficiency.

Productivity and performance

The productivity of virtual workers depends on real-time access to their core set of desktops, applications and data. But providing desktops and applications for remote workers usually requires costly, support-intensive local installation and maintenance on every device. In addition, bandwidth and latency issues that arise when accessing the company network over public links can impact performance and the user experience.

Collaboration and support

Virtual workers must be able to collaborate easily and effectively with colleagues and customers dispersed across the globe to maintain their productivity. Organizations need to communicate business priorities, provide career growth opportunities and stay connected to their virtual workers as if they were present in the office. Managers need ways to monitor the performance of their workforce wherever workers are located. For workshifting to be successful, the IT organization must find ways to support virtual workers.

Security

To successfully implement workshifting, IT must secure corporate data from data loss and malicious threats as well as meet intellectual property, data privacy, and , compliance and risk management policies. IT must address concerns about who has access, when, from where and from which device, even while allowing users to access corporate resources over public networks from a wide variety of devices. IT must compensate for workers' tendency to ignore restrictions on use of local data storage and management, and for the security overhead of offering access on a proliferation of workers' preferred devices.

Efficiency

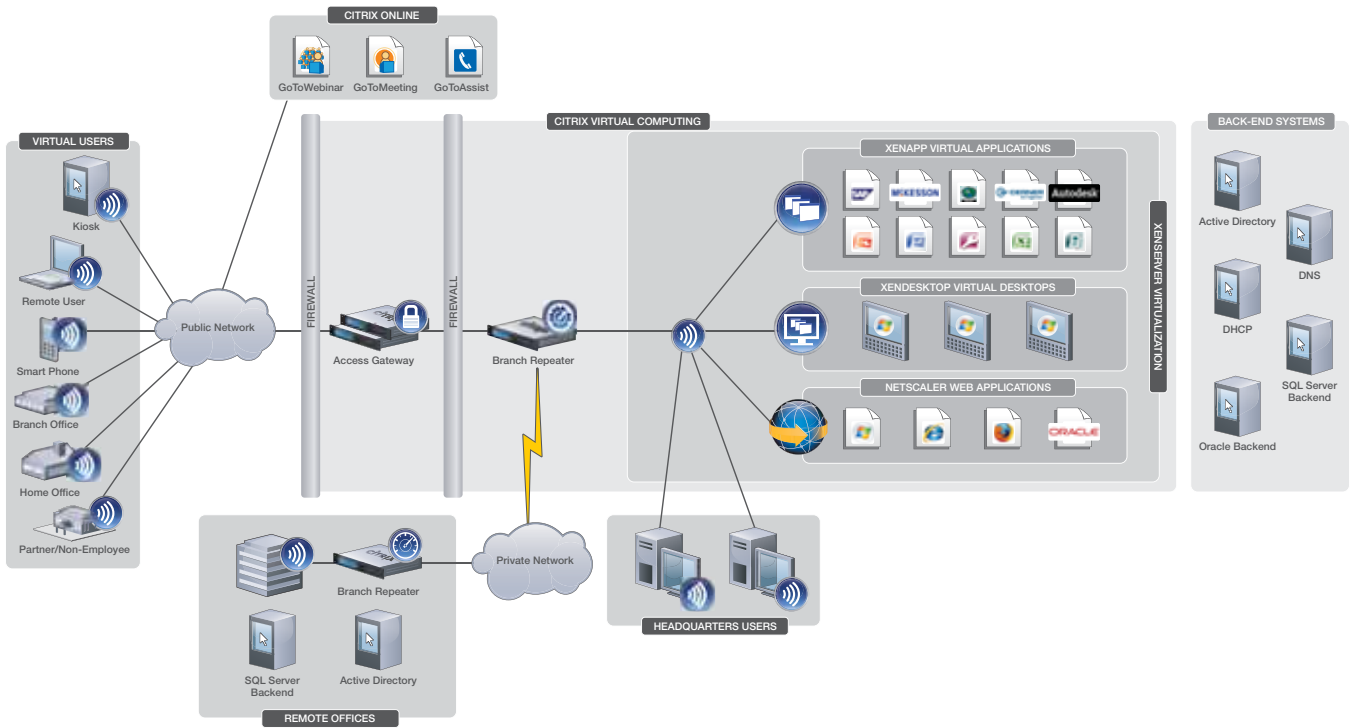
A virtual workforce can be more efficient and require fewer resources than a centralized, location-locked workforce. To achieve this level of success, the IT department must avoid adding new systems and hardware to the datacenter based on maximum concurrency, or replicating them for each remote office and/or location. Installing those new systems would require valuable capital and operational resources. In addition, this over-provisioning would leave machines idle much of the time, costing the organization in space, power, software licenses, communication fees and bandwidth.

Citrix service delivery architecture

The following principles guide the creation of an architecture that can properly support workshifting while maintaining productivity, security and collaboration for any worker, anywhere, using any PC, Mac, tablet or smartphone:

- **Simplicity** – Virtual computing and collaboration tools should be easy and intuitive, requiring little, if any, training for the users. XenDesktop with FlexCast™ technology offers an integrated platform on which to build a virtual workforce environment that gives IT the flexibility to tailor the virtual desktop experience to address the needs of each individual user.
- **Performance** – System responsiveness must be similar for the virtual workforce and local users. With desktops, applications and data hosted from the datacenter, XenDesktop utilizes Citrix HDX™ technologies to enable the best user experience by minimizing network bandwidth requirements, taking advantage of local endpoint processing power and optimizing server-side rendering capabilities.
- **Secure by design** – The solution should be configured so that no access is allowed unless it has been specifically granted. Citrix Access Gateway™ creates a single secure tunnel for external virtual workers, providing them access while maintaining compliance and corporate security policies through SmartAccess technology.
- **Cost efficiencies** – The environment should reduce overall costs through an integrated and optimized solution that can scale to support business needs, including business continuity and disaster recovery. Citrix NetScaler® increases server scalability by offloading expensive and repetitive tasks. Citrix XenServer® enables you to optimize use of the physical server infrastructure by virtualizing application workloads and running them seamlessly across pooled hardware resources.

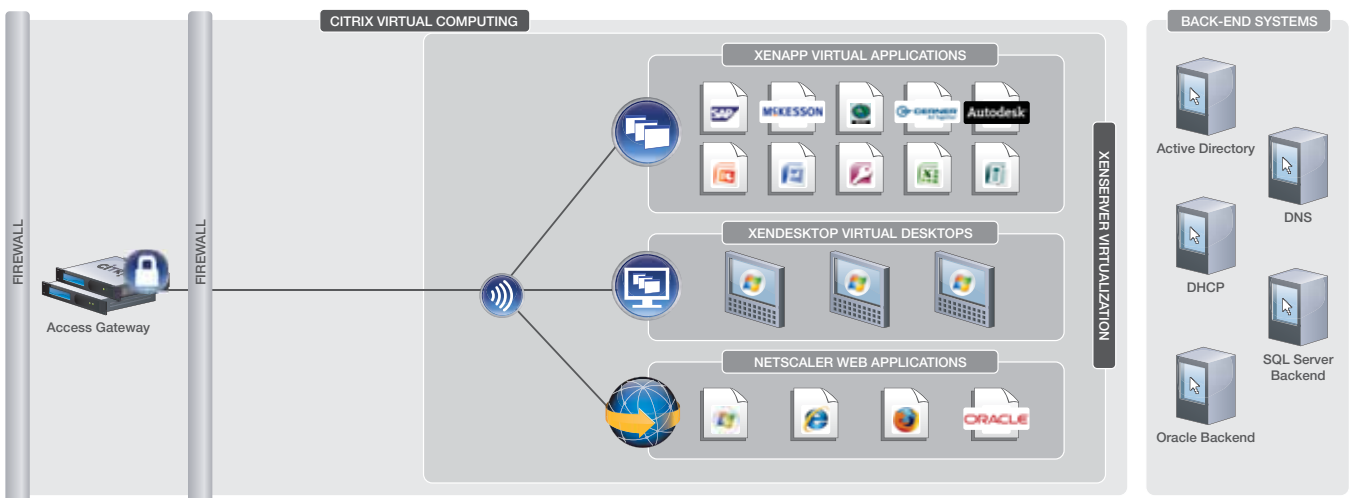
Creating a separate solution for the virtual workforce would not simplify or control costs, but duplicate environments. Instead, Citrix virtual computing solutions integrate with an organization's existing infrastructure, extending it so that all workers regardless of location can leverage it. The following sections detail how IT can efficiently set up the datacenter and then implement scenarios for branch office, remote office, remote and non-employee users, meeting the productivity, collaboration and security requirements of each.



This architecture can support any number of virtual workers by focusing on virtualization, centralization and simplification of the environment.

The datacenter infrastructure

Citrix is integrated into an organization's infrastructure, while utilizing the core datacenter foundation of directory services, networking, firewalls and backend data repositories.



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Efficiency

Consolidate all server hardware

- **Challenge** – Most implementations rely on one server for one workload architecture. This often means servers are underutilized because a single application workload rarely consumes all resources of the standard server hardware configuration. This results in hardware sprawl with its related maintenance and support overhead, underutilization of servers and increased power consumption.
- **Solution** – XenServer allows multiple workloads (including XenDesktop virtual desktops, Citrix XenApp™ servers, web-based application servers or infrastructure components) to share the same physical hardware, separated by a virtualization layer. This XenServer virtualization layer allows each virtualized server to appear as a stand-alone server functioning independently from the other virtual servers as if they were on their own hardware. IT can easily move servers from physical to virtual with P2V tools, included with XenServer.

Consolidate network appliances

- **Challenge** – To achieve the best hardware performance, many organizations use load balancers, SSL VPNs and security devices. These devices are often delivered through different, standalone networking components, each requiring support, datacenter space and power.
- **Solution** – NetScaler replaces many specialized standalone networking components and creates a more efficient datacenter design while still providing the performance capabilities of standalone products.

Simplify server workload administration

- **Challenge** – IT spends a significant amount of time building and maintaining servers through manual or semi-automated processes. Many tools require constant modification for different hardware platforms and system-level updates.
- **Solution** – Citrix Provisioning Services™ helps maintain and support configuration updates, patches and service packs across all servers, physical or virtual, with:
 - **Golden images** – A Citrix Provisioning Services golden image (vDisk) defines each unique role within Citrix, whether it is a XenApp server hosting a certain application or a virtual desktop configuration. IT builds each golden image once manually and delivers it over the network to any number of defined physical or virtual servers.
 - **Image sharing** – Each vDisk image is read-only, allowing IT to stream the single image to any number of physical or virtual machines. During server startup, portions of the

vDisk, required for booting stream across the network to the target device. Additional sections of the vDisk stream across as the server requires more information. Hundreds or thousands of target devices can simultaneously use the same read-only image.

- **Simple updates** – It's easy to maintain the environment because each target device is executing from the same vDisk image. When a new patch, update or service pack is available, IT simply copies the appropriate vDisk image to a test environment, updates it and places it back into production. Citrix Provisioning Services notifies all the vDisk's target devices of the new version. During the next startup routine, each target device will start using the latest vDisk image, which includes the latest patches, updates and service packs.

Optimize web server utilization

- **Challenge** – Many application servers allocate a significant amount of resources for TCP session creation, SSL encryption/decryption and compression. These compute-intensive tasks increase the amount of server hardware required within the datacenter.
- **Solution** – Fully utilizing hardware does not always mean trying to pack as much on the server as possible. Offloading resource-intensive tasks to optimized and dedicated hardware provides greater usability and efficiency within the datacenter. NetScaler delivers a set of technologies that offloads expensive networking-related tasks from the web server, thus increasing server scalability.
 - **TCP optimization** – Servicing each application user requires setting up and tearing down a TCP connection. As this process expands to hundreds, thousands, or millions of requests, it takes more time and more CPU cycles and impacts scalability. NetScaler not only offloads the responsibility of managing TCP connections for each user from application servers, it multiplexes the connections so that each server only handles a minimal number of long-lived TCP connections. This reduces the overall TCP load by up to 60 percent, which improves server performance and helps increase scalability of the virtual and physical server infrastructure.
 - **SSL offload** – Application server tasks—such as encrypting or decrypting SSL traffic, exchanging keys and performing SSL handshakes—are processor intensive. NetScaler manages the SSL process to free up CPU cycles, thus allowing the servers to respond to more user requests.
 - **Web compression** – You can improve performance by reducing the amount of data sent from Web servers to browsers. Citrix AppCompress™ technology compresses application responses sent to clients in order to improve the overall application performance for end users.

Additionally, AppCompress offloads web servers from these computationally expensive operations, enabling organizations to serve much larger user populations without adding additional server hardware.

- **Static content caching** – Citrix AppCache™ technology provides in-memory storage of static web content, such as images. This frees the web server from having to repetitively generate the same application data for multiple users. In addition, integrated content caching provides faster application delivery by serving popular content immediately out of memory, with minimal data generation cost.
- **Dynamic content caching** – Many web applications host dynamically generated content, thereby negating the benefits of standard caching mechanisms. AppCache technology uses custom-defined parameters to determine whether the content in a specific application response can safely be cached and served to the user. AppCache technology also has safeguards in place to prevent serving outdated information to the user.

Security

Many virtual users connect to the datacenter over a public network, which requires secure communication and secure access. To keep the environment protected, IT must strictly control firewall ports and encrypt communication. An appropriate solution will protect the organization from packet sniffing, contamination of the infrastructure and data loss, as well as enforce compliance policy.

Extend user access without compromising your firewall

- **Challenge** – Allowing virtual workers to access internal resources often requires massive modifications to the organization's firewall configuration. Each application communicates on a different TCP/UDP port. As you open more ports in the firewall, you increase the chances of someone gaining access through one of these firewall holes.
- **Solution**
 - **Encapsulation** – Citrix Access Gateway encapsulates all communication within SSL (port 443). This solution requires only a single port for all applications, which greatly simplifies the implementation and support for a secure access solution.
 - **Rapid on/Rapid off** – In many cases, granting virtual workers secure access requires days or weeks to align networking, directory services and application rules. With Citrix Access Gateway, you can grant a virtual worker secure access in seconds by adding them to the appropriate group(s). You can use the same process to remove the user from an approved group list and completely disable the user's access. You can also immediately change access privileges as virtual workers rotate projects, transfer jobs, complete assignments, or leave the organization.

Maintain control over user access and actions

- **Challenge** – Many organizations must adhere to different compliance standards including HIPAA, DISA or PCIDSS, regardless of the locations and devices of workers. Many security solutions will not adjust to changing virtual user circumstances and cannot ensure compliance when a virtual worker uses a corporate-owned device in the corporate office and later uses a public kiosk.
- **Solution** – Virtual workers must have access to appropriate information, while IT must ensure data privacy and compliance with policy and regulations that require tracking who had access to what data, from where and when. Also, a company may need to deny access to a user from a certain device at a specific time and location; the integration of policies from Citrix Access Gateway and XenDesktop provides security for these use cases.
- Access Gateway access policies and endpoint scans identify endpoints and determine configurations (such as personal or corporate device, antivirus, operating system) and corresponding trust levels.
- When the virtual worker attempts to launch a desktop or application, the associated administrator-defined policies will determine if the resource is available based on time of day, endpoint device characteristics or user identification and if certain functionality such as drives and printing should be permitted.

Centralize data—Avoid malware and spyware contamination

- **Challenge** – With a VPN connection to the internal network, a virtual user's personal machine might appear as if it is on the internal network. Malicious software on the workstation could migrate to the internal network, infecting the entire infrastructure.
- **Solution** – Citrix solutions prevent malicious software that is present on the local device from infecting the internal network through the use of a secure access solution. Users working on virtualized desktops and applications only transfer screen updates and mouse/keyboard movements. IT can configure Citrix to deny all other traffic going into or coming out, adding another layer of protection for the environment.

Productivity

Centralized application management

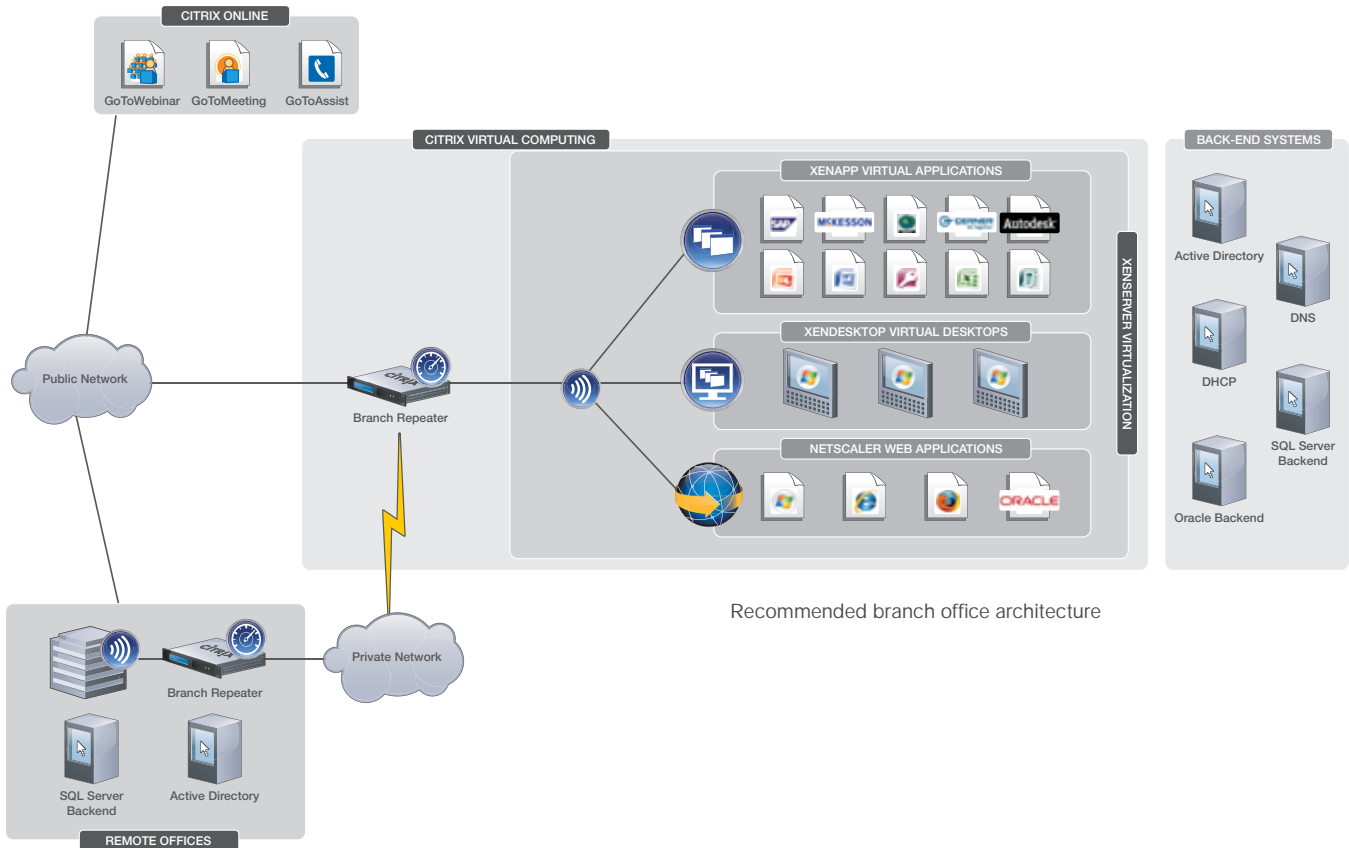
- **Challenge** – Virtual workers require application access, which often dictates support and maintenance of local installations including application updates and patches.
- **Solution** – With XenApp, a key component of XenDesktop, users receive their applications and support from a centralized datacenter. Users get the core applications they need from the XenApp environment either through application hosting or application streaming. IT maintains applications centrally and delivers them to users anywhere. When applications require patches, IT updates the centralized application hub, resulting in automatic updates to every application. Also, if applications experience issues due to changes in the underlying application files, XenApp will automatically repair the application by synchronizing the local application files with the centralized application hub.

Centralized desktop management

- **Challenge** – Many virtual workers require a desktop operating environment based on the organization's standard image. IT must patch these images with the latest operating system security fixes as well as support them in the event of a failure. While machines are being repaired or updated, user productivity declines and IT sometimes needs to provide a temporary device.
- **Solution** – With XenDesktop, virtual workers have a virtualized and centralized desktop operating environment that is always available. If the virtual worker's device fails, they can use any other device to connect to the datacenter and receive their virtualized desktop. The desktop is built on top of XenServer or other preferred hypervisor solutions, which virtualize the underlying hardware so it can support many virtual desktops. Desktop Studio, the administrative console for XenDesktop, streams the operating system from a single base image to each virtual machine. IT maintains this one image and delivers it to thousands of virtual desktops. Finally, XenApp delivers the applications on top of the operating system, providing the user with a desktop environment personalized with their applications.

The branch office user

Organizations may have substantial operations in branch offices, including on-site IT staff. These offices may be the result of a merger or acquisition or an offshore operation, and may include a major manufacturing site, a retail store, or a temporary construction or project site.



Recommended branch office architecture

Economies of scale may dictate how to provide the best experience for branch office users. If multiple users at the same site are doing similar tasks, IT can compress and optimize these tasks and leverage Citrix virtual computing solutions in addition to those described in the previous section.

Efficiency

Work offline and use high-performance applications

- Challenge** – Certain applications are more appropriate for execution on the virtual worker’s local workstation because of the proximity of data, hardware requirements (CAD/CAM) or offline mobility. Installing the applications manually on the device adds complexity to the environment, which requires distributed support.
- Solution** – XenDesktop can deliver applications as needed to XenApp servers, XenDesktop virtual desktops or user devices. When a user launches a streamed application, XenDesktop delivers portions of the application profile to the user device. As

the user works with more functionality within the application, XenDesktop delivers additional sections of the application profile to the device. The application, if configured, will also be functional when disconnected from the network, allowing for offline mobility. Likewise, XenDesktop's local VM-based desktops provide all the benefits of a virtual desktop to the mobile worker. With XenClient™, users can run their virtual machines on their laptop so that they can be productive when they have no network connectivity.

User task duplication

- **Challenge** – Each user receiving a streamed application requires the stream from the centralized application hub, and all this application data travelling across the wire can stress the network connection to the datacenter. If multiple branch office users receive a document in email, the WAN link between the branch office and the datacenter has to send that file once for each user.
- **Solution** – Citrix HDX WAN Optimization technologies help improve the efficiency of the branch office by:
 - Caching Windows objects, bitmaps and common application display data locally at the branch office. Instead of transmitting and receiving the same image across the WAN for hundreds of users' virtual desktops or virtual application sessions, HDX WAN Optimization finds and uses a locally stored version of the object, resulting in faster response times.
 - Caching users' displays from either virtual desktops or virtual applications. When users quickly scroll through a document, HDX WAN Optimization utilizes the locally cached version of the screen representation instead of waiting for the datacenter to respond.
 - Staging application profiles locally so streamed application communication only crosses the network link once for the entire site versus once for every user. The combined benefits of reducing the amount of data traversing the WAN and accessing applications over the LAN instead of across the WAN greatly improves speed and usability for the branch office users.

Traffic compression

- **Challenge** – Virtual workers access the datacenter from locations with varying bandwidth speeds. Some offices have poor performance and others have exceptional performance; users have no choice but to accept slow session responsiveness when the network bandwidth is low.
- **Solution** – An ever-changing virtual worker environment requires technology that adjusts based on the current health of the link. Citrix Branch Repeater™, located in both the branch office and the datacenter, works in tandem with XenDesktop to provide an

optimal delivery experience. Included within Branch Repeater is Citrix HDX WAN Optimization technology, which examines the traffic and determines if:

- The penalties with TCP communication and flow control are wasting bandwidth. First, TCP does not know the bandwidth of each link; to gain this understanding, TCP gradually increases the send rate for each successful round-trip packet and, once a collision occurs, TCP reduces the rate by 50 percent and only slowly increases it again. HDX WAN Optimization technology optimizes the flow of traffic by defining the available bandwidth and foregoing the 50 percent penalty for collisions as well as the slow bandwidth startup.
- Multi-level compression can help save bandwidth and speed up delivery.
 - > First, HDX WAN Optimization monitors the communication across the wire and generates a history. If a part of the communication is repeated, HDX WAN Optimization doesn't send the chunk of data again, it sends a token telling the other end where to find the data on the local device. For example, if an email is sent to a group of users in a branch office, HDX WAN Optimization would send the information once, and then the branch office would pick up the data and re-use it for the other local requests at a significant bandwidth savings while greatly increasing the speed for the user. HDX WAN Optimization does not work at the file level; it works at the data stream level, which makes it more capable than other solutions. If the same picture is in an email, Microsoft Word document and PowerPoint presentation, that picture only crosses the wire once because the packet-level communication for the picture is the same across applications.
 - > Second, multi-level compression identifies the best compression approach to take based on the type of data being sent. For example, small chunks of data will be compressed with a memory-based compression due to the speed advantages. Larger chunks of data are best suited for disk-based compression, due to the cost savings from disk versus RAM. For data that is more random, such as TCP-based video, an intra-session compression algorithm similar to LZS or Zlib will be used. HDX WAN Optimization selects from among different options based on the type of data compressed, which provides the optimal compression ratios.

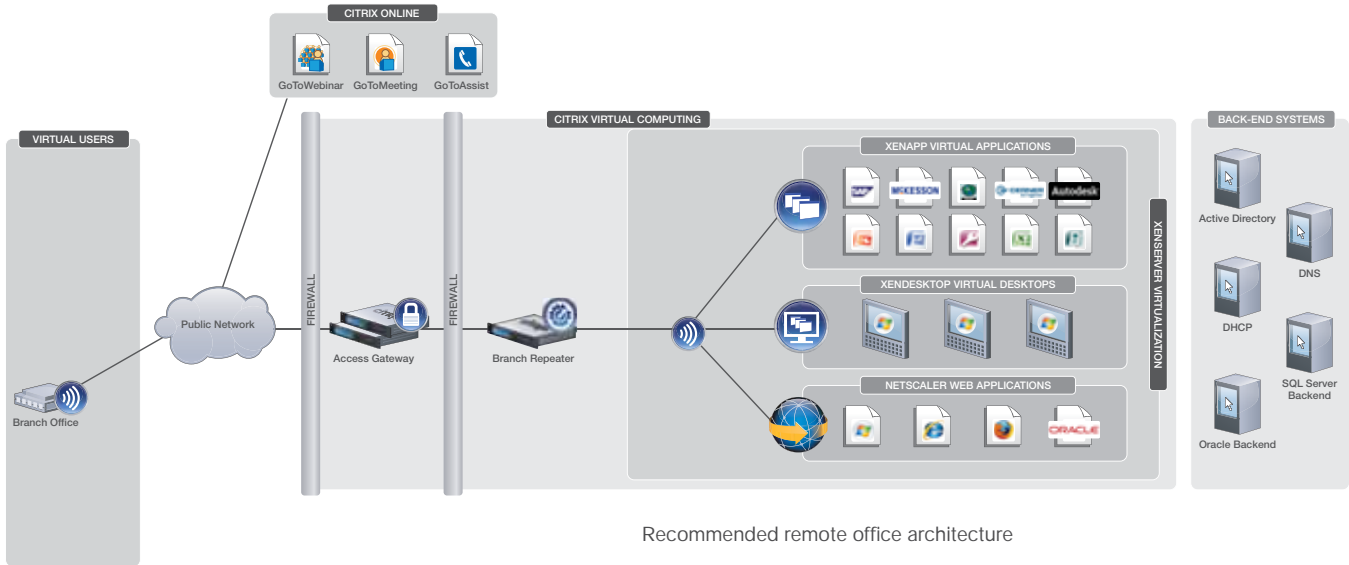
Collaboration and support

Colleague interactions

- **Challenge** – Workers need to be able to easily share ideas with each other, build relationships and complete projects in a timely manner—without incurring travel time, travel costs or extensive monthly communication bills.
- **Solution** – Workers in any location can connect to a cloud-based Citrix GoToMeeting conference and collaborate with each other. Each participant connects to the GoToMeeting service with a meeting ID; the virtual meeting space does not store files or resources. The host of the meeting:
 - Shares his/her screen so others within the meeting can see and collaborate on the appropriate materials simultaneously
 - Allows other attendees to have mouse and keyboard control of the meeting, thus giving others the ability to make changes and interact with the visible desktop
 - Highlights key sections on the screen with drawing tools and uses chat to get group feedback
 - Can enable other attendees to show their screens and present or work on their own materials

The remote office user

The remote office may be a local sales or services office, a retail store or kiosk, a small production plant or warehouse. Typically, IT staff don't work at remote offices.



To provide the best virtual worker experience for the remote office user, IT must secure and optimize communication to the fullest extent possible without compromising usability. In addition to the underlying Citrix virtual computing infrastructure, IT can take advantage of the following solutions when working with the remote office user group.

Security

Instead of locating security devices within the remote office, far from IT staff, organizations can leverage Access Gateway to provide remote office users secure access to centralized resources, as explained in the infrastructure section of this paper.

Productivity

Multimedia

- **Challenge** – Remote office users often experience sporadic, jittery and poor quality multimedia, resulting in low user acceptance of the solution.
- **Solution** – Within XenDesktop and XenApp, as a user launches streaming media (i.e., DivX, XVID, MPEG, MP3, etc.), Citrix HDX MediaStream optimizes transmission. Instead of breaking the media down into chunks of information focusing on screen updates, HDX MediaStream automatically re-routes the stream directly to the virtual user's endpoint, rather than to the server to which the user is connected. This provides the virtual user with smoother performance and a high-definition video experience.

Graphical resources

- **Challenge** – Many applications include high-quality graphics (with millions of colors) or contain graphical images that change frequently. When a remote office worker utilizes one of these applications—which can be as simple as Adobe Acrobat Reader or PowerPoint or more complex like PACS, GIS or CAD applications—the graphical content causes the application to stall while downloading the graphical information. Large portions of animations tend to go missing as the data does not stream to the user quickly enough.
- **Solution** – When Citrix XenDesktop encounters a graphically rich application, it invokes the Citrix HDX 3D technology in a multi-pronged optimization. First, it compresses high-quality static graphics, which greatly reduces the amount of data traffic but doesn't affect what users see. Second, when users manipulate the image, the HDX 3D technology dynamically increases the compression further so the image transitions occur more smoothly and fluidly and the user can move and edit the image accurately without noticing a lag in application responsiveness. Finally, as soon as the image stops moving, it reduces compression to the full, high-definition picture quality.

Collaboration

In addition to the challenges branch office users experience in collaborating with colleagues, remote office users also confront the following:

Support

- **Challenge** – Virtual workers must often deal with IT issues themselves. This often results in long downtimes, especially in the event of a major issue with a machine or device.
- **Solution** – With Citrix Receiver™ installed on the remote office user's machine or device, the remote support team can see exactly what the virtual worker sees on his/her computer screen through the use of Citrix GoToAssist. A worker simply selects Citrix Receiver and launches a support request, which goes to a remote support team member who contacts the virtual user and, with the worker's permission, sets up a screen sharing session that enables the technician to view and control the worker's computer just as if they were sitting side by side. This not only enables them to solve the problem quickly, but also educates the virtual worker, who sees everything the technician is doing.

IT maintenance

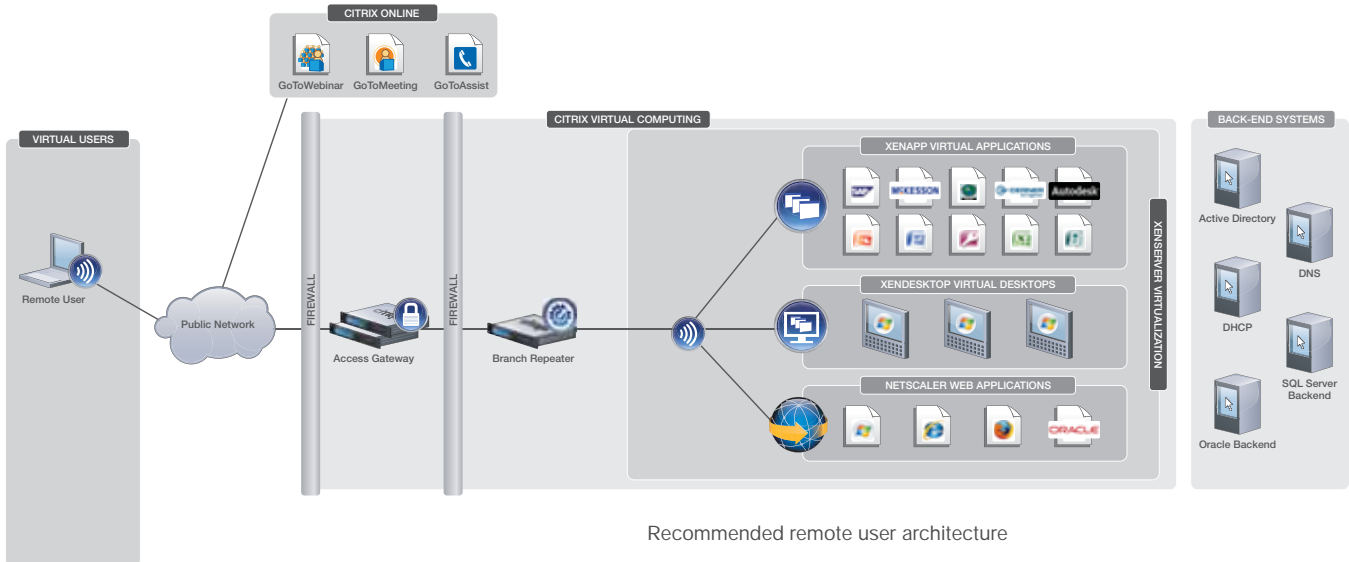
- **Challenge** – Remote IT staff need to manage routine maintenance and upgrades at remote offices, often after business hours. Onsite visits require time and money that could be better used on building the business.
- **Solution** – The IT team can use Citrix GoToManage® to remotely view and control computers and to monitor machines, networks and servers from any location. IT can provide remote maintenance with the virtual worker present at his/her computer, or in unattended sessions after hours.

Training

- **Challenge** – Remote office users often have to learn new applications on their own, as travelling to the training center takes too much time and costs too much. This results in longer learning curves for the remote office users and slower adoption of new, more advanced solutions.
- **Solution** – Virtual workers can attend live or pre-recorded training through GoToMeeting®, Citrix GoToWebinar®, or Citrix GoToTraining®, depending on the class size and interactive features required. IT can offer pre-recorded training on demand whenever the virtual worker needs it.

The remote user

The remote user category includes field and roaming employees, road warriors, telecommuters and teleworkers. These workers consider their office to be anywhere including labs, exam rooms, customer locations, temporary project sites or events, home, hotels, airports or even coffee shops.



Remote users benefit from the same solutions that help branch-office and remote-office users, but with additional capabilities to allow offline work and more collaboration options. The following Citrix solutions help address these needs.

Security

The remote user and the branch office user both traverse public links to reach the datacenter. Both require similar security solutions from Citrix, including SmartAccess, as discussed in the infrastructure section.

Productivity

Like remote office or branch office users, the remote user leverages any available network connection, where bandwidth and latency are unknown and requires many of the same solutions, including those that address:

- Multimedia
- Graphical resources
- Traffic compression

Additionally, remote users must also be productive in a disconnected fashion, which requires:

Offline mobility

- **Challenge** – Remote workers are often on an airplane, at a customer site or in transit. Without connectivity, they can't be productive unless they install applications locally, which increases application support costs.

- **Solution** – Citrix XenDesktop and XenApp support offline remote workers through application streaming. When remote workers make a connection to Citrix, they see a list of their applications, some of which are streamed applications. The Citrix infrastructure delivers streamed applications to the remote worker's device in a complete and encapsulated package that is kept separate from the rest of the device. This prevents application conflicts and residual application traces. When users disconnect from the network, they can still start the streamed applications. Once the user reconnects to the corporate network and launches the locally streamed application, the network validates it and automatically updates it as needed. Note: Only applications that can properly function without access to backend data are good candidates for offline mobility and can be fully encrypted by using XenClient. Also, offline applications should adhere to security and compliance policies focusing on local storage of corporate data.

Collaboration

The remote user requires an extensive set of resources to communicate and interact across the extended organization. Many of these solutions are also critical to the success of the remote-office and branch-office users (described earlier in this paper), and address:

- Colleague interactions
- Support and IT maintenance
- Training

The remote user requires an additional set of solutions to provide collaboration in the following areas:

Visibility

Voice connectivity

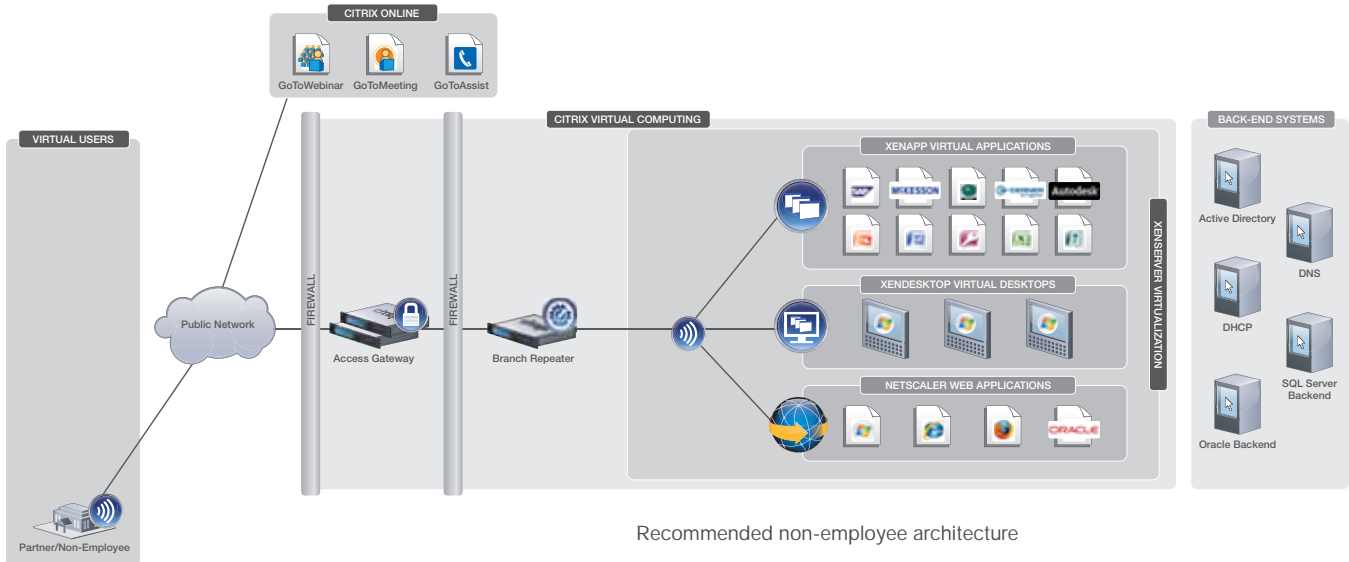
- **Challenges** – Each remote user needs a way to talk easily to clients and co-workers. Mobile phones are a costly solution for general use and in some instances offer only sporadic coverage.
- **Solution** – Citrix provides solutions for any number of circumstances requiring audio conferencing:
 - GoToMeeting, GoToWebinar and GoToTraining – These Citrix collaboration solutions include integrated audio conferencing through Voice over Internet Protocol (VoIP), local toll-based numbers and, with additional purchase, toll-free numbers in more than 40 countries. Integrating audio with web conferencing makes it easy for remote users to interact with colleagues and customers while reducing communication costs. Whether it be a one-on-one online meeting or a webinar with hundreds of participants, remote users can stay in sync with both visual and audio communication.

Video connectivity

- **Challenge** – Seeing and hearing people are major facets of collaboration and an important aspect often missing in the virtual workforce.
- **Solution** – With third-party webcams, remote workers can use Citrix solutions to enable video conferencing calls.
 - GoToMeeting with HDFaces™ – Using the HDFaces video conferencing feature included with GoToMeeting, remote workers can share their webcam and view up to five other webcam streams (for a total of six streams) in an online meeting. At the same time, meeting participants can also collaborate on a shared desktop screen. This creates a natural, interactive experience that helps eliminate misunderstanding and fosters stronger relationships.
 - Citrix solutions may also support other video conferencing software. The remote user can use his/her locally attached webcam through HDX Plug-and-Play. Depending on the format of the webcam video stream, the HDX MediaStream technology may augment the quality and speed of the video.

The non-employee user

Non-employees include business partners, consultants, outsourced teams or contingent workers, such as contractors or temporary workers. They can work onsite or offsite. The non-employee does not have the ability to install equipment within the environment to work with the organization.



The non-employee needs the same solutions as the previous three user groups, expanded to provide greater security.

Security

The non-employee user may traverse public or private network links to reach the datacenter. Regardless of the infrastructure used, IT must strictly control the resources the non-employee can and cannot access. IT can accomplish this with the following technologies:

- **Endpoint scans** – Non-employees will connect and authenticate to the Citrix environment, as will their workstations. The environment will determine workstation characteristics like antivirus scanners, patches, hotfixes or even if the device is corporate-owned, and depending on these characteristics will then grant or deny access to portions of the infrastructure through SmartAccess.
- **SmartAccess** – Based on the endpoint scan results, a non-employee will only have access to virtualized desktops, data, applications and application functionality. The endpoint scans and SmartAccess technology work in conjunction with XenDesktop or XenApp policies to enable or disable functionality within the environment. This deep integration allows non-employee users to access identified applications, without the ability to save or print material from the application.
- **Smart Auditor** – Policies can be set to record non-employees' application sessions. The recording is available for security audit to view at a later date either as an ongoing monitoring process or to track down an unauthorized breach into the system.

Productivity

Similar to branch office users, a non-employee uses any available network connection, where bandwidth and latency are unknown and requires the same solutions to address:

- Multimedia
- Graphical resources
- Traffic compression

Collaboration

The non-employee user requires an extensive set of resources to communicate and interact across the extended organization. Many of these solutions are also critical to the success of the remote office and branch office users, addressing:

- Colleague interactions
- Support
- Training
- Voice connectivity
- Video connectivity

Conclusion

Workshifting fundamentally transforms the way business is done. Organizations that embrace a workshifting strategy drive growth through rapid branch expansion and prompt integration of mergers and acquisitions, better serve customers and empower employees while at the same time controlling costs. With this incredible potential for positive impact on the bottom line, it's no wonder many organizations are ready to embrace workshifting and create a virtual workforce of diverse workers—from any department, role and status—distributed across geographic boundaries and between enterprises.

To help these workers maximize their productivity regardless of where they work, when, what type of work they do, or what device they use, IT must provide service levels comparable to those at the headquarters. IT must also cater for individual needs and choice of device, protect corporate data and ensure a high definition experience—all without adding complexity or expense.

Citrix provides a single core, tightly integrated virtual computing solution that delivers the virtual worker a personalized, optimized and secure environment based on an architecture that is:

- Efficient to help control costs
- Secure to protect corporate data and intellectual property and adhere to compliance policies
- Productive to help users do their jobs quickly and accurately
- Collaborative to allow all users to work together to create the best options, ideas and solutions

Unlike piecemeal solutions, only a comprehensive Citrix solution can:

- Tightly control access to resources, while protecting, encrypting and auditing virtual worker sessions with Access Gateway
- Save hardware costs with better server utilization for application processes by offloading expensive networking communication processes to NetScaler
- Save costs by simplifying maintenance through optimization and standardization on a build-once, deliver-anywhere model that utilizes XenServer and Citrix Provisioning Services
- Deliver the appropriate resources for every user regardless of device or location with the use of XenDesktop, XenApp and XenClient
- Create a headquarters-like computing experience for all users with integrated Citrix HDX technologies
- Provide online collaboration and support tools to allow greater levels of communication and interaction through the use of solutions including GoToMeeting, GoToWebinar, GoToManage and GoToAssist

Next steps

To develop and implement a workshifting architecture, first assess user interest and the business demand. You'll then need to establish a virtual workforce policy. Once you have laid this groundwork, it's time to start.

1. Identify business and IT requirements to build or expand a virtual workforce.
2. Calculate potential cost savings across labor, travel, facilities and IT budgets.
3. Create a pilot of Citrix virtualization solutions and set up GoToMeeting and GoToManage trial accounts to show a set of virtual workers the value of the solution.
4. Design and roll out a more complete solution that can support the entire organization, from the virtual worker to the local employee.

For more information on how workshifting can fundamentally transform your business, visit www.citrix.com/workshifting.

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About Citrix

Citrix Systems, Inc. (NASDAQ:CTXS) is a leading provider of virtual computing solutions that help companies deliver IT as an on-demand service. Founded in 1989, Citrix combines virtualization, networking, and cloud computing technologies into a full portfolio of products that enable virtual workstyles for users and virtual datacenters for IT. More than 230,000 organizations worldwide rely on Citrix to help them build simpler and more cost-effective IT environments. Citrix partners with over 10,000 companies in more than 100 countries. Annual revenue in 2010 was \$1.87 billion.

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