Technical Guide to Application Delivery Option(s) for XenApp™ and/or XenDesktop™

Determining the best technical solution for delivering applications to users can initially seem overwhelming, especially for organizations that deliver hundreds or thousands of applications.

Citrix provides many options for application delivery. This document focuses on the options that are available, as well as the criteria that should be used by architects and administrators when making these decisions.

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Introduction

Decoupling the operating system, user profile, and applications enables administrators and architects to provide customized user environments. Citrix technologies provide many ways to deliver applications to users, and this document will focus on the application portion of the equation. Each organization is unique in terms of business, technical, and user requirements, and from a technical standpoint, deciding which applications to deliver via which method can be complex.

To facilitate the technical decision-making process, this guide contains the following sections:

- Application Delivery Options
- Application Delivery Criteria
- Presenting Applications to Users
- Case Scenario: 3D Application
- Resources

Options for Delivering Applications to Users

Throughout this document, we will reference the many options that are available to administrators and architects for delivering applications to users. Specifically, these are:

<table>
<thead>
<tr>
<th>XenApp</th>
<th>XenDesktop</th>
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<tbody>
<tr>
<td>Install on XenApp server</td>
<td>Install on XenDesktop</td>
</tr>
<tr>
<td>Stream to XenApp server</td>
<td>Stream to XenDesktop</td>
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<tr>
<td>App-V to XenApp server</td>
<td>App-V to XenDesktop</td>
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<td>Stream to Windows client</td>
<td>On-demand apps for XenDesktop:</td>
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<tr>
<td>App-V to Windows client</td>
<td>• Installed on XenApp server</td>
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<tr>
<td>VM Hosted Apps</td>
<td>• Streamed to XenApp server</td>
</tr>
<tr>
<td></td>
<td>• App-V to XenApp server</td>
</tr>
<tr>
<td></td>
<td>• XenApp VM Hosted Apps</td>
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</tbody>
</table>
Versions of XenApp and XenDesktop

For the purposes of this document, references to XenApp and XenDesktop are based on the following versions:

- XenApp 5 for Windows Server 2003
- XenApp 5 for Windows Server 2008
- XenApp 6 for Windows Server 2008 R2
- XenDesktop 4

The latest Hotfix Rollup Packs and Service Packs are assumed as these provide the most up-to-date functionality.

Licensing

From the Citrix standpoint, this document assumes the availability of the XenDesktop Platinum or Enterprise edition, and all options discussed are available with those editions. XenApp Platinum and Enterprise editions provide only those options listed under the XenApp list on the previous page.

From the Microsoft standpoint, this document assumes the appropriate licensing, which is based on the following:

- Operating System
- Terminal Services/Remote Desktop Services Client Access License
- Microsoft Desktop Optimization Pack
- Software Assurance (Windows client)
- Virtual Desktop Access (non-Windows client)

Please contact your Microsoft representative for more information regarding licensing.
Application Delivery Options

From the user perspective, exactly how applications are delivered should be transparent. Administratively, Citrix provides many options for delivering applications to the users. The following table represents the core underlying technologies, which will be further described in subsequent sections:

<table>
<thead>
<tr>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Apps</td>
<td>• Applications can be installed onto XenApp servers or embedded within the XenDesktop virtual desktop vDisk image</td>
</tr>
<tr>
<td>Streamed Apps</td>
<td>• Through Citrix Streaming (which now includes the capability to deliver Microsoft App-V sequences), applications can be profiled/sequenced and then streamed into isolated environments on XenApp servers, XenDesktop virtual desktops, and/or Windows physical desktops</td>
</tr>
<tr>
<td>VM Hosted Apps</td>
<td>• An application can be hosted within a single-user environment on a virtual or physical Windows desktop and accessed as a XenApp published application</td>
</tr>
</tbody>
</table>

Installed Applications

Installed applications imply those applications that are installed directly onto either XenApp servers or virtual desktops. Installed applications can be embedded into the base server image or installed separately from the operating system. Installed applications typically install into the c:\Program Files folder.

XenApp

Since the early days of XenApp technologies, administrators have been installing applications and enabling multi-user access. Applications installed on XenApp servers can be presented to users as published applications. In addition, the XenApp Connector for System Center Configuration Manager can be used to publish resources. For more information, please see http://www.citrix.com/English/ps2/products/subfeature.asp?contentID=2301676.

Virtual Desktop

Within the vDisk used to generate virtual desktops, applications can be embedded and are thus included as part of the user desktop. Thus, the applications would be self-contained and pre-installed within the virtual desktop.
Best Practices and Considerations

Best practices and considerations for installing applications directly onto XenApp servers and/or XenDesktop virtual desktops include:

- **Familiar Process.** Especially for those administrators accustomed to installing applications directly onto XenApp servers or vDisk virtual desktop base images, this process is easy and familiar.
- **Unpackaged Application Installation.** Applications without MSI or EXE packages can be installed directly onto servers or desktops. Where possible, the installation should be automated via script or embedded into the base image.
- **Automate Installation Method.** Installing applications manually leaves room for error. Applications should be installed via an automated method. Whether applications are embedded into the base image or installation is automated via a software distribution mechanism, manual installation should be avoided wherever possible.
- **Multi-User Aware.** For XenApp environments, applications that are not multi-user aware can only be accessed by a single user. In order to service multiple users on the same server, multi-user functionality is required.
- **Ascertain Application Compatibility/Sociability.** Not all applications can co-exist on the same computer if application conflicts occur. For example, some older applications may place DLLs or other files into the `c:\Windows\System32` folder, which may create a conflict.
- **Testing.** Where application compatibility/sociability issues may exist, testing should be performed to ascertain any peculiarities that may impact multiple applications being installed on the same computer.

Streamed Applications

Streamed applications are based on application packaged by means of Citrix Profiler or App-V Sequencer. Both App-V sequences and Citrix Streaming profiles can be used to deploy isolated applications on XenApp servers or XenDesktop virtual desktops. In order to use App-V sequences to stream applications, it is necessary to incorporate the App-V integration that is available through MyCitrix.

Application streaming is especially compelling where multiple versions of an application are required on the same computer or application conflicts exist. Also, where organizations choose to offer a base operating system with application customization based on streamed applications. On the other hand, application streaming should not be used where the applications cannot be profiled/sequenced, where streamed application performance is unacceptable, or where application streaming negatively impacts the network.

**XenApp**

Application streaming is initiated by means of XenApp published application configuration, regardless of whether the application is ultimately installed into an isolated environment on a XenApp server, virtual desktop, or physical desktop.
When installing streamed applications onto XenApp servers, pre-caching is recommended to ensure that the initial user session does not appear to be slow. When a user requests access to an application, regardless of whether it is hosted or streamed, the load balancing process directs the user to the least loaded server. The user session is initiated on that server, and then the request for the specific application is invoked. If the application is pre-cached, the user sees no noticeable difference in the application startup time as compared with a hosted application. However, if the application is not pre-cached, the application must then be streamed to the server for the first user’s initial session. All subsequent users will then use the now locally cached virtual application.

In addition to streaming applications to XenApp servers as the primary method of access, dual mode streaming can be invoked so that users first attempt to access the streamed application on the physical or virtual Windows desktop and then fallback to XenApp Hosted applications. For example, if a users accesses an application by means of a mobile device, streaming to that devices is not possible, and thus the user would fallback to accessing the application by means of the XenApp shared host through session virtualization.

Because Microsoft licenses App-V to Terminal Services computers based on Remote Desktop Services Client Access Licenses (formerly Terminal Services Client Access Licenses), administrators may use App-V to stream applications to XenApp servers that are properly licensed based on Remote Desktop Services Client Access Licensing.

Virtual or Physical Desktop

Applications can be streamed to virtual and/or physical Windows XP or higher desktops using Citrix Streaming technologies. When using App-V with Citrix Streaming, ensure compliance with Microsoft licensing requirements which have changed effective July 1, 2010.

Because the applications are installed into isolated environments on desktop workstations, administrators should ensure that sufficient space is available to cache the streamed applications.

Best Practices and Considerations

Best practices and considerations for streaming applications to XenApp servers, virtual and/or physical desktops include:

- **No Application Conflicts.** Application streaming eliminates application conflicts because applications are run in isolated environments. You may enable applications to contact one another where necessary, through inter-isolation communications.
- **Decoupling Operating System and Applications.** By using application virtualization and streaming, the base operating system and applications can be segregated, thus creating a customized user environment.
- **Operating System.** Create the profile or sequence based on the same operating system as the target device. Dissimilar operating systems may work but should be fully tested.
Consider Space on Target Devices. Minimize application options if space on target devices is unknown. For example, it may be necessary to eliminate some Microsoft Office functionality if space is unavailable.

Runtimes. Profiling/sequencing problems may relate to runtime such as .NET Framework version. It is best to pre-load runtime on profiler/sequencer and target machine.

Packaging Effort. As with all managed software delivery methods, application deployment is not as simple as double clicking an MSI or EXE file. Additional effort and resources are required to package applications for delivery.

Streaming Incompatibility. Applications should be tested to ensure that they can be virtualized as there may be a small number of applications that cannot be virtualized.

Pre-Cache Applications. The normal behavior for streamed applications is based on fetching and running in an isolated environment on first request. Pre-caching applications eliminates the initial delay for streamed applications. Where users are offline or minimal bandwidth is available, such as when traveling or in a remote location, pre-caching should be used.

Bandwidth/Distribution Points. When a multitude of users access applications that are streamed for first-time use at the same time, such as Monday morning at 8:00 AM, bandwidth and distribution points may become saturated. Consideration should be given to staggering application deployment and/or pre-caching applications.

Licensing. Ensure compliance with Microsoft and Citrix licensing with respect to Application Virtualization, Citrix Streaming, and App-V.

Dual-Mode Streaming. Where properly licensed and warranted, enable dual-mode streaming so that users can access applications from a XenApp server when it is not possible to access the streamed applications on a virtual or physical workstation.

VM Hosted Apps

XenApp Enterprise and Platinum licensing includes VM Hosted apps, which adds application delivery via a Windows XP, Vista, or 7 desktop using session virtualization. VM Hosted Apps makes use of XenDesktop infrastructure to host applications on a Windows-based virtual machine or blade PC.

VM Hosted Apps allows one application to be published and presented as a single seamless XenApp hosted application. The application can be a single application, such as a CAD application, or it can be a single application that represents a consolidation of multiple applications. The application(s) access can contact helper applications on that same Windows-based desktop. For example, if a CAD application is deployed as a VM Hosted App and it can export data to Excel or Word, these helper applications can likewise be made available.
Best Practices and Considerations

Best practices and considerations for employing VM Hosted Apps to host applications include:

- **Applicability.** VM Hosted Apps is commonly used for applications that are resource-intensive and/or require a Windows workstation operating system.
- **Licensing.** VM Hosted Apps requires XenApp Enterprise or Platinum licensing.
- **Farm.** The farm infrastructure supporting VM Hosted Apps is distinct from the XenApp farm and is consolidated by means of Web Interface.
## Application Delivery Criteria

When determining how applications will be delivered, administrators and architects have many decisions to make. Now that the options have been reviewed, the applications should be critiqued in order to arrive at the best decision.

As an example, the following questions should be addressed:

<table>
<thead>
<tr>
<th><strong>Packaging</strong></th>
<th>Is the app based on a standard MSI or EXE?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Does the app install follow Microsoft standards, including installation location?</td>
</tr>
<tr>
<td><strong>Backend Data</strong></td>
<td>Where is the backend data repository?</td>
</tr>
<tr>
<td></td>
<td>Are communications with the data resource bursty and/or intensive?</td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td>Are CPU or memory heavily utilized?</td>
</tr>
<tr>
<td></td>
<td>Are resource requirements consistent or bursty?</td>
</tr>
<tr>
<td><strong>Operating System</strong></td>
<td>Are there limitations or support requirements based on operating system?</td>
</tr>
<tr>
<td><strong>Licensing</strong></td>
<td>What is legal within the boundaries of Microsoft, Citrix, and application vendor licensing?</td>
</tr>
<tr>
<td><strong>Usage</strong></td>
<td>How many users require this app? Are they task-based, power users, or light users?</td>
</tr>
<tr>
<td></td>
<td>Do users require access to the application when offline?</td>
</tr>
<tr>
<td><strong>User Data</strong></td>
<td>Where are user settings and data saved, including home directory and user profile?</td>
</tr>
<tr>
<td></td>
<td>Does the app have any unique requirements that impact the user profile?</td>
</tr>
<tr>
<td><strong>User Experience</strong></td>
<td>How does the user expect the app to perform?</td>
</tr>
<tr>
<td></td>
<td>Has the user experience been validated?</td>
</tr>
</tbody>
</table>

Some of these items will be further explored in subsequent sections.

### Packaging

Most applications install into `c:\Program Files` or `c:\Program Files (x86)` and can be packaged as MSI or EXE files, thus following Microsoft standards. Applications that do not follow Microsoft development standards may present challenges.

Although more common for older and internally-developed applications, it is possible that some vendor applications do not follow Microsoft application standards. Where deviations exist, potential issues may arise regarding application compatibility/sociability, as well as packaging. In particular, applications that cannot be packaged and thus do not install into standard folders may impact co-existence with other applications. As a result, these applications may not be compatible with other applications and thus cannot be housed on the same computer as hosted applications.
Backend Data

Citrix recommends locating XenApp and/or XenDesktop applications physically and logically near backend data resources in order to optimize responsiveness. This is because the user experience is improved where data requests are fulfilled quickly and efficiently.

Where applications must fetch data across WAN links, the response time may be latent. Branch Repeater may improve the responsiveness of the backend data source where it resides across a WAN link.

Application Usage

Most organizations support one or more applications that are required by just a handful of users. Where only a few Windows-based users require access to those applications, streaming to the desktop may represent the best option since it requires little to no additional testing.

To ensure redundancy, administrators may wish to enable dual-mode streaming and isolate the application on at least two XenApp servers. When profiling or sequencing the application, it should also be packaged and tested based on the operating system of the XenApp servers.

User Profiles

During logon to XenApp or XenDesktop resources, the user profile is loaded. The user profile includes settings from HK Current User, which are primarily customizations within the Control Panel.

In addition, user data, such as the contents of the AppData folder, are loaded as part of the user profile unless it has been administratively redirected by means of Active Directory GPOs. Where folder redirection is configured, user data is not loaded as part of the user profile and the user profile thus loads faster.

In many cases, folder redirection is desirable in order to enable faster user profile loading time. However, some applications make frequent calls to the AppData folder and thus frequent calls to the folder repository are required during the user session. From the user perspective, the application will appear to be slow or unresponsive while this data is fetched from the repository housing the redirected folder.
To determine whether applications make frequent calls to the AppData folder, testing should be performed. A basic tool that can be used for this purpose is Process Monitor from Microsoft SysInternals (http://technet.microsoft.com/sysinternals). By means of Process Monitor, application calls to the AppData folder in particular should be monitored in order to determine which folders are candidates for redirection.

Another consideration relates to the user profile solution itself. Where XenApp and XenDesktop are accessed at distinct times, any user profile solution will suffice. However, where XenApp and XenDesktop are accessed concurrently, such as where XenApp-hosted applications are accessed through XenDesktop, the user profile solution should be carefully considered. In this scenario, network-based roaming profiles should not be used because last writer wins issues will impact the user experience. Instead, network-based mandatory profiles, Citrix Profile management, and/or third-party user profiles should be considered. For additional information regarding user profile considerations, please see CTX124799.

Special Requirements

Some applications have special requirements such as printing, graphic rendering, and hardware modules. As an example, a payroll application may require use of a special check printer. These requirements should be addressed during pre-production testing.

Application Impact on Enterprise/Platinum Components

When considering how applications will be delivered to users, the following questions should be raised regarding optional features:

- **Single sign-on (Password Manager)**
  - Does the app follow standards and/or can password fields be identified?
- **CPU/Memory Optimization (XenApp only)**
  - Does the app function with CPU and/or Memory Optimization?
- **SmartAuditor (XenApp only)**
  - If application selected as the criteria, is it the only or first app opened?
Presenting Applications to Users

Citrix provides a number of ways to present applications to users. Regardless of the interface used, HDX technologies provide enhancements and optimizations.

XenApp and/or XenDesktop Presentation

These options are based on the XenApp and/or XenDesktop technologies used and include the following:

- Published apps or published desktop
- Published desktop or virtual desktop
- XenApp Web or XenApp Services site
- Streamed apps presented via XenApp Services
- Access XenApp-based apps via physical workstation or virtual desktop
- Dazzle

Administrators can advertise XenApp and XenDesktop resources within a single Web Interface site. However, a better option would be to present XenApp resources through XenDesktop. By doing so, users are presented with a clean, straightforward interface.

Dazzle provides a self-service application storefront that enables users to select the applications needed. It requires the following components:

- Merchandising Server: Virtual machine that houses and manages plug-ins
- Citrix Receiver plug-in for Dazzle: Enables app store

HDX Technologies to Optimize the User Experience

Citrix HDX technologies provide a High-Definition User Experience and are geared toward optimizing the look and feel of applications. These technologies optimize media-rich applications, peripherals, ICA traffic, and much more. Examples of HDX functionality:

- HDX 3D Pro Graphics is a feature of XenDesktop Enterprise and Platinum editions for delivering high-end 3D professional graphics applications, including OpenGL and DirectX based applications, that demand the power of a graphics processing unit (GPU) for hardware acceleration.
- HDX Monitor for XenDesktop can be used to validate the operation of HDX technologies including the latest HDX MediaStream for Flash and HDX RealTime features.
- HDX technologies enable an optimized user experience for not only Microsoft Office Communicator instant messaging and voice chat but also XenDesktop 4 adds webcam support via isochronous USB remoting.

Please see http://hdx.citrix.com for more information.
Case Scenario: 3D Application

Due to their highly graphical nature, 3D applications have special requirements. From a physical standpoint, additional processor and memory resources, as well as graphics cards are common recommendations. As you will see below, Citrix provides a number of technologies that can be used to address 3D applications.

Given the following criteria, what is the best option for deploying a 3D application?

- About 10 users need access to a new 3D geographic application
- Licensed based on single-user workstation
  - May or may not work in a multi-user environment
- Heavy CPU and memory requirements
- XenApp Platinum licensing
- Microsoft Software Assurance licensing
- Sufficient hardware budget has been allocated for justifiable purchases

Based on this information, VM Hosted Apps based on blade PCs equipped with dual CPUs, abundant RAM, and powerful graphics cards would provide the best solution as it would be in compliance with app, Citrix, and Microsoft licensing requirements.

As you are testing this solution, you realize that you also need to take into account several additional criteria:

- A XenApp hosted CRM application will be used with the 3D application to paste diagrams into work orders
- Terminal Services roaming profiles are used for XenApp-based user sessions
- Users previously rejected mandatory user profiles
- All user folders are redirected by Active Directory GPOs
- The 3D application communicates with the AppData folder frequently
- Your company just upgraded all of your XenApp licenses to XenDesktop

With these additional pieces of information, the solution will change:

- The user profile will need to be transitioned from a Terminal Services roaming profile because that profile type is not applicable to either VM Hosted Apps or XenDesktop. Citrix Profile management or a third-party profile solution would be the best options to avoid last writer wins issues that present themselves with network-based roaming profiles.
- Redirection of the AppData folder should be reconsidered based on the chattiness of the application.
- So far as cutting/pasting between the XenApp and VM Hosted Apps applications, this functionality is enabled by default, and it should be ascertained that it has not been disabled by policy.

Deciding whether to proceed with VM Hosted Apps or XenDesktop for this application requires more information and an understanding of additional environmental factors. Either solution would technically be sufficient, and the final decision may depend on business requirements.
Note that the XenApp server is not being considered to host the application due to the heavy resource requirements. Although XenApp offers CPU optimization to provide fair sharing of CPU resources, XenDesktop and VM Hosted Apps represent better solutions for an application that is resource-intensive.

In any event, it would be useful to do the following:

- Configure the HDX SmartRendering bandwidth threshold to check endpoint resources (CTX124777)
- Use HDX 3D for Professional Graphics to take advantage of the power of a GPU for hardware acceleration
- Use video cards that are nVidia CUDA enabled and use multiple nVidia processing cores

As has been shown, the characteristics of the application will determine the technical options for delivering it to users. Additional business requirements may drive the application delivery method towards a specific solution.
Resources

Where feasible and/or necessary, testing should be undertaken to ensure application functionality and compatibility. Testing should always be done in a test farm to ensure that production farm resources and users are not impacted. Application testing should encompass the following:

- **Standalone**
  - OS compatibility
  - Data calls
  - Resource requirements
  - Peripherals
  - Multi-user (XenApp)
- **Sociability**
  - Compatibility with other apps (hosted or streamed)
  - Resource/peripheral sharing
- **Pre-Production**
  - Expert users
  - Impact on data (profiles, user, backend)
  - Scalability
  - Network impact

It may be helpful to incorporate Service Monitoring (EdgeSight) and/or Load Testing (EdgeSight for Load Testing) as appropriate. In addition, the Citrix Ready web site includes community input regarding specific applications and can be located at [http://community.citrix.com/citrixready](http://community.citrix.com/citrixready).

When testing applications for functionality and compatibility, Citrix provides no-cost evaluation software. XenApp can be tested by means of the Evaluation Virtual Appliance (EVA) or Platinum 90-day evaluation. Please see [http://www.citrix.com/TryXenApp](http://www.citrix.com/TryXenApp). Similarly, the XenDesktop Express edition can be used for testing and can be accessed from [http://www.citrix.com/TryXenDesktop](http://www.citrix.com/TryXenDesktop).

Citrix has a number of partners that provide application-related offerings, including the following:

- **App-DNA AppTitude** automates pre-migration application testing and intelligently remediates compatibility issues for XenApp hosted, Citrix Streaming, App-V, 64-bit, and Windows 7 applications
- **VisionApp package templates** provide a collection of over 2,500 certified package templates for applications, hotfixes, and services packs that automate application installation and configuration
Citrix Systems, Inc. (Nasdaq:CTXS) is the global leader and the most trusted name in application delivery infrastructure. More than 200,000 organizations worldwide rely on Citrix to deliver any application to users anywhere with the best performance, highest security and lowest cost. Citrix customers include 100% of the Fortune 100 companies and 98% of the Fortune Global 500, as well as hundreds of thousands of small businesses and prosumers. Citrix has approximately 6,200 channel and alliance partners in more than 100 countries. Annual revenue in 2006 was $1.1 billion.