

## XenServer for XenApp - Better Together

# Overview

Before embarking on server virtualization for the XenApp architecture, a set of goals should be defined. Organizations typically require a solid business case before investing time and money for new technologies. The business case and defined goals will server to determine which servers to virtualize and how to virtualize them. Some common goals are as follows:

- Reduce overall physical server counts by increasing server utilization without impacting user performance.
- Save X administration hours per month by simplifying operating system and application patching.
- Improve disaster recovery response time by being able to bring new systems online in minutes

At this stage, typical business goals focus solely on the business and not on the technology. A technical solution is a means to an end, but it is rarely the goal. When we try to achieve these goals for XenApp environments, it is quickly identified that we can achieve higher utilization, greater availability and increased flexibility with a server virtualization solution like XenServer. Simply adding server virtualization solutions to a XenApp environment will not allow an organization to achieve all of their goals. In fact, server virtualization adds another layer that must be managed and maintained. XenServer goes beyond simple virtualization to allow an organization gain better control of their infrastructure.

This design consideration document focuses on the core decisions that must be made before integrating server virtualization into a XenApp environment. The overall act of virtualizing XenApp is easy, but if these core decisions are not identified beforehand, supporting and maintaining the environment will be difficult. These decisions focus on the following concepts:

- Controlling Image Sprawl
- Base Image Considerations
- Deciding Which Systems to Virtualize
- Getting Started with XenApp Virtualization

Once the environment is assessed and these core decisions are made, other more detailed decisions can be investigated to provide an even better computing environment for the users. These areas include:

- Automated Customizations
- Scalability Influencers

## Controlling Image Sprawl

How many images are required for a XenApp environment? The answer to this question will have profound ramifications. For example, if there are 100 physical servers delivering the same applications, those 100 physical servers require

separate management and maintenance. If those physical servers are all virtualized, there will still be 100 servers to manage and maintain in addition to maintaining the server virtualization infrastructure. Simply changing a server from physical to virtual does not simplify the environment nor does it make management and maintenance easier. In fact, when virtualizing a previously physical architecture additional considerations are required, such as virtualization infrastructure, storage requirements and network requirements. This is because 100 server images will be centralized and delivered to the virtual infrastructure. Take the following scenario:

- Group 1: Contains 23 servers delivering a set of applications for the HR business unit
- Group 2: Contains 75 servers delivering a set of applications for the Sales business unit
- Group 3: Contains 2 infrastructure servers configured as data collector

XenServer Platinum is able to consolidate 100 physical or virtual server images into three distinct roles. Managing, maintaining and patching three server roles is significantly easier and faster than supporting 100 servers. Managing roles instead of servers greatly simplifies the environment. Note that this is different than server cloning as server cloning merely simplifies image duplication. XenServer Platinum creates server roles that can be utilized for any number of physical and virtual servers. As the environment continues to expand, the number of roles could potentially also increase, unless more advanced solutions are used.

With the functionality making up XenServer Platinum and XenApp Platinum, a single XenApp base image could potentially be utilized for every XenApp server, even though those servers will have different workloads, applications and roles. Depending on the environment and applications, XenApp's streamed applications or installed applications and XenServer Platinum's image personalization could continue to reduce the number of unique images down to one.

## Streamed Applications

Applications are one of the main culprits of image sprawl. As the number of images increases, the costs and time associated with supporting the environment also increases. Each image must be maintained, patched and supported. In the base architecture, as described by the **XenServer for XenApp Better Together – Reference Architecture**, there typically can be as many as four or more different server roles:

- Data Collector
- Core business applications
- Line-of-business applications
- Business unit line-of-business

Simply because of applications and a XenApp server configuration for the data collector, each role would require a different base image. It is possible to reduce this number down to a single image. The first part of this solution is to separate out the applications from the virtual server. Without applications, each XenApp server consists of an operating system and the XenApp software, which gets the administrator closer to the goal of a single common image for all XenApp servers. However, not all XenApp servers are configured the same.

In many environments, organizations dedicate a single server to the task of data collector. At first glance, this role makes the data collector server functionality unique, which may require the use of a distinct server role and subsequent image. This is not the case because the zone preference setting is part of the farm configuration. For example, with XenServer Platinum's integration with XenApp, a single base image can be used to provision a multitude of "unique" servers in the eyes of the data store with the use of the XenApp Integration Utility, as explained in the **XenServer for XenApp Better Together – Implementation Guide**.

When a new server is provisioned, it is given a name within the Provisioning Server Console. This name becomes the server's computer name and is subsequently used within Active Directory and within the XenApp farm. The first time one of these newly provisioned servers is brought online, the XenApp administrator will use the XenApp management console to properly configure the server and set the zone election preference level. Such XenApp configurations affecting the server are stored within the Data Store. Although changes to the actual server are lost upon reboot due to the common image, the designation of the XenApp server's role as most preferred is retained within the data store. When the server is restarted and it receives its fresh operating system, the computer name has not changed. The

XenApp server will contact the data store and receive its XenApp configuration, thereby promoting it to the role of data collector.

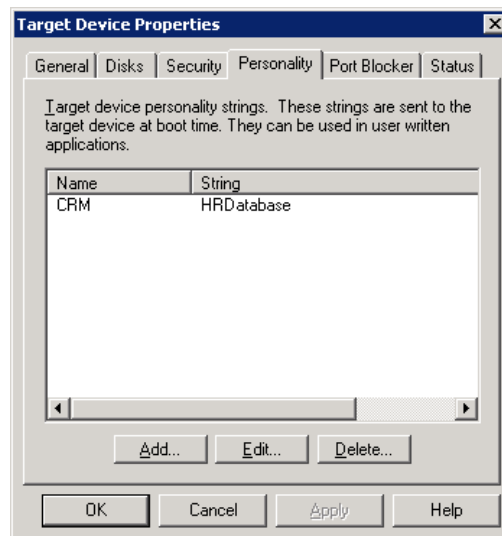
Being able to store zone election properties in the data store helps eliminate the need for a special image for the data collector role, but what happens when applications are introduced into the equation? If applications are installed and are part of the image, this will require the creation and maintenance of multiple XenApp server roles. However, if applications are not installed and are instead streamed to the server via XenApp application streaming functionality, a single base XenApp image could be used for all XenApp servers. With application streaming, each application is profiled and stored on a file server. This process eventually creates a catalog of all applications delivered by XenApp.

The simplicity of this solution is again based on the data store. As new servers are provisioned for the first time and are added to the XenApp farm, the XenApp administrator will use the XenApp management console to publish the correct streamed applications to their respective provisioned servers. The application streaming solution allows a single XenApp role to deliver different sets of applications. During a reboot of the server, all local changes are discarded. When the server is restated, the streamed applications are not present. However, because published application information is stored within the data store, each XenApp server will receive its application delivery instructions during the startup synchronization with the data store.

## Image Personalization

Imagine for a moment two different business units using the same application. The applications undergo the same updates, but the applications are different because they are configured to go to different backend databases. This is not uncommon in XenApp environments. In many situations, two different application profiles or two different installation packages would be used; however, this would require the maintenance of multiple application profiles or packages. One of the goals of virtualizing XenApp is to not make it more difficult to manage and maintain the XenApp environment. A single server role along with a single application profile or package can be used, but they can be configured differently with the use of XenApp Platinum's image personalization.

The Provisioning Server component included with XenServer Platinum allows an organization to specify personalization characteristics to target devices. The personalization settings are populated into the server as variables that can be used with startup scripts to dynamically reconfigure the system. Within the Provisioning Server console, a personalization setting of CRM is created with a string value of HRDatabase, as shown in Figure 1.



**Figure 1: Personalization Configuration**

When the corresponding server starts, the personalization setting will be populated into a local file (C:\ClientPersonality.ini) that can be read and used within a script, registry or file as shown in Figure 2.

```

C:\>getclientinfo
GetClientInfo - manually update client personality information
Usage:
GetClientInfo FieldName /r=RegistryKeyPath    <- Place field in registry
GetClientInfo FieldName /f=FileName          <- Place field in file
GetClientInfo FieldName /o                  <- Output field to stdout
GetClientInfo                               /? Or /help          <- Display help

C:\>getclientinfo crm /o
HRDatabase
C:\>_

```

**Figure 2: Personalization Usage**

A startup script can be set either in the base image or via an Active Directory group policy, which utilizes the personalization setting to configure the application with the correct backend database. This, of course, is just one small example of how XenServer Platinum's personalization can be used to customize applications without requiring additional server images.

## Design Recommendations

The following list includes general recommendations when integrating XenApp and XenServer together. As every environment is different, keep in mind that these recommendations are general and may not be applicable to your environment.

- **Images:** The fewer number of server images the better. With the addition of each image, maintenance and support increases. Virtualizing XenApp should do more than just provide better utilization of the server hardware. Incorporating virtualization into a XenApp environment should make it easier to support and maintain the environment. This means controlling the number of images and reducing to as few as possible. With physical servers, each server must be maintained separately. When the physical servers are virtualized, each virtual server role must be maintained separately. With XenServer Platinum, the number of images decreases because applications are removed from the equation and server images are based on functionality and not server instances.
- **Application Profiles:** The fewer number of XenApp application profiles the better. Application streaming allows the environment to be more dynamic and helps prevent applications from interfering with each other. However, there is a concern for application profile sprawl just like there is with virtual server sprawl. If possible, image personalization should be used to configure application profiles for specific user groups.
- **Application Packages:** Due to technical challenges or XenApp architectural designs, application streaming might not be the best solution. For example, some environments designed each XenApp server to host all applications and remove the concept of load managed group from the design. In this case, it might make more sense to create application packages and have the packages installed as part of a new XenApp role.
- **Stream or Personalize:** A common question often asked is why not utilize image personalization instead of application streaming? When applications can be streamed, image personalization is not required because each server is designated its role from the data store. The applications are delivered as needed with the streaming functionality. If, however, installed applications are used because the application does not function properly with application streaming, image personalization can be used to install applications during startup. Unfortunately, installed applications bring about new challenges and chances are high that installing the applications will require a reboot of the XenApp server. As the image is a common (shared) image, the changes from the application installation are not saved between reboots, which would get you stuck in a vicious cycle.

In the best case scenario, all applications can be streamed; however, the best case scenarios are usually not the real world scenarios. If the image does not function properly with XenApp application streaming and the application requires a reboot after installation, then a new server image/role is required.

# Base Image Considerations

One of the major challenges with creating a base XenApp image is determining what to include and what not to include. Of course you need the operating system, XenApp and XenServer tools, but beyond that what is recommended and why? Take the following scenario: due to business reasons, an environment has three sets of XenApp servers hosting different line-of-business applications. All three line-of-business applications are dependent on Microsoft Excel for viewing and editing integrated spreadsheets. Should Microsoft Excel be part of the base image or should it be a streamed application? There answer is... there is no right or wrong answer; it is all dependent on other factors within the environment.

The decision to include core applications is oftentimes a result in the belief that the base image should contain the greatest number of items that are common between XenApp servers. If every server requires the same application, more network bandwidth will be used when the application is streamed to every server. Also, application streaming, in the default configuration, does not start as fast as a previously installed application because the application must be sent across the wire. This means users will experience latency while the application is streamed for the first time (this latency can be overcome with application pre-caching and XenServer Platinum's image personalization. Please refer to the Automated Customizations section for an example of how to achieve this level of automation).

There is also a business aspect to this decision. In some organizations different sets of administrators are responsible for applications and another set is responsible for the XenApp configuration. By separating the applications from the base image, the technical decision can integrate more closely with the organizational structure of the business.

- **Application Administrators:** This group, responsible for application profiling, packaging and application updates, will use the XenApp application profiling solution or Installation Manager to build the profiles/packages.
- **XenApp Administrators:** This group, responsible for creating and maintaining the base image with hotfixes, service packs and the latest clients, will utilize XenServer Platinum components.

	Base Image Application Inclusion	Base Image Application Exclusion
<b>Benefits</b>	<ul style="list-style-type: none"> <li>• Base image and applications included in a single server role, which will allow for the fastest rebuild and delivery times.</li> <li>• Less network bandwidth is used because the applications are already present in the base image and no additional installations are required. The complete image can be deployed during off hours.</li> <li>• Application startup time is shorter because the application is already part of the image and does not need to be streamed.</li> </ul>	<ul style="list-style-type: none"> <li>• With fewer items included in the base image, maintaining the image is easier as only the core operating system and XenApp are provisioned initially.</li> <li>• XenApp base images are managed with one set of tools, and applications and corresponding updates are managed with a different set of tools. This makes it easier to have different administrators responsible for different areas of expertise.</li> </ul>
<b>Concerns</b>	<ul style="list-style-type: none"> <li>• Core application versioning changes can impact the base image. For example, if all servers require the same version of Microsoft Excel, no issues are raised. However, when individual application upgrades occur, some applications might require Excel 2007 while others require an older version. This would have a profound impact on the contents of the base image.</li> <li>• Modifying an application within an image will impact all servers that rely on the image. This might require different levels of change control for applications that are integrated with the base image and applications that are not integrated.</li> </ul>	<ul style="list-style-type: none"> <li>• Streaming applications will increase network utilization.</li> <li>• In the default configuration, the first user starting an application will notice a pause before application startup as the application is streamed to the server. This can be overcome with customization detailed in the Automated Customizations section</li> <li>• Multiple application profiles or packages to maintain and track.</li> </ul>

Regardless of the decision on what applications to include and exclude in the base image, the following are general recommendations for the base image:

- All relevant operating system and XenApp hotfixes and service packs should be included in the base image.

- The most common operating system and XenApp configuration should be used for the base image. If 80% of the servers require a specific setting while another 20% do not, the base image should include the special setting and use image personalization to modify the setting for the remaining 20%.
- The base image should include all appropriate XenApp clients. If application streaming will be used, the streaming client should be installed as part of the base image.
- Depending on the usage of server certificates, the appropriate root certificate should be part of the base image.

## Deciding Which Systems to Virtualize

If server virtualization is expected to help organizations achieve better hardware utilization, facilitate fault tolerance, and simplify disaster recovery, why aren't entire XenApp environments being migrated to a server virtualization solution like XenServer? Different factors, business and technical, are influencing the virtualization decision. These considerations will dictate the need to support an integrated solution of physical and virtual servers. But when looking into a XenApp environment, what are some of the critical factors for deciding what to virtualize or what not to virtualize?

### Business Factors

The first area that might limit servers from being virtualized relates to how the business operates and their implemented system architectures.

#### Business Units

In most organizations, there is a global XenApp environment where the core farm is designed and built to support the global applications. However, within some environments, different business units integrate into the XenApp environment by purchasing servers for their own specific applications. These servers belong to the business unit and are only used by employees of the specific business unit. This type of architecture allows all business units to utilize the common infrastructure components while still allowing them control of their specific requirements.

This type of architecture model typically results in underutilized systems. Each business unit must have enough servers to support users in the event of a failure, so the purchases are based on worst-case scenarios. Virtualizing these systems with other business units would help improve server utilization, but this is often difficult to do because different business units typically have different cost centers and support staff resulting in difficulties in defining who owns, pays for and maintains the servers.

This does not mean that the systems cannot be virtualized; it just means the systems cannot be virtualized with other business units. If it makes sense and helps the organization meet their defined goals, server virtualization could still be used but the solution must meet the requirements of the business units.

#### Security

In some organizations, especially in government, one set of applications can be delivered in a standard environment while another set of applications are only available within a high security environment. Trying to virtualize both systems together is not permitted. These systems must remain separate due to security requirements and concerns. However, this does not mean server virtualization cannot fit within these environments; it just means that the server virtualization resource pool cannot cross security boundaries, as set forth by the mandates.

Integrating XenServer with XenApp within the security boundaries could help organizations achieve higher utilization, greater availability and increased flexibility.

#### Special Situations

Some systems, like pharmaceutical environments, are under strict government controls where every aspect of the server must be documented and validated before it can be used for the business. This is a long, time-consuming process. Server virtualization adds another layer that must go through the validation process. Also, virtualizing these servers can exasperate the challenge of validating the system as the actual physical system the virtual server is being delivered from can change.

Special considerations must be made when trying to integrate XenServer and XenApp within these types of environments. The workloads of each virtual server must be documented and remain static so the entire physical server can be validated. This might dictate a set of virtual servers provisioning multiple XenApp servers running the same workload.

## Technical Factors

Many times, the decision to virtualize a server is based solely on technical aspects of the environment.

### Utilization

If one of the goals of server virtualization is to better utilize the hardware, what is the best course of action for systems already running at peak utilization across processor and memory? In all probability, the best course of action is to not virtualize the server because the act of server virtualization will have some negative impact on the server resources. Server virtualization adds another layer, which takes processor and memory resources. By integrating server virtualization with XenApp in these situations, the scalability of the server would actually decrease by a small amount, potentially requiring more hardware. Thus, where physical XenApp servers are substantially utilized, Citrix does not recommend virtualizing these servers.

The concern in situations where the physical server utilization is already at the peak is that there is no room for faults or failures. If all physical servers are fully maximized and one server fails, how can the load of the failed server be redistributed? The load will be spread across all remaining servers, which are already at peak utilization. This will overload the systems causing disruptions for the users.

In the end, the overall best solution is a joint mixture of physical and virtual for the systems in question. All physical servers are fully utilized so they will be left in their current state, while another set of virtual servers are available for immediate distribution during unplanned outages.

A physical and virtual solution would typically require two different processes to update and maintain images. These types of systems, however, could still be managed as a single entity by utilizing the provisioning component of XenServer Platinum. Integrating XenServer Platinum in these situations allows organizations to achieve maximum resource utilization, greater availability and increased flexibility while helping to simplify management of a mixed physical and virtual environment.

# Getting Started with XenApp Virtualization

The decision to virtualize the XenApp environment with XenServer Platinum has been decided based on the expected achievement of identified goals. The next decision is how to begin? Server virtualization is a new component to the XenApp environment and should be integrated in a phased approach. It is assumed the following components, based on expectations, goals and decision factors, will be virtualized:

- License Server
- Web Interface
- Data Collectors
- Load Managed Groups

## License Server

The XenApp farm requires access to a license server in order to allow continuous availability to users. The loss of a license server requires the XenApp administrator to have the licenses re-hosted within 30 days or users will be denied delivery of their applications. Many organizations dedicate a physical server for this purpose. A physical server is a lot of hardware to throw at the problem of availability considering that the license server is single-threaded and lightly

utilized for most of the day. Virtualizing the license server is an easy way to start integrating server virtualization into a XenApp environment.

Once the license server is virtualized, it becomes more efficient to provide license server fault tolerance. There are two common ways to provide license server redundancy without requiring the need for other software solutions:

- **Cold Standby:** A cold standby fault tolerant solution requires the building of an additional license server with the same server name as the primary license server. With physical systems, this is a waste of hardware resources and data center space. Plus, offline servers are oftentimes forgotten resulting in missed patches and updates.

When the primary license server is virtualized, the virtualized license server can always remain available with features like XenMotion allowing a virtual server to be migrated from one host to another without requiring downtime. However, a XenMotion-like feature will not protect the system from malicious activity or corruption.

For organizations concerned with corruption, a cold standby can be created by periodically cloning the primary system. Keeping this system offline is the cold standby solution but without the need for dedicated hardware or data center space. In order to keep the clone current with updates while powered off, new clones can be created on weekly or monthly timeframes. The new clones will contain the latest licenses, operating system updates, and current system configurations. If the primary license server fails, the clone can be brought online and used immediately.

- **Hot Standby:** A hot standby fault tolerant solution requires the building of an additional license server with a different server name than the primary license server. In addition to consuming hardware resources and data center space, a hot standby solution also consumes power. The hot standby server will be updated as it is available on the network, but during a failure of the primary license server, the standby server either must undergo a name change or the XenApp farm must be told to point to a new license server.

Virtualizing a hot standby server will improve utilization by not requiring additional hardware or the additional space of a physical system. Even though the hot standby is running, it is not significantly impacting the processor, so other virtual servers can take advantage of the unused capacity. During a failure of the primary license server, the hot standby will still require modification by implementing a name change or a farm change.

### Design Considerations

- Virtualizing the license server is a fast way to integrate virtualization into the XenApp environment. Fault tolerance can be integrated by creating a cold standby server with cloning functionality. The clones should be self-sufficient, meaning the clone should not require the availability of other clones, snapshots or templates to function.
- The license server can be provisioned, which would make it much more difficult for unmanaged changes to corrupt the license server when deployed in common image mode. Unfortunately, delivering the license server in common image mode does bring about the following challenges:
  - **Log Files:** The log files must be stored on a different server in order to generate license reports.
  - **Host Names:** A XenApp license is tied to the hostname of the license server. If a common image is used, the license incorporated into the common image would work for only the provisioned server with the correct hostname.

## Web Interface

In many scenarios, a site's Web Interface servers are identical except for system-level settings like server name and IP address, which makes the Web Interface server a great component to virtualize and provision with XenServer Platinum. As Web Interface is oftentimes the users' main point of presence into a XenApp environment, it is critical, regardless of server, that Web Interface responds the same, protects the communication and is always available. Because of these requirements, Web Interface is a likely component for server virtualization.

- **Availability:** During a typical workday, there are periods where large influxes of users access the XenApp environment, which can stress a Web Interface server. To continually provide availability, even during the influxes, multiple physical Web Interface servers are deployed. Except during the surges, the Web Interface servers are left underutilized.
- **Duplication:** Because there are multiple Web Interface servers to provide redundancy and capacity, it is often a challenge keeping the multiple systems identical. Users require like systems to function the same way, and Web Interface is no different.

If Web Interface is virtualized, modified clones can be deployed allowing for better availability without increasing data center space requirements, power requirements or wasting CPU resources. However, simple virtualization cloning will increase storage requirements and it will not solve the duplication impact of keeping many different virtual servers identical. To properly deliver Web Interface, Provisioning Server should be used. A common base Web Interface role should be created with all pertinent configurations. This will help keep all Web Interface servers in sync and help protect the server as changes will not be saved during reboots.

### Design Considerations

- **Certificates:** The common image for the Web Interface must contain a server certificate if communication between the end-point -> Web Interface or Access Gateway -> Web Interface is to be encrypted. As multiple servers can be delivered from a single image, certificates pose a challenge that can be solved by:
  - Install multiple server certificates on the base image. Each server certificate will correspond to a potential server name defined within Provisioning Server.
  - Use a wildcard certificate that can be used across all provisioned Web Interface servers. The wildcard will dictate the need for a common naming standard for the Web Interface servers.

## Data Collector

Once Web Interface and the License Server have been virtualized, organization start looking at making bigger hardware savings by virtualizing actual XenApp servers instead of the supporting components. The data collector, which is a XenApp server, is responsible for application enumeration and finding the appropriate server for the user to go. The data collector is the typical first place to start as users interact indirectly with this system. Just like Web Interface, organizations often dedicate a primary and potentially a secondary data collector to meet surges in user connections. Unless a user is logging on, logging off or disconnecting, the data collector remains fairly unused.

Virtualizing will improve the utilization by sharing resources with other virtual servers, but virtualization alone will not improve administration of the virtual server. By provisioning the data collector, a single role could be used for all data collectors. The Integration Utility, that is part of Provisioning Server, makes it possible to use a single image to delivery any number of “unique” virtual XenApp servers. The integration utility does the following:

**Preparation Phase:** The preparation phase gets the server ready for provisioning. As this one image will be used for multiple servers, variables are required and server data must be removed. The following items explain what is occurring during the preparation phase.

- **XenApp Session Client Name:** Removes the file WFCName.INI. This file contains the devices client name that is used when making a XenApp connection to a server.
- **Services:** The Citrix XenApp services (IMA, WMI, SMA and HTTP) are stopped and set to manual start.
- **Local Cache Cleanup:** The local host cache and the application streaming caches are cleared so no residual application or server role information is kept before server imaging.
- **Resource Manager:** The local database for Resource Manager is erased. This database contains real-time information. This database should contain no residual information before server imaging.
- **Hostname:** The hostname value is set to a variable within the appropriate DSN files for XenApp and application streaming. After the server is imaged, these files will use the computer name, as it is set in the Provisioning Server console.

**Execution Phase:** Once the server has been imaged and streamed to a newly provisioned server, the following occurs during the server startup, after the administrator logs in:

- **Resource Manager:** The local database for Resource Manager is cleared if it was not erased during the preparation phase. The data contained within this database is no longer relevant as this is a newly provisioned server.
- **Hostname:** IMA Logging information is updated to include the new hostname for the provisioned server instead of the hostname used during imaging.
- **STA:** The Secure Ticket Authority must be unique in order for Access Gateway to distinguish the correct STA to validate tickets. The integration utility updates each XenApp servers STA ID based on the MAC address of the server.
- **Local Cache Rebuild:** The local host cache and the application streaming cache is resynchronized with the data store based on the new server name.
- **Services:** The Citrix XenApp services (IMA, SMA, WMI and HTTPS) are started:
  - If the server has not been added to the data store before, this process adds the new server to the farm.
  - If the server has been added to the data store during a previous boot sequence, the appropriate hosting information is synchronized from the data store.

### Design Considerations

- **Real Time Metrics:** When servers are provisioned, the resource manager real-time metric information is lost upon reboot because a common image is used. Resource Manager summarizes this information daily.
- **STA:** The integration utility automatically makes the STA unique because MAC addresses are unique. If the MAC address changes within the virtual server, the STA settings within Access Gateway must be updated to contain the latest STA ID value.
- **Base Image:** Because the Data Collector preference levels are defined and stored in the data store, the data collectors can be provisioned with a base XenApp image. The base image should contain the core items needed for every XenApp server. Suggestions for the base image are located in the Base Image Considerations section.
- **Integration Utility:** In the default configuration, the integration utility requires an administrator to login each time a server is provisioned before the Execution Phase can begin. It is recommended this is automated by being a service or an Active Directory group policy. An explanation of these two options is described in the Auto Execute XenApp Integration section.

## Load Managed Groups

A goal for all infrastructure work is to not make things worse for the users or administrators. If each server is virtualized, there would be a virtual server image sprawl issue that would have to be fixed. Utilizing XenServer Platinum and XenApp application streaming will help keep image sprawl under control. Because of the due diligence work involved, virtualizing and provisioning load managed groups will take the greatest amount of time. The first step is to determine if virtualizing and provisioning the load managed group will help achieve the defined goals. If the answer is “yes”, then the following should be completed:

- Select one load managed group and document the following:
  - Applications: Which applications make up the load managed group?
  - Application Dependencies: Does the application require a driver, a special operating system setting, a service or another application?
- In a test environment, setup a virtualized XenApp environment and determine:
  - Which applications will be part of the base image?

- Is streaming possible
  - For stand-alone applications, can they be successfully streamed?
  - For applications with dependencies, can all integrated components be streamed within a single profile?
- Build application profiles and configure the published applications for the appropriate streamed servers

The servers must be tested to make certain no functionality has been lost due to application streaming. Without proper planning and testing, the environment will be difficult to maintain and support, probably resulting in poor service for the users.

### Design Considerations

- **Server Roles:** The number of unique server roles should be kept to a minimum to make supporting the images easier. At the least, each load managed group should be based off of a Provisioning Server virtual disk image. Having a unique virtual server instance for each system will incur too much overhead (administrative, disk, support) for the solution.
- **Applications:** Application streaming will not function for certain applications due to technical requirements. These applications require installation instead of streaming, which will dictate the need for a new role and Provisioning Server image.
- **Fault Tolerance:** There should be enough physical and virtual servers available to support the users in case an entire XenServer system fails. The down virtual servers due to a XenServer failure can be moved to an active XenServer. In many cases, the hot swap of the virtual servers could be unnoticeable to the users.
- **Active Directory Integration:** To better organize the provisioned servers and to allow for greater levels of personalization, different groups of servers should be added to unique organizational units within Active Directory. For example, all XenApp servers should belong to a XenApp OU with child OUs consisting of Web Interface, different load managed groups, data collector, etc. These OUs will be used within the Automated Customizations section.

## Automated Customizations

A goal for any virtualized XenApp environment is to keep the number of images to a minimum. Each image is a cost to the organization in terms of support time or even storage costs. By integrating automated customizations into the environment, the number of images required could decrease. The following two examples will show how automated customizations can be integrated to provide a more robust and flexible environment:

- Auto Execute XenApp Integration
- Pre-Cache Streamed Applications

### Auto Execute XenApp Integration

Following the standard installation procedures for Provisioning Server's XenApp Integration Utility requires an administrator to logon each time a XenApp server is started in order for the server to complete its farm registration. This is not practical for production scenarios. Two different options can be used to automate this process:

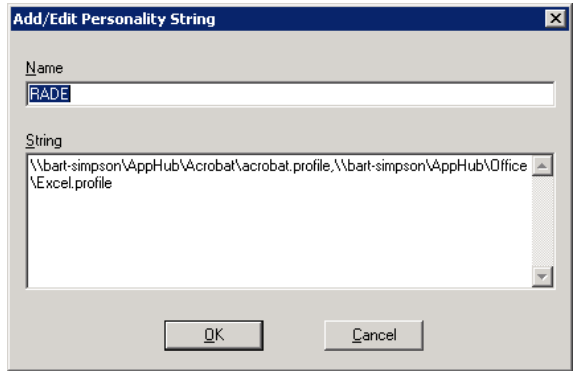
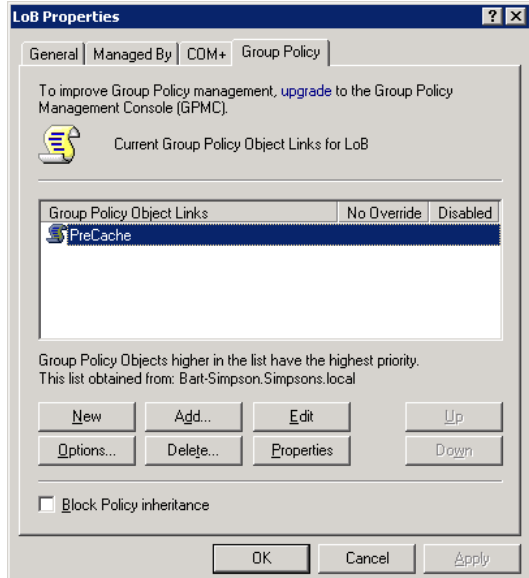
- **Local Service:** The installation of the integration utility within the base image contains an option to implement the execution phase as a Windows service. Within the utility are two files (cpsmods.bat and cpsmods.reg). These files should be placed within the "C:\Program Files\Citrix\Provisioning Server" directory of the base XenApp image. Once the files are in the correct directory, the cpsmods.bat file should be executed. This will create a service that will be part of all XenApp servers based on this one virtual disk image.

- **Active Directory Group Policy:** After the integration utility has been executed on a XenApp base image, a new VBScript file is available located at "C:\Program Files\Citrix\Provisioning Server\cpsmods.vbs". This file contains all items needed for integration into the farm during the execution phase. A new Active Directory Group Policy could be created on the OU containing the provisioned XenApp servers that runs a copy of the cpsmods.vbs as a startup script.

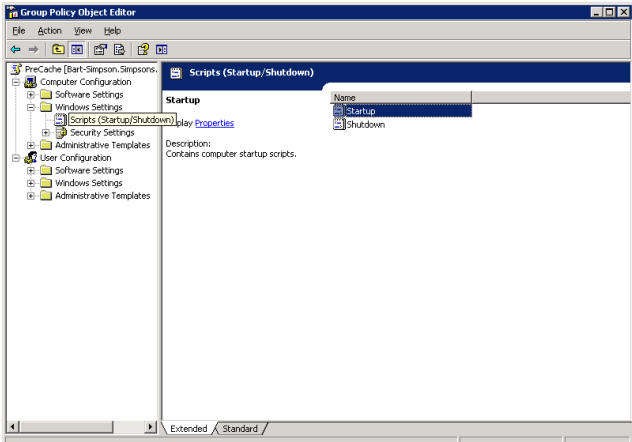
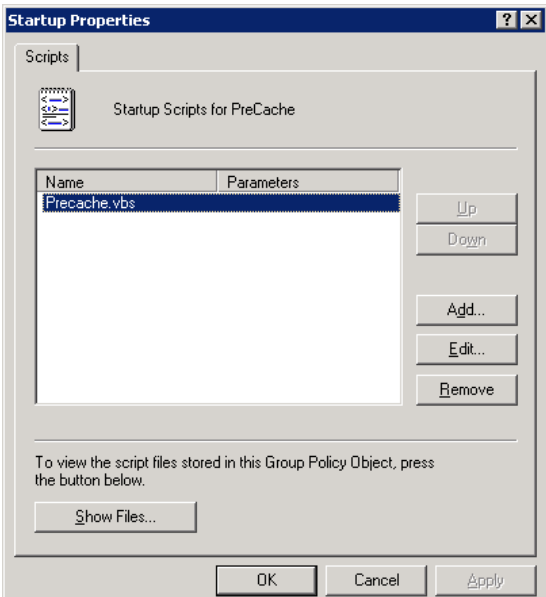
Both options are better than requiring an administrator to logon after each reboot. Many organizations will find it easier to implement the local service solution as opposed to the Active Directory Group Policy solution. Many XenApp administrators will not have access to Active Directory to implement group policies, but they will have access to the base XenApp images. Also, if the integration utility is part of the image, there is less of a chance for someone to remove or modify the integration solution.

## Pre-Cache Streamed Applications

A common concern with streamed applications is the startup time. When a user tries to start an application, the application is not yet on the server. The application request will start the streaming process where parts of the applications are sent over the network to the XenApp server. Depending on the application and environment, this could take less than one second to more than 10 seconds. Even a one second delay would be noticeable to a user. XenApp allows streamed applications to be pre-cached allowing for faster startup time. To accomplish this when using provisioned servers, do the following items:

Pre-Cache Streamed Applications		
	Screenshot	Description
1		<p>On the Provisioning Server, launch the <b>Provisioning Server Console</b>.</p> <ul style="list-style-type: none"> <li>• Select a <b>Target Device</b> -&gt; <b>File</b> -&gt; <b>Properties</b></li> <li>• Select the <b>Personality</b> tab and select <b>Add</b></li> <li>• Enter in the following: <ul style="list-style-type: none"> <li>○ Name: <b>RADE</b></li> <li>○ String: Path to all application profiles to be delivered to the target device separate by commas.</li> </ul> </li> <li>• Select <b>OK</b></li> <li>• Select <b>OK</b></li> </ul>
		<p>Within Active Directory Users and Computers on the Domain Controller</p> <ul style="list-style-type: none"> <li>• Select the Organizational Unit containing the servers requiring pre-application delivery</li> <li>• With the OU highlighted, select <b>Action</b> -&gt; <b>Properties</b></li> <li>• Select the <b>Group Policy</b> tab and select <b>New</b> entering in a name for the policy</li> <li>• Select <b>Edit</b></li> </ul>

## Pre-Cache Streamed Applications

Screenshot	Description
 <p>The screenshot shows the Group Policy Object Editor window. The left-hand tree view is expanded to 'Computer Configuration' &gt; 'Windows Settings' &gt; 'Scripts (Startup/Shutdown)'. The 'Startup' script is selected in the right-hand pane. The description for the Startup script reads: 'Contains computer startup scripts.'</p>	<p>The Group Policy Object Editor appears.</p> <ul style="list-style-type: none"> <li>• Select <b>Computer Configuration -&gt; Windows Settings -&gt; Scripts (Startup/Shutdown)</b></li> <li>• Highlight the Startup name</li> <li>• Select <b>Action -&gt; Properties</b></li> </ul>
 <p>The screenshot shows the 'Startup Properties' dialog box with the 'Scripts' tab selected. A list box contains one entry: 'PreCache.vbs'. To the right of the list are buttons for 'Up', 'Down', 'Add..', 'Edit..', and 'Remove'. Below the list box, there is a 'Show Files...' button and a note: 'To view the script files stored in this Group Policy Object, press the button below.'</p>	<p>The Startup Properties screen appears</p> <ul style="list-style-type: none"> <li>• Select <b>Add</b></li> <li>• Select <b>Browse</b></li> <li>• Within the Browse window, right-click and select <b>New -&gt; Text Document</b></li> <li>• Rename the document to <b>PreCache.vbs</b></li> <li>• Right-click the PreCache.vbs file and select <b>Edit</b></li> <li>• Paste the script, contained in the following row, within the file. <b>Save</b> and <b>exit</b> notepad</li> <li>• Highlight PreCache.vbs and select <b>Open</b></li> <li>• On the Add a script window, select <b>OK</b></li> <li>• On the Startup Properties window, select <b>OK</b></li> <li>• <b>Close</b> the remaining windows and screens</li> </ul>

Pre-Cache Streamed Applications	
Screenshot	Description
<pre> set wshShell = CreateObject("Wscript.shell") intLoop = 0 intStart= 1 intEnd = 0  ' Populate registry with Streaming Application paths based on personality settings wshshell.run chr(34) &amp; "c:\Program Files\Citrix\Provisioning Server\getclientinfo" &amp; chr(34) &amp; " rade /r=HKEY_LOCAL_MACHINE\SOFTWARE\BUILD\RADE", 1, true  ' Read unique application names strRadeApps = wshShell.RegRead("HKLM\Software\Build\RADE") Set objRegex = CreateObject("VBScript.RegExp") objRegex.IgnoreCase = True objRegex.Global = True objRegex.Pattern = "," set colMatches = objRegex.Execute(strRadeApps)  ' For each pathname, pre-deploy the application Do until (colMatches.count &lt; intLoop)     intend = Instr(intStart +1, strRadeApps, ",")     if intEnd &lt;&gt; 0 then         strApp = Mid(strRadeApps, intStart, intEnd -intstart)     else         strApp = Mid(strRadeApps, intStart)     end if     intLoop = intLoop + 1     intStart = intEnd + 1     wshshell.run chr(34) &amp; "C:\Program Files\Citrix\Streaming Client\radedeploy" &amp; chr(34) &amp; " /deploy:" &amp; chr(34) &amp; strApp &amp; chr(34) Loop </pre>	

When the XenApp servers contained within the organizational unit starts, the script will execute reading in the personalization settings. The personalization string for **RADE** will pre-deploy the streamed applications to the server.

## Scalability Influencers

When incorporating a new technology into XenApp environments, organizations are quick to question what impact this new item will have on single-server scalability as well as the impact on users' perceptions of system responsiveness. As always, there is no good answer because single-server scalability and user responsiveness depends on the workload, user behavior, hardware, and software configurations. However, this section will offer a few key guidelines on XenApp scalability and responsiveness.

- **XenApp Single Server Scalability:** How much of a hit will XenServer place on a XenApp server? There is no straight answer to this question as the impact depends on overall XenApp and XenServer utilization. To get a valid answer, proper testing must be done. One item of importance is that XenServer does not over commit memory, so what is assigned to a XenApp server will always be available to the XenApp server regardless of other virtual servers. This is extremely important as over committing memory could pose a risk to the environment as surges in XenApp utilization could overwhelm the server.
- **Disk Performance:** Using remote storage solutions might actually improve overall XenApp performance as opposed to a physical XenApp server installation. In a physical setup, XenApp requires the proper purchase, installation and configuration of the hardware in order for the disk subsystem to perform optimally. Proper

installation and configuration includes the use of high-speed disks, write cache, array controllers, etc. If the hardware is not configured correctly, then there will likely be a performance hit. Dedicated storage solutions, like Network Appliance, are optimized for file serving and contain the proper integration and configuration of all storage components. Because these systems are optimized for file serving, disk access is likely to be faster.

- Personnel: The productivity of XenApp administrators can be increased significantly with the proper server virtualization solution. With XenServer Platinum, new systems can be provisioned and disaster recovery tests can be performed in a matter of minutes. The speed of delivery allows XenApp administrators to focus their attention on providing the best application delivery experience to the users instead of trying to support server build requests.

## Conclusion

Virtualizing a XenApp environment is not difficult. With the available tools and utilities, almost any system can be virtualized. But the simple act of virtualization adds another layer to the infrastructure that must be managed. If design considerations were not taken into account during virtualization, the XenApp environment could be more difficult to maintain than previously. That is why before embarking on the XenApp virtualization solution, organizations should:

- Have clearly defined goals and expectations they wish to achieve
- Investigate how to control the sprawl of virtual images
- Define what images are required and what should be incorporated into the base image
- Identify the systems to virtualize
- Start virtualizing XenApp in phases

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