This white paper has been deprecated.

For the most up to date information, please refer to the Citrix Virtual Desktop Handbook.

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XenDesktop Planning Guide: Image Delivery

(Provisioning Services / Machine Creation Services)
Overview

With previous versions of XenDesktop (version 4 and prior), the single image management option was to use Provisioning Services. This solution worked great as it made optimal use of resources and maximized performance and scalability. However, many organizations, especially smaller environments, found the solution too complex for their environment. Because of this challenge, Machine Creation Services was integrated into XenDesktop 5 as a way to provide simple, single image management.

Now with XenDesktop 5, organizations can utilize two different features to provide single image management: Machine Creation Services and Provisioning Services. As there are now two options, many architects questioned if and when to use each option.

In short, both solutions are appropriate for any organization; however, each has a specific focus that can better align with the overall business strategy for desktop transformation. Before making a decision, it is advisable to understand the different guidelines and ramifications for each solution.

Note: The decision between the two options is not something that an organization is locked-in with for the duration of the infrastructure.

Note: In order to fully understand the ramifications of each image delivery option, it is advisable to review the XenDesktop 5 Reference Architecture, which provides an overview of Machine Creation Services, Provisioning Services and Installed Images as well as the different Citrix FlexCast options.

Guidelines

The single image management option is not based on which solution is better, as each has their own strengths. Instead, the decision should be based on a few core themes:

1. Scope
2. Manageability
3. Infrastructure Requirements

Scope

The first, and most critical, decision when determining the correct model is the overall business direction and scope of the desktop transformation architecture. For example, based on the following figure, different Citrix FlexCast options utilize different imaging solutions.
Machine Creation Services is limited in that it is meant for hosted VDI desktops only, pooled or dedicated. Organizations looking to utilize a hosted shared desktop model, a streamed VHD model or a Hosted VDI model with blade PCs still require the use of Provisioning Services. Being able to share the same infrastructure components for multiple FlexCast types helps simplify the operational model for the complete solution.

An additional aspect to consider is the requirement for private (1:1) desktops. Private desktops allow users to have complete control of their virtual desktop. With private desktops, the initial delivery of the desktop is identical. Once deployed, each desktop becomes unique as changes persist across reboots. Within the Hosted VDI Desktop FlexCast model, this level of personalization can be achieved with installed images, Machine Creation Services images and Provisioning Services images.

- Installed images: Requires either running through the desktop operating system install or utilizing SysPrep tools to provide the desktop with a unique identity.
- Provisioning Services: Uses built-in technology to provide each desktop with a unique identity, but also utilizes a complete copy of the base desktop image in read/write mode. Each copy consumes disk space, which also increases as additional items are added to the desktop image by the user.
- Machine Creation Services: Uses built-in technology to provide each desktop with a unique identity and also thin provisions each desktop from a master image. Only changes made to the desktop consume additional disk space.

Based on these examples, most organizations utilize either installed images or Machine Creation Services images when required to deliver a dedicated desktop due to the additional requirements of Provisioning Services.

Manageability
The operational model for supporting a desktop transformation is critical.

The first part of the operation model focuses on how the desktop images are maintained. This should be a major focus for organizations, as regular updates help keep the desktops secure.

Provisioning Services and Machine Creation Services follow similar processes for updating the base desktop image. Once the base image is updated, the virtual desktops automatically utilize the latest version of the desktop. However, Provisioning Services adds a few more “challenges” with the image update process.

- First, Provisioning Services requires the administrator to copy the image, change to private (read/write) mode, and start the appropriate virtual machine. Machine Creation Services requires the administrator to start the master virtual machine.

- Second, certain updates made to a Provisioning Services image requires extra precautions as missteps could result in a corrupted image, which is why it is always recommended to have a backup of the image before making updates. For example, if a required update impacts the network connection, the image update will fail because a Provisioning Services desktop requires a network connection at all times. If the desktop disconnects from the network because of an update, the desktop halts immediately until it receives a connection to Provisioning Services, which will never happen because the desktop disconnected the network link and is now paused. This challenge does not impact Machine Creation Services because this type of desktop is simply a virtual machine with no requirement of network connectivity. If an update temporarily disables the network, the virtual machine continues to operate and process the update.

The second part of the operational model focuses on expansion. Many organizations will expand their infrastructure to include more users and more desktops. This process can have an impact on the underlying infrastructure and potentially impact production.

- Adding new desktops in a Provisioning Services environment has minimal impact as the target desktops do not require storage infrastructure operations. In some configurations, there might be a small disk associated with each virtual machine, but the rest of the configuration (identity) occurs within the Provisioning Services server.

- Machine Creation Services impacts the underlying storage infrastructure as new desktops are allocated. Each Machine Creation Services desktop has two drives associated: a Differencing Disk and an Identity Disk. As new desktops are created, the storage infrastructure must utilize resources to allocate space. If the desktop expansion happens during a resource intensive time of day for production, the user experience could be impacted. Because of this, special care must be taken when new desktops are allocated with the use of Machine Creation Services.
Infrastructure Requirements

The final aspect used to determine the most appropriate imaging model is focused on the overall requirements for the infrastructure… How much hardware is required?

Machine Creation Services uses technology within the hypervisor (XenServer, Hyper-V and vSphere) to deliver images. Provisioning Services requires a separate server, and potentially multiple servers, within the infrastructure.

However, the infrastructure requirements should not be solely based on the number of servers required to run the feature, it should also look at comparisons in performance and scalability. Additional Provisioning Services servers might not be as important as being required to purchase additional SAN storage. For example, read IOPS can be optimized and reduced using different options:

- Provisioning Services: Portions of the image are read and cached within RAM, which utilizes Windows memory caching algorithms. If enough RAM is available, subsequent requests from other desktops will not impact the disk. In many Provisioning Services implementations, the read IO is located on a different storage infrastructure as the write IO. This allows organizations to better optimize the storage solution.

- Machine Creation Services: The SAN infrastructure hosting the desktop image is responsible for caching the image to help reduce read IOPS. Caching on the SAN might not be a feature or requires purchasing additional functionality from the SAN vendor, which increases costs. However, read and write IOPS occur on the same SAN. This increases the storage requirements, around IOPS, when compared to Provisioning Services.

In some tests, it was shown that Machine Creation Services required 1.5x as many IOPS on the SAN as Provisioning Services. This increase can even impact the hypervisor architecture as increase storage load can impact scalability of the hypervisor pools. The increased IOPS load is expected based on the aforementioned process for handling reads and writes. Provisioning Services experiences many fewer read IOPS than Machine Creation Services. This helps significantly reduce storage requirements for Provisioning Services.

**Note:** Additional functionality that will help reduce IOPS requirements, like XenServer IntelliCache, is planned for future integration with XenDesktop 5 and Machine Creation Services, but it is not fully integrated and is currently out of scope.

Even though read IOPS can be reduced, the larger impact for desktop virtualization are write IOPS, which can account for 80-90% of storage IO activity. For example, the following can be expected on the SAN infrastructure for a boot storm:

- If Machine Creation Services and Provisioning Services use dynamic disks for the differencing/write cache disks, the first boot of a virtual desktop requires expansion of
the disk to accommodate the changes required during startup. During a boot storm, the expansion on the SAN requires significant resources. However, subsequent reboots do not impact Provisioning Services because the same disk, which was already expanded, is still used. Machine Creation Services, however, disconnects the old disk, creates a new disk, expands the disk, boots the virtual desktop, and eventually deletes the old disk. This impacts the storage every time a desktop is rebooted.

• Due to the impact of disk expansion on a SAN infrastructure, most recommendations are to utilize fixed disks instead of dynamic. Although fixed allocates all defined space, which can be wasteful, it does significantly reduce the impact of a boot storm. Machine Creation Services can only use dynamic disks, which incurs the expansion penalty. Provisioning Services is flexible to allow the use of dynamic or fixed disks.
Planning

Taking all of the guidelines into account helps provide an overall recommendation for the most appropriate imaging option for XenDesktop 5 deployments. Although both options are viable, organizations should strive to utilize only one solution as two requires additional operational processes. Following the decision tree outlined below helps provide the most appropriate recommendation:

The following explains how the decisions impact the overall selection:

Comment [d3]: San should be pure local storage
• Hosted VDI Desktops Only: Larger enterprise environments are often more complex, in
terms of end user requirements. The complex user requirements cannot be completely met
with Hosted VDI desktops, which require the organization to expand into different FlexCast
options. Using Provisioning Services for these architectures is recommended due to the
ability to deliver images more than Hosted VDI desktops.

• Dedicated VDI Desktops: If there is a user requirement for dedicated desktops, there is an
increased recommendation to use Machine Creation Services or to use installed images.
Although Provisioning Services can do dedicated desktop images, it is more complex than
using Machine Creation Services or installed images.

• Large Boot/Logon Storms: Boot and logon storms create massive IO activity on the storage
infrastructure, requiring greater levels of IOPS. Provisioning Services separates read and
write IOPS, thus allowing the environment to be better optimized, equating in smaller IOPS
requirements. For larger deployments with a large boot/logon storm, Provisioning Services
is recommended.

• Blade PCs: Certain users require the performance of a Blade PC, while still secure within the
data center. Because Blade PCs are standalone hardware devices, Machine Creation Services
cannot be used.

• SAN: Provisioning Services has the flexibility to work with and without a SAN
infrastructure. However, Machine Creation Services becomes more challenging without a
shared storage infrastructure, like a SAN. If a shared storage solution is not in scope or is
too costly for the environment, Provisioning Services is a better option.

• Change Control Processes: Maintaining Provisioning Services desktop images requires
proper processes depending on the type of update required (hotfix versus network driver
update). Smaller environments will most likely not have processes in place.

Provisioning Services and Machine Creation Services are both viable options for desktop image
delivery within XenDesktop 5. The decision of which one to use should be based on the overall big
picture of the organization, the management activities and the resource requirements. Selecting one
option does not lock an organization into that option forever. Moving from one platform to the
other only requires modification of the desktop images and the desktop group configurations.
Product Versions

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Revision History

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