



# Linux Virtual Delivery Agent 2012

## Contents

<b>What's new</b>	<b>3</b>
<b>Fixed issues</b>	<b>4</b>
<b>Known issues</b>	<b>5</b>
<b>Third party notices</b>	<b>7</b>
<b>Deprecation</b>	<b>7</b>
<b>System requirements</b>	<b>8</b>
<b>Installation overview</b>	<b>13</b>
<b>Configure Delivery Controllers</b>	<b>14</b>
<b>Easy install</b>	<b>15</b>
<b>Create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure</b>	<b>30</b>
<b>Use Machine Creation Services (MCS) to create Linux VMs</b>	<b>33</b>
<b>Install Linux Virtual Delivery Agent for RHEL/CentOS</b>	<b>71</b>
<b>Install Linux Virtual Delivery Agent for SUSE</b>	<b>108</b>
<b>Install Linux Virtual Delivery Agent for Ubuntu</b>	<b>134</b>
<b>Configure the Linux VDA</b>	<b>170</b>
<b>Integrate NIS with Active Directory</b>	<b>170</b>
<b>Publish applications</b>	<b>177</b>
<b>Remote PC Access</b>	<b>178</b>
<b>Print</b>	<b>190</b>
<b>File copy and paste</b>	<b>198</b>
<b>File transfer</b>	<b>199</b>
<b>PDF printing</b>	<b>203</b>
<b>Configure graphics</b>	<b>204</b>

<b>Thinwire progressive display</b>	<b>213</b>
<b>Non-GRID 3D graphics</b>	<b>215</b>
<b>Configure policies</b>	<b>217</b>
<b>Policy support list</b>	<b>219</b>
<b>Configure IPv6</b>	<b>228</b>
<b>Configure Citrix Customer Experience Improvement Program (CEIP)</b>	<b>229</b>
<b>Configure USB redirection</b>	<b>234</b>
<b>Configure session reliability</b>	<b>245</b>
<b>Soft keyboard</b>	<b>247</b>
<b>Client Input Method Editor (IME)</b>	<b>250</b>
<b>Support for multiple language inputs</b>	<b>251</b>
<b>Dynamic keyboard layout synchronization</b>	<b>253</b>
<b>Client IME user interface synchronization</b>	<b>257</b>
<b>HDX Insight</b>	<b>260</b>
<b>Rendezvous protocol</b>	<b>261</b>
<b>Adaptive transport</b>	<b>263</b>
<b>Integrate with the Citrix Telemetry Service</b>	<b>266</b>
<b>Tracing On</b>	<b>270</b>
<b>Shadow sessions</b>	<b>274</b>
<b>Browser content redirection</b>	<b>280</b>
<b>Support Citrix Workspace app for HTML5</b>	<b>286</b>
<b>Monitor Linux sessions in Citrix Director</b>	<b>287</b>
<b>Monitor service daemon</b>	<b>288</b>
<b>Secure user sessions using TLS</b>	<b>290</b>

<b>Secure user sessions using DTLS</b>	<b>294</b>
<b>Text-based session watermark</b>	<b>295</b>
<b>Pass-through authentication by using smart cards</b>	<b>296</b>
<b>Double-hop single sign-on authentication</b>	<b>306</b>
<b>Configure unauthenticated sessions</b>	<b>308</b>
<b>Configure LDAPS</b>	<b>311</b>
<b>Create a Python3 virtual environment</b>	<b>315</b>
<b>XDPing</b>	<b>318</b>
<b>Configure Xauthority</b>	<b>322</b>
<b>Federated Authentication Service</b>	<b>325</b>

## What's new

March 10, 2021

### What's new in 2012

Version 2012 of the Linux VDA includes the following new features and enhancements:

#### Enlightened Data Transport (EDT) MTU discovery

EDT automatically determines the Maximum Transmission Unit (MTU) when establishing a session. Doing so prevents EDT packet fragmentation that might result in performance degradation or failure to establish a session. For more information, see [EDT MTU discovery](#).

#### Support for LDAP channel binding

Previously, the Linux VDA was not able to register with a Delivery Controller when channel binding is enabled in Active Directory. This release of the Linux VDA supports channel binding to increase the security of communications with the Active Directory domain controllers. Make sure to create a Python3 virtual environment before enabling channel binding on the Linux VDA. For more information, see [Create a Python3 virtual environment](#) and [Configure LDAPS](#).

#### XDPing integrated with the Linux VDA

The Linux [XDPing](#) tool is a command-line based application that automates the process of checking for common configuration issues with a Linux VDA environment. Previously, you had to download [XDPing](#) from the [CTX202015](#) page and install the tool separately from the Linux VDA. Starting with this release, [XDPing](#) is integrated with the Linux VDA and can be installed automatically when you install the Linux VDA. For more information, see [XDPing](#).

#### Support for RHEL 7.9, RHEL 8.3

We have added RHEL 7.9 and RHEL 8.3 as supported distributions. For more information, see [System requirements](#) and [Install Linux Virtual Delivery Agent for RHEL/CentOS](#).

#### Support for Ubuntu 20.04

Previously available as an experimental feature, Ubuntu 20.04 is fully supported in this release. For more information, see [System requirements](#) and [Install Linux Virtual Delivery Agent for Ubuntu](#).

### Support for the Rendezvous protocol

The Linux VDA now supports the Rendezvous protocol. In environments that use the Citrix Gateway service, the Rendezvous protocol allows HDX sessions to bypass the Citrix Cloud Connector and connect directly and securely to the Citrix Gateway service. For more information, see [Rendezvous protocol](#).

### Support for Machine Creation Services (MCS) on Google Cloud Platform (GCP)

You can now use MCS to create Linux VMs on GCP. For more information, see [Use MCS to create Linux VMs on GCP](#).

### Wake on LAN available for Linux machines

The integrated Wake on LAN functionality is now available for Linux machines. For more information, see [Remote PC Access](#).

#### Note:

Starting with this release, you must install .NET Core Runtime 3.1 before installing the Linux VDA. For more information, see [Install .NET Core Runtime 3.1 as a prerequisite](#).

## Fixed issues

December 21, 2021

The following issues have been fixed since Linux Virtual Delivery Agent 2009:

- Attempts to upload 10 files or more at the same time by using the file transfer feature might fail. The progress bar continuously shows **0% Completed**. The issue occurs on Ubuntu16.04 intermittently. To work around the issue, log off and back on to the session. [LNXVDA-7620]
- Changing the locale to a non-English language might make performance counters unable to convert a string value to a numeric value. The following error occurs in the VDA log.

```
[PerfCounter] [Error] SysStat.ReadUpTime: Converting element '29363.68' resulted in a NumberFormatException. Error: Input string was not in a correct format
```

```
[CVADHELP-15767]
```

- After performing scans, the `ctxmonitorservice` process might exit unexpectedly with a SIGABRT error. [CVADHELP-15969]

- When you perform any one of the following operations in a Word document opened through Secure Browser, the document might automatically zoom in:
  - Press Ctrl+Z to undo your changes
  - Press Ctrl+C to copy text
  - Press Ctrl+B to make text bold

The issue occurs when the Mobile Receiver virtual channel (MRVC) policy is enabled. [CVADHELP-16214]

## Known issues

March 10, 2021

The following issues have been identified in this release:

- With channel binding enabled, the Linux VDA might fail to register with the Delivery Controller. The issue occurs when the Kerberos ticket used for authentication expires. To work around the issue, complete the following steps:
  1. Open the `/etc/krb5.conf` file and increase the values of `ticket_lifetime` and `renew_lifetime` to prolong the ticket lifetime.
  2. Run the `sudo kinit -k MACHINE\@$REALM` command to renew the expired ticket manually. `MACHINE` is the host name of the Linux VDA in uppercase. `REALM` is the Kerberos realm name in uppercase. [LNXVDA-9076]
- In a GNOME desktop session, attempts to change the keyboard layout might fail. [CVADHELP-15639]
- Non-seamless published applications might exit shortly after launch. The issue occurs after a Mutter upgrade to a version later than mutter-3.28.3-4. To work around the issue, use mutter-3.28.3-4 or earlier. [LNXVDA-6967]
- The Linux VDA does not work as expected when you use NVIDIA GRID 3D cards without enabling HDX 3D Pro. The issue occurs on RHEL 7.7 and earlier, SUSE 12.5 and earlier, and Ubuntu 16.04. The reason is that multiple OpenGL libraries cannot coexist in the graphics systems of these Linux distributions.
- An unexpected window appears during file download. The window does not affect the file download functionality and it automatically disappears after a while. [LNXVDA-5646]
- The default settings of PulseAudio cause the sound server program to exit after 20 seconds of inactivity. When PulseAudio exits, audio does not work. To work around this issue, set `exit-idle-time=-1` in the `/etc/pulse/daemon.conf` file. [LNXVDA-5464]

- `libtcmalloc` 4.3.0 in SUSE 12.5 might cause processes to exit unexpectedly.
- The `ctxhdx` service might exit unexpectedly on the Ubuntu 16.04 and SUSE 12.5 VDAs. [The issue](#) occurs with the GNU C Library (`glibc`) Versions 2.22 through 2.24. The issue is fixed in `glibc` 2.25. If you are using the SUSE 12.5 distribution, you can install [the patch](#) that SUSE provides for fixing the issue. No fix is available for Ubuntu 16.04 at the time the Linux VDA is released. [LNXVDA-4481]
- Sessions cannot be launched in Citrix Workspace app for Linux when SSL encryption is enabled. [RFLNX-1557]
- The `indicator-datetime-service` process does not consume the `$TZ` environment variable. When the client and session locate in different time zones, the unity panel on Ubuntu 16.04 Unity Desktop does not show the time of the client. [LNXVDA-2128]
- Ubuntu graphics: In HDX 3D Pro, a black frame might appear around applications after resizing the Desktop Viewer, or sometimes, the background can appear black.
- Printers created by the Linux VDA printing redirection might not be removed after logging out of a session.
- CDM files are missing when a directory contains numerous files and subdirectories. This issue might occur if the client side has too many files or directories.
- In this release, only UTF-8 encoding is supported for non-English languages.
- Citrix Workspace app for Android CAPS LOCK state might be reversed during session roaming. The CAPS LOCK state can be lost when roaming an existing connection to Citrix Workspace app for Android. As a workaround, use the Shift key on the extended keyboard to switch between upper case and lower case.
- Shortcut keys with ALT do not always work when you connect to the Linux VDA using Citrix Workspace app for Mac. Citrix Workspace app for Mac sends AltGr for both left and right Options/Alt keys by default. You can modify this behavior within the Citrix Workspace app settings but the results vary with different applications.
- Registration fails when the Linux VDA is rejoined to the domain. The rejoining generates a fresh set of Kerberos keys. But, the Broker might use a cached out-of-date VDA service ticket based on the previous set of Kerberos keys. When the VDA tries to connect to the Broker, the Broker might not be able to establish a return security context to the VDA. The usual symptom is that the VDA registration fails.

This problem can eventually resolve itself when the VDA service ticket expires and is renewed. But because service tickets are long-lived, it can take a long time.

As a workaround, clear the Broker's ticket cache. Restart the Broker or run the following command on the Broker from a command prompt as Administrator:



```
1 klist -li 0x3e4 purge
2 <!--NeedCopy-->
```

This command purges all service tickets in the LSA cache held by the Network Service principal under which the Citrix Broker Service runs. It removes service tickets for other VDAs and potentially other services. However, it is harmless – these service tickets can be reacquired from the KDC when needed again.

- Audio plug-n-play is not supported. You can connect an audio capture device to the client machine before starting to record audio in the ICA session. If a capture device is attached after the audio recording application has started, the application might become unresponsive and you must restart it. If a capture device is unplugged while recording, a similar issue might occur.
- Citrix Workspace app for Windows might experience audio distortion during audio recording.

## Third party notices

October 20, 2021

[Linux Virtual Delivery Agent Version 2012](#) (PDF Download)

This release of the Linux VDA can include third party software licensed under the terms defined in the document.

## Deprecation

March 10, 2021

The announcements in this article are intended to give you advanced notice of platforms, Citrix products, and features that are being phased out so that you can make timely business decisions. Citrix monitors customer use and feedback to determine when they are withdrawn. Announcements can change in subsequent releases and might not include every deprecated feature or functionality. For details about product lifecycle support, see the [Product Lifecycle Support Policy](#) article.

## Deprecations and removals

The following table shows the platforms, Citrix products, and features that are deprecated or removed.

**Deprecated** items are not removed immediately. Citrix continues to support them in this release but they will be removed in a future Current Release.

**Removed** items are either removed, or are no longer supported, in the Linux VDA.

Item	Deprecation announced in	Removed in
Support for RHEL 7.7, CentOS 7.7	2006	2009
Support for SUSE 12.3	2006	2006
Support for RHEL 6.10, CentOS 6.10	2003	2003
Support for RHEL 6.9, CentOS 6.9	1909	1909
Support for RHEL 7.5, CentOS 7.5	1903	1903
Support for RHEL 7.4, CentOS 7.4	1811	1811
Support for RHEL 6.8, CentOS 6.8	1811	1811
Support for RHEL 7.3, CentOS 7.3	7.18	7.18
Support for RHEL 6.6, CentOS 6.6	7.16	7.16
SUSE 11.4	7.16	7.16

## System requirements

October 22, 2021

### Linux distributions

**Note:**

System requirements for components not covered here (such as Citrix Workspace app) are described in their respective documentation sets.

Before installing the Linux VDA, install .NET Core Runtime 3.1 according to the instructions at

<https://docs.microsoft.com/en-us/dotnet/core/install/linux-package-managers>.

For more information about using this Current Release (CR) in a Long Term Service (LTSR) environment and other FAQs, see [Knowledge Center article](#).

The Linux VDA supports the following Linux distributions:

- SUSE Linux Enterprise:
  - Server 12 Service Pack 5 + SUSE Linux Enterprise Workstation Extension 12 SP5
  - Server 12 Service Pack 5
- Red Hat Enterprise Linux
  - Workstation 8.3
  - Workstation 8.2
  - Workstation 8.1
  - Workstation 7.9
  - Workstation 7.8
  - Server 8.3
  - Server 8.2
  - Server 8.1
  - Server 7.9
  - Server 7.8
- CentOS Linux
  - CentOS 8.2
  - CentOS 8.1
  - CentOS 7.9
  - CentOS 7.8
- Ubuntu Linux
  - Ubuntu Desktop 20.04
  - Ubuntu Server 20.04
  - Ubuntu Desktop 18.04
  - Ubuntu Server 18.04
  - Ubuntu Live Server 18.04
  - Ubuntu Desktop 16.04
  - Ubuntu Server 16.04

**Note:**

CentOS project shifts focus to CentOS Stream. CentOS Linux 8, as a rebuild of RHEL 8, ends at the end of 2021. CentOS Stream continues after that date, serving as the upstream (development) branch of Red Hat Enterprise Linux. For more information, see <https://www.redhat.com/en/blog/centos-stream-building-innovative-future-enterprise-linux>.

The Linux VDA supports several methods for integrating Linux machines with Microsoft Active Directory (AD):

	Winbind	SSSD	Centrify	PBIS
RHEL 8.3	Yes	Yes	Yes	No
RHEL 8.2	Yes	Yes	Yes	No
CentOS 8.2	Yes	Yes	Yes	No
RHEL 8.1	Yes	Yes	Yes	No
CentOS 8.1	Yes	Yes	Yes	No
RHEL 7.9	Yes	Yes	Yes	Yes
CentOS 7.9	Yes	Yes	Yes	Yes
RHEL 7.8	Yes	Yes	Yes	Yes
CentOS 7.8	Yes	Yes	Yes	Yes
Ubuntu 20.04	Yes	Yes	Yes	Yes
Ubuntu 18.04	Yes	Yes	Yes	Yes
Ubuntu 16.04	Yes	Yes	Yes	Yes
SUSE 12.5	Yes	No	Yes	No

For a matrix of the Linux distributions and the Xorg versions that this version of the Linux VDA supports, see the following table. For more information, see [XorgModuleABIVersions](#).

Linux distribution	Xorg version
RHEL 8.3	1.20
RHEL 8.2, CentOS 8.2	1.20
RHEL 8.1, CentOS 8.1	1.20
RHEL 7.9, CentOS 7.9	1.20
RHEL 7.8, CentOS 7.8	1.20
Ubuntu 20.04	1.20
Ubuntu 18.04	1.19
Ubuntu 16.04	1.18
SUSE 12.5	1.19

Do not use HWE kernel or Xorg server on Ubuntu.

Use Xorg server 1.20.8 and PulseAudio 13.99 on RHEL 8.x and CentOS 8.x.

In all cases, the supported processor architecture is x86-64.

**Note:**

Citrix's support for a Linux OS platform and version expires when the support from the OS vendor expires.

**Important:**

GNOME and KDE desktops are supported in SUSE 12, RHEL 7, CentOS 7, RHEL 8, and CentOS 8. Unity desktop is supported in Ubuntu 16.04. GNOME desktop is supported in Ubuntu 20.04 and Ubuntu 18.04. At least one desktop must be installed.

## Citrix Virtual Desktops

The Linux VDA is compatible with all currently supported versions of Citrix Virtual Apps and Desktops. For information about the Citrix product lifecycle, and to find out when Citrix stops supporting specific versions of products, see the [Citrix Product Lifecycle Matrix](#).

The configuration process for Linux VDAs differs slightly from Windows VDAs. However, any Delivery Controller farm is able to broker both Windows and Linux desktops.

## Supported host platforms and virtualization environments

- Bare metal servers
- Citrix Hypervisor
- VMware ESX and ESXi
- Microsoft Hyper-V
- Nutanix AHV
- Microsoft Azure Resource Manager
- Amazon Web Services (AWS)
- Google Cloud Platform (GCP)

**Tip:**

See the vendor's documentation for the list of supported platforms.

**Note:**

Azure, AWS, and GCP are compatible only with the Citrix Virtual Apps and Desktops service. Bare metal servers are not supported when MCS is used to create virtual machines.

## Active Directory integration packages

The Linux VDA supports the following Active Directory integration packages or products:

- Samba Winbind
- Quest Authentication Services v4.1 or later
- Centrify DirectControl
- SSSD
- PBIS (compatible with RHEL 7 and Ubuntu)

### Tip:

For the list of supported platforms, see the documentation from the vendors of the Active Directory integration packages.

## HDX 3D Pro

The following hypervisors and NVIDIA GRID™ GPU are required to support HDX 3D Pro.

### Hypervisors

- Citrix Hypervisor
- VMware ESX and ESXi
- Nutanix AHV

### Note:

The hypervisors are compatible with certain Linux distributions.

## GPU

The Linux VDA supports the following GPUs for GPU pass-through:

- NVIDIA GRID - Tesla T4
- NVIDIA GTX750Ti
- NVIDIA GRID - Tesla M60
- NVIDIA GRID - K2
- NVIDIA GRID - Tesla P40
- NVIDIA GRID - Tesla P4
- NVIDIA GRID - Tesla P100

The Linux VDA supports the following GPUs for vGPU:

- NVIDIA GRID - Tesla T4
- NVIDIA GRID - Tesla V100

- NVIDIA GRID - Tesla M60
- NVIDIA GRID - Tesla M10
- NVIDIA GRID - Tesla P40
- NVIDIA GRID - Tesla P4
- NVIDIA GRID - Tesla P100

## Installation overview

March 10, 2021

There are three options for you to install the Linux VDA. You can do a fresh installation or upgrade an existing installation from the previous two versions and from an LTSR release.

- Easy install. After installing the Linux VDA package on a machine, you can configure the running environment by using the `ctxinstall.sh` script. For more information, see [Easy install](#).
- Non-domain-joined Linux VDAs: You can create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure to deliver virtual apps and desktops to any device from Microsoft Azure. For more information, see [Create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure](#).
- MCS. You can use MCS to create Linux VMs in batches where the Linux VDA package is also installed. For more information, see [Use MCS to create Linux VMs](#).
- Manual installation. You can use the following general steps to install the Linux VDA. Variations and specific commands are documented by distribution. For more information, see [Install Linux Virtual Delivery Agent for RHEL/CentOS](#), [Install Linux Virtual Delivery Agent for SUSE](#), and [Install Linux Virtual Delivery Agent for Ubuntu](#).
  1. Prepare for installation.
  2. Prepare the hypervisor.
  3. Add the Linux virtual machine (VM) to the Windows domain.
  4. Install the Linux VDA.
  5. Configure the Linux VDA.
  6. Create the machine catalog in Citrix Virtual Apps or Citrix Virtual Desktops.
  7. Create the delivery group in Citrix Virtual Apps or Citrix Virtual Desktops.

## XDPing

You can use the Linux XDPing tool to check for common configuration issues with a Linux VDA environment. For more information, see [XDPing](#).

## Install .NET Core Runtime 3.1 as a prerequisite

Before installing the Linux VDA, install .NET Core Runtime 3.1 according to the instructions at <https://docs.microsoft.com/en-us/dotnet/core/install/linux-package-managers>.

After installing .NET Core Runtime 3.1, run the **which dotnet** command to find your runtime path.

Based on the command output, set the .NET Core runtime binary path. For example, if the command output is /aa/bb/dotnet, use /aa/bb as the .NET binary path.

## Configure Delivery Controllers

March 22, 2022

XenDesktop 7.6 and earlier versions require changes to support the Linux VDA. For those versions, a hotfix or update script is required. The installation and verification instructions are provided in this article.

### Update Delivery Controller configuration

For XenDesktop 7.6 SP2, apply Hotfix Update 2 to update the Broker for Linux Virtual Desktops. Hotfix Update 2 is available here:

[CTX142438](#): Hotfix Update 2 - For Delivery Controller 7.6 (32-bit) – English

For versions earlier than XenDesktop 7.6 SP2, you can use the PowerShell script named **Update-BrokerServiceConfig.ps1** to update the Broker Service configuration. This script is available in the following package:

- citrix-linuxvda-scripts.zip

Repeat the following steps on every Delivery Controller in the farm:

1. Copy the **Update-BrokerServiceConfig.ps1** script to the Delivery Controller machine.
2. Open a Windows PowerShell console in the context of the local administrator.
3. Browse to the folder containing the **Update-BrokerServiceConfig.ps1** script.
4. Run the **Update-BrokerServiceConfig.ps1** script:

```
1 .\Update-BrokerServiceConfig.ps1
2 <!--NeedCopy-->
```



**Tip:**

By default, PowerShell is configured to prevent the execution of PowerShell scripts. If the script fails to run, change the PowerShell execution policy before trying again:

```
1 Set-ExecutionPolicy Unrestricted
2 <!--NeedCopy-->
```

The **Update-BrokerServiceConfig.ps1** script updates the Broker Service configuration file by using new WCF endpoints required by the Linux VDA and restarts the Broker Service. The script determines the location of the Broker Service configuration file automatically. A backup of the original configuration file is created in the same directory, with **.prelinux** appended to the file name.

These changes have no impact on the brokering of Windows VDAs configured to use the same Delivery Controller farm. A single Controller farm can manage and broker sessions for both Windows and Linux VDAs seamlessly.

**Note:**

The Linux VDA does not support Secure ICA for encryption. Enabling Secure ICA on the Linux VDA causes session launch failure.

## Verify Delivery Controller configuration

When the required configuration changes have been applied to a Delivery Controller, the **EndpointLinux** string appears five times in the **%PROGRAMFILES%\Citrix\Broker\Service\BrokerService.exe.config** file.

From the Windows command prompt, log on as a local administrator to check:

```
1 cd "%PROGRAMFILES%" \Citrix\Broker\Service\
2 findstr EndpointLinux BrokerService.exe.config
3 <!--NeedCopy-->
```

## Easy install

June 10, 2022

Easy install is supported as of Version 7.13 of the Linux VDA. This feature helps you set up a running environment of the Linux VDA by installing the necessary packages and customizing the configuration

files automatically.

## Use easy install

To use this feature, do the following:

1. Prepare configuration information and the Linux machine.
2. Install the Linux VDA package.  
Go to the [Citrix Virtual Apps and Desktops download page](#). Expand the appropriate version of Citrix Virtual Apps and Desktops and click **Components** to download the Linux VDA package that matches your Linux distribution.
3. Set up the runtime environment to complete the Linux VDA installation.

### Step 1: Prepare configuration information and the Linux machine

Collect the following configuration information needed for easy install:

- Host name - Host name of the machine on which the Linux VDA is to be installed
- IP address of Domain Name Server
- IP address or string name of NTP Server
- Domain Name - The NetBIOS name of the domain
- Realm Name - The Kerberos realm name
- FQDN of Active Domain - Fully qualified domain name

#### Important:

- To install the Linux VDA, verify that the repositories are added correctly on the Linux machine.
- To launch a session, verify that the X Window system and desktop environments are installed.

### Considerations

- The workgroup name, by default, is the domain name. To customize the workgroup in your environment, do the following:
  - a. Create the `/tmp/ctxinstall.conf` file on the Linux VDA machine.
  - b. Add the `workgroup=<your workgroup>` line to the file and save your changes.
- Centrify does not support pure IPv6 DNS configuration. At least one DNS server using IPv4 is required in `/etc/resolv.conf` for `adclient` to find AD services properly.

#### Log:

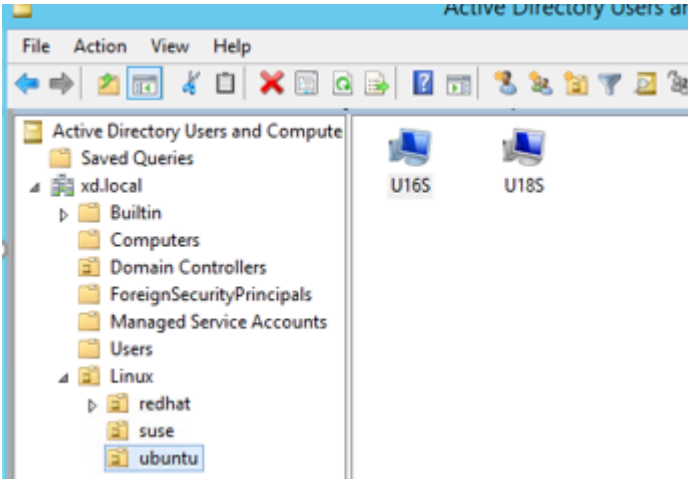
```

1  ADSITE    : Check that this machine's subnet is in a site known by
    AD      : Failed
2          : This machine's subnet is not known by AD.
3          : We guess you should be in the site Site1.
4  <!--NeedCopy-->
    
```

This issue is unique to Centrify and its configuration. To resolve this issue, do the following:

- a. Open **Administrative Tools** on the domain controller.
  - b. Select **Active Directory Sites and Services**.
  - c. Add a proper subnet address for **Subnets**.
- To join your VDA to a specific OU, do the following:
    1. Ensure that the specific OU exists on the domain controller.

For an example OU, see the following screen capture



2. Create the /tmp/ctxinstall.conf file on the VDA.
3. Add the ou=<your ou> line to the /tmp/ctxinstall.conf file.

OU values vary with different AD methods. See the following table.

OS	Winbind	SSSD	Centrify	PBIS
RHEL 8	ou="OU=redhat,O=	ou="OU=redhat,O=	ou="XD.LOCAL/Lin	NOT SUPPORTED
RHEL 7	ou="Linux/redhat"	ou="Linux/redhat"	ou="XD.LOCAL/Linux/redhat"	ou="Linux/redhat"
Ubuntu 20.04, Ubuntu 18.04, Ubuntu 16.04	ou="Linux/ubuntu	ou="Linux/ubuntu	ou="XD.LOCAL/Lin	ou="Linux/ubuntu"

OS	Winbind	SSSD	Centrify	PBIS
SUSE 12.5	ou="Linux/suse"	NOT SUPPORTED	ou="XD.LOCAL/Linux/SUSE"	SUPPORTED

- Easy install supports pure IPv6 as of Linux VDA 7.16. The following preconditions and limitations apply:
  - Your Linux repository must be configured to ensure that your machine can download required packages over pure IPv6 networks.
  - Centrify is not supported on pure IPv6 networks.

**Note:**

If your network is pure IPv6 and all your input is in proper IPv6 format, the VDA registers with the Delivery Controller through IPv6. If your network has a hybrid IPv4 and IPv6 configuration, the type of the first DNS IP address determines whether IPv4 or IPv6 is used for registration.

- If you choose Centrify as the method to join a domain, the `ctxinstall.sh` script requires the Centrify package. There are two ways for `ctxinstall.sh` to get the Centrify package:
  - Easy install helps download the Centrify package from the Internet automatically. The following are the URLs for each distribution:
    - RHEL: `wget http://edge.centrify.com/products/centrify-suite/2016-update-1/installers/centrify-suite-2016.1-rhel4-x86\_64.tgz?\_ga=1.178323680.558673738.1478847956`
    - CentOS: `wget http://edge.centrify.com/products/centrify-suite/2016-update-1/installers/centrify-suite-2016.1-rhel4-x86\_64.tgz?\_ga=1.186648044.558673738.1478847956`
    - SUSE: `wget http://edge.centrify.com/products/centrify-suite/2016-update-1/installers/centrify-suite-2016.1-suse10-x86\_64.tgz?\_ga=1.10831088.558673738.1478847956`
    - Ubuntu: `wget https://downloads.centrify.com/products/infrastructure-services/19.9/centrify-infrastructure-services-19.9-deb8-x86\_64.tgz?\_ga=2.151462329.1042350071.1592881996-604509155.1572850145`
  - Fetch the Centrify package from a local directory. To designate the directory of the Centrify package, do the following:
    - a. Create the `/tmp/ctxinstall.conf` file on the Linux VDA server if it does not exist.
    - b. Add the “`centrifypkgpath=<path name>`” line to the file.

For example:

```
1 cat /tmp/ctxinstall.conf
2 set "centrifypkgpath=/home/mydir"
3 ls -ls /home/mydir
4 9548 -r-xr-xr-x. 1 root root 9776688 May 13 2016
   adcheck-rhel4-x86_64
5 4140 -r--r--r--. 1 root root 4236714 Apr 21 2016
   centrifida-3.3.1-rhel4-x86_64.rpm
6 33492 -r--r--r--. 1 root root 34292673 May 13 2016
   centrifidc-5.3.1-rhel4-x86_64.rpm
7 4 -rw-rw-r--. 1 root root 1168 Dec 1 2015
   centrifidc-install.cfg
8 756 -r--r--r--. 1 root root 770991 May 13 2016
   centrifidc-ldaproxy-5.3.1-rhel4-x86_64.rpm
9 268 -r--r--r--. 1 root root 271296 May 13 2016
   centrifidc-nis-5.3.1-rhel4-x86_64.rpm
10 1888 -r--r--r--. 1 root root 1930084 Apr 12 2016
   centrifidc-openssh-7.2p2-5.3.1-rhel4-x86_64.rpm
11 124 -rw-rw-r--. 1 root root 124543 Apr 19 2016
   centrifify-suite.cfg
12 0 lrwxrwxrwx. 1 root root 10 Jul 9 2012 install-
   express.sh -> install.sh
13 332 -r-xr-xr--. 1 root root 338292 Apr 10 2016 install
   .sh
14 12 -r--r--r--. 1 root root 11166 Apr 9 2015 release-
   notes-agent-rhel4-x86_64.txt
15 4 -r--r--r--. 1 root root 3732 Aug 24 2015 release-
   notes-da-rhel4-x86_64.txt
16 4 -r--r--r--. 1 root root 2749 Apr 7 2015 release-
   notes-nis-rhel4-x86_64.txt
17 12 -r--r--r--. 1 root root 9133 Mar 21 2016 release-
   notes-openssh-rhel4-x86_64.txt
18 <!--NeedCopy-->
```

- If you choose PBIS as the method to join a domain, the ctxinstall.sh script requires the PBIS package. There are two ways for ctxinstall.sh to get the PBIS package:

- Easy install helps download the PBIS package from the Internet automatically. The following are the URLs for each distribution:

RHEL 7 / CentOS 7: `wget https://github.com/BeyondTrust/pbis-open/releases/download/8.8.0/pbis-open-8.8.0.506.linux.x86\_64.rpm.sh`

Ubuntu: `wget https://github.com/BeyondTrust/pbis-open/releases/download/8.8.0/pbis-open-8.8.0.506.linux.x86\_64.deb.sh`

- Fetch a specific version of the PBIS package from the Internet. To do so, change the “pbis-DownloadPath” line in the /opt/Citrix/VDA/sbin/ctxinstall.sh file to designate the URL of the PBIS package.

For an example, see the following screen capture:

```
pbisDownloadPath_RHEL="https://github.com/BeyondTrust/pbis-open/releases/download/8.8.0/pbis-open-8.8.0.506.linux.x86_64.rpm.sh"
pbisDownloadPath_Ubuntu="https://github.com/BeyondTrust/pbis-open/releases/download/8.8.0/pbis-open-8.8.0.506.linux.x86_64.deb.sh"
```

## Step 2: Install the Linux VDA package

To set up the environment for the Linux VDA, run the following commands.

For RHEL and CentOS distributions:

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

For Ubuntu distributions:

```
1 sudo dpkg -i <PATH>/<Linux VDA deb>
2 sudo apt-get install -f
3 <!--NeedCopy-->
```

For SUSE distributions:

```
1 zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

## Step 3: Set up the runtime environment to complete the installation

### Note:

Before setting up the runtime environment, ensure that the `en_US.UTF-8` locale has been installed in your OS. If the locale is not available in your OS, run the `sudo locale-gen en_US.UTF-8` command.

After installing the Linux VDA package, configure the running environment by using the `ctxinstall.sh` script. You can run the script in interactive mode or silent mode.

**Note:**

Easy install might seem unresponsive while it downloads .NET Core Runtime that is over 27 MB in size. For the downloading progress, check `/var/log/ctxinstall.log`.

**Interactive mode:**

To do a manual configuration, run the following command and type the relevant parameter at each prompt.

```
1 sudo /opt/Citrix/VDA/sbin/ctxinstall.sh
2 <!--NeedCopy-->
```

**Silent mode:**

To use easy install in silent mode, set the following environment variables before running `ctxinstall.sh`.

- **CTX\_EASYINSTALL\_HOSTNAME=host-name** – Denotes the host name of the Linux VDA server.
- **CTX\_EASYINSTALL\_DNS=ip-address-of-dns** – IP address of DNS.
- **CTX\_EASYINSTALL\_NTPS=address-of-ntp** – IP address or string name of the NTP server.
- **CTX\_EASYINSTALL\_DOMAIN=domain-name** – The NetBIOS name of the domain.
- **CTX\_EASYINSTALL\_REALM=realm-name** – The Kerberos realm name.
- **CTX\_EASYINSTALL\_FQDN=ad-fqdn-name**
- **CTX\_EASYINSTALL\_ADINTEGRATIONWAY=winbind | sssd | centrify | pbis** – Denotes the Active Directory integration method.
- **CTX\_EASYINSTALL\_USERNAME=domain-user-name** – Denotes the name of the domain user; used to join the domain.
- **CTX\_EASYINSTALL\_PASSWORD=password** – Specifies the password of the domain user; used to join the domain.

The `ctxsetup.sh` script uses the following variables:

- **CTX\_XDL\_SUPPORT\_DDC\_AS\_CNAME=Y | N** – The Linux VDA supports specifying a Delivery Controller name using a DNS CNAME record.
- **CTX\_XDL\_DDC\_LIST='list-ddc-fqdns'** – The Linux VDA requires a space-separated list of Delivery Controller Fully Qualified Domain Names (FQDNs) to use for registering with a Delivery Controller. At least one FQDN or CNAME must be specified.
- **CTX\_XDL\_VDA\_PORT=port-number** – The Linux VDA communicates with Delivery Controllers through a TCP/IP port.
- **CTX\_XDL\_REGISTER\_SERVICE=Y | N** – The Linux Virtual Desktop services are started after machine startup.
- **CTX\_XDL\_ADD\_FIREWALL\_RULES=Y | N** – The Linux Virtual Desktop services require incoming network connections to be allowed through the system firewall. You can automatically open the

required ports (by default ports 80 and 1494) in the system firewall for the Linux Virtual Desktop.

- **CTX\_XDL\_HDX\_3D\_PRO=Y | N** – The Linux VDA supports HDX 3D Pro, a set of GPU acceleration technologies designed to optimize the virtualization of rich graphics applications. If HDX 3D Pro is selected, the VDA is configured for VDI desktops (single-session) mode - (that is, CTX\_XDL\_VDI\_MODE=Y).
- **CTX\_XDL\_VDI\_MODE=Y | N** – Whether to configure the machine as a dedicated desktop delivery model (VDI) or hosted shared desktop delivery model. For HDX 3D Pro environments, set the value to Y.
- **CTX\_XDL\_SITE\_NAME=dns-name** – The Linux VDA discovers LDAP servers through DNS. To limit the DNS search results to a local Site, specify a DNS Site name. If unnecessary, set to **<none>**.
- **CTX\_XDL\_LDAP\_LIST='list-ldap-servers'** – The Linux VDA queries DNS to discover LDAP servers. If DNS cannot provide LDAP service records, you can provide a space-separated list of LDAP FQDNs with LDAP ports. For example, ad1.mycompany.com:389. If unnecessary, set to **<none>**.
- **CTX\_XDL\_SEARCH\_BASE=search-base-set** – The Linux VDA queries LDAP through a search base set to the root of the Active Directory Domain (for example, DC=mycompany,DC=com). To improve search performance, you can specify a search base (for example, OU=VDI,DC=mycompany,DC=com). If unnecessary, set to **<none>**.
- **CTX\_XDL\_FAS\_LIST='list-fas-servers'** – The Federated Authentication Service (FAS) servers are configured through AD Group Policy. The Linux VDA does not support AD Group Policy, but you can provide a semicolon-separated list of FAS servers instead. The sequence must be the same as configured in AD Group Policy. If any server address is removed, fill its blank with the **<none>** text string and do not modify the order of server addresses.
- **CTX\_XDL\_DOTNET\_RUNTIME\_PATH=path-to-install-dotnet-runtime** – The path to install .NET Core Runtime 3.1 for supporting the new broker agent service (`ctxvda`). The default path is `/usr/bin`.
- **CTX\_XDL\_START\_SERVICE=Y | N** – Whether or not the Linux VDA services are started when the configuration is complete.
- **CTX\_XDL\_TELEMETRY\_SOCKET\_PORT** – The socket port for listening for Citrix Scout. The default port is 7503.
- **CTX\_XDL\_TELEMETRY\_PORT** – The port for communicating with Citrix Scout. The default port is 7502.

If any parameters are not set, the installation rolls back to interactive mode, with a prompt for user input. When all parameters are already set through the environment variables, the `ctxinstall.sh` script still prompts for user input for the path to install .NET Core Runtime 3.1.

In silent mode, you must run the following commands to set environment variables and then run the `ctxinstall.sh` script.



```
1 export CTX_EASYINSTALL_HOSTNAME=host-name
2
3 export CTX_EASYINSTALL_DNS=ip-address-of-dns
4
5 export CTX_EASYINSTALL_NTFS=address-of-ntfs
6
7 export CTX_EASYINSTALL_DOMAIN=domain-name
8
9 export CTX_EASYINSTALL_REALM=realm-name
10
11 export CTX_EASYINSTALL_FQDN=ad-fqdn-name
12
13 export CTX_EASYINSTALL_ADINTEGRATIONWAY=winbind | sssd | centrify |
    pbis
14
15 export CTX_EASYINSTALL_USERNAME=domain-user-name
16
17 export CTX_EASYINSTALL_PASSWORD=password
18
19 export CTX_XDL_SUPPORT_DDC_AS_CNAME=Y | N
20
21 export CTX_XDL_DDC_LIST= 'list-ddc-fqdns'
22
23 export CTX_XDL_VDA_PORT=port-number
24
25 export CTX_XDL_REGISTER_SERVICE=Y | N
26
27 export CTX_XDL_ADD_FIREWALL_RULES=Y | N
28
29 export CTX_XDL_HDX_3D_PRO=Y | N
30
31 export CTX_XDL_VDI_MODE=Y | N
32
33 export CTX_XDL_SITE_NAME=dns-site-name | '<none>'
34
35 export CTX_XDL_LDAP_LIST= 'list-ldap-servers' | '<none>'
36
37 export CTX_XDL_SEARCH_BASE=search-base-set | '<none>'
38
39 export CTX_XDL_FAS_LIST= 'list-fas-servers' | '<none>'
40
41 export CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime
42
43 export CTX_XDL_TELEMETRY_SOCKET_PORT=port-number
```

```
44
45 export CTX_XDL_TELEMETRY_PORT=port-number
46
47 export CTX_XDL_START_SERVICE=Y | N
48
49 sudo -E /opt/Citrix/VDA/sbin/ctxinstall.sh
50 <!--NeedCopy-->
```

When running the sudo command, type the -E option to pass the existing environment variables to the new shell it creates. We recommend that you create a shell script file from the preceding commands with **#!/bin/bash** as the first line.

Alternatively, you can specify all parameters by using a single command:

```
1 sudo CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N \
2
3 CTX_XDL_DDC_LIST= 'list-ddc-fqdns' \
4
5 CTX_XDL_VDA_PORT=port-number \
6
7 CTX_XDL_REGISTER_SERVICE=Y|N \
8
9 CTX_XDL_ADD_FIREWALL_RULES=Y|N \
10
11 CTX_XDL_AD_INTEGRATION=1|2|3|4 \
12
13 CTX_XDL_HDX_3D_PRO=Y|N \
14
15 CTX_XDL_VDI_MODE=Y|N \
16
17 CTX_XDL_SITE_NAME=dns-name \
18
19 CTX_XDL_LDAP_LIST= 'list-ldap-servers' \
20
21 CTX_XDL_SEARCH_BASE=search-base-set \
22
23 CTX_XDL_FAS_LIST= 'list-fas-servers' \
24
25 CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime \
26
27 CTX_XDL_TELEMETRY_SOCKET_PORT=port-number \
28
29 CTX_XDL_TELEMETRY_PORT=port-number \
30
```

```
31 CTX_XDL_START_SERVICE=Y|N \  
32 \  
33 /opt/Citrix/VDA/sbin/ctxsetup.sh \  
34 <!--NeedCopy-->
```

## Troubleshooting

Use the information in this section to troubleshoot issues that can arise from using this feature.

### Joining a domain by using SSSD fails

An error might occur when you attempt to join a domain, with the output similar to the following (verify logs for screen printing):

```
Step 6: join Domain!Enter ctxadmin's password:Failed to join domain: failed  
to lookup DC info for domain 'CITRIXLAB.LOCAL'over rpc: The network name  
cannot be found
```

/var/log/xdl/vda.log:

```
1 2016-11-04 02:11:52.317 [INFO ] - The Citrix Desktop Service  
    successfully obtained the following list of 1 delivery controller(s)  
    with which to register: 'CTXDDC.citrixlab.local (10.158.139.214)'.  
2 2016-11-04 02:11:52.362 [ERROR] - RegistrationManager.  
    AttemptRegistrationWithSingleDdc: Failed to register with http://  
    CTXDDC.citrixlab.local:80/Citrix/CdsController/IRegistrar. Error:  
    General security error (An error occurred in trying to obtain a TGT:  
    Client not found in Kerberos database (6))  
3 2016-11-04 02:11:52.362 [ERROR] - The Citrix Desktop Service cannot  
    connect to the delivery controller 'http://CTXDDC.citrixlab.local  
    :80/Citrix/CdsController/IRegistrar' (IP Address '10.158.139.214')  
4 Check the following:-The system clock is in sync between this machine  
    and the delivery controller.  
5 - The Active Directory provider (e.g. winbind daemon) service is  
    running and correctly configured.  
6 - Kerberos is correctly configured on this machine.  
7 If the problem persists, please refer to Citrix Knowledge Base article  
    CTX117248 for further information.  
8 Error Details:  
9 Exception 'General security error (An error occurred in trying to  
    obtain a TGT: Client not found in Kerberos database (6))' of type '  
    class javax.xml.ws.soap.SOAPFaultException'.
```

```
10 2016-11-04 02:11:52.362 [INFO ] - RegistrationManager.
    AttemptRegistrationWithSingleDdc: The current time for this VDA is
    Fri Nov 04 02:11:52 EDT 2016.
11 Ensure that the system clock is in sync between this machine and the
    delivery controller.
12 Verify the NTP daemon is running on this machine and is correctly
    configured.
13 2016-11-04 02:11:52.364 [ERROR] - Could not register with any
    controllers. Waiting to try again in 120000 ms. Multi-forest - false
14 2016-11-04 02:11:52.365 [INFO ] - The Citrix Desktop Service failed to
    register with any controllers in the last 470 minutes.
15 <!--NeedCopy-->
```

/var/log/messages:

```
Nov 4 02:15:27 RH-WS-68 [sssd[ldap_child[14867]]]: Failed to initialize
    credentials using keytab [MEMORY:/etc/krb5.keytab]: Client 'RH-WS-68
    $@CITRIXLAB.LOCAL'not found in Kerberos database. Unable to create GSSAPI-
    encrypted LDAP connection.Nov 4 02:15:27 RH-WS-68 [sssd[ldap_child[14867]]]:
    Client 'RH-WS-68$@CITRIXLAB.LOCAL'not found in Kerberos database
```

To resolve this issue:

1. Run the `rm -f /etc/krb5.keytab` command.
2. Run the `net ads leave $REALM -U $domain-administrator` command.
3. Remove the machine catalog and delivery group on the Delivery Controller.
4. Run `/opt/Citrix/VDA/sbin/ctxinstall.sh`.
5. Create the machine catalog and delivery group on the Delivery Controller.

### Ubuntu desktop sessions show a gray screen

This issue occurs when you launch a session that is then blocked in a blank desktop. In addition, the console of the machine also shows a gray screen when you log on by using a local user account.

To resolve this issue:

1. Run the `sudo apt-get update` command.
2. Run the `sudo apt-get install unity lightdm` command.
3. Add the following line to `/etc/lightdm/lightdm.conf`:  
`greeter-show-manual-login=true`

### Attempts to launch Ubuntu desktop sessions fail due to a missing home directory

/var/log/xdl/hdx.log:

```

1 2016-11-02 13:21:19.015 <P22492:S1> citrix-ctxlogin: StartUserSession:
   failed to change to directory(/home/CITRIXLAB/ctxadmin) errno(2)
2
3 2016-11-02 13:21:19.017 <P22227> citrix-ctxhdx: logSessionEvent:
   Session started for user ctxadmin.
4
5 2016-11-02 13:21:19.023 <P22492:S1> citrix-ctxlogin: ChildPipeCallback:
   Login Process died: normal.
6
7 2016-11-02 13:21:59.217 <P22449:S1> citrix-ctxgfx: main: Exiting
   normally.
8 <!--NeedCopy-->

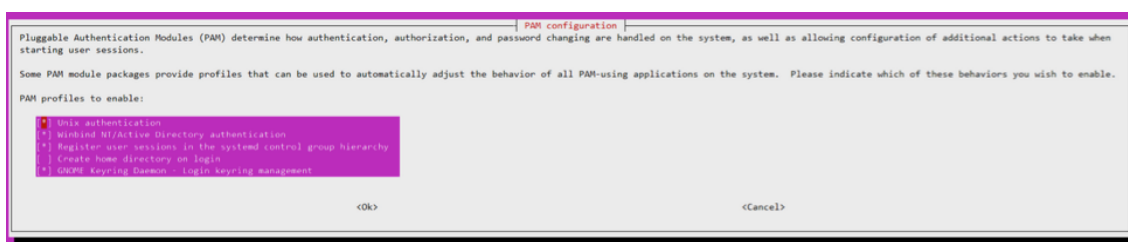
```

**Tip:**

The root cause of this issue is that the home directory is not created for the domain administrator.

To resolve this issue:

1. From a command line, type **pam-auth-update**.
2. In the resulting dialog, verify that **Create home directory login** is selected.

**Session does not launch or ends quickly with dbus error**

/var/log/messages (for RHEL or CentOS):

```

1 Oct 27 04:17:16 CentOS7 citrix-ctxhdx[8978]: Session started for user
   CITRIXLAB\ctxadmin.
2
3 Oct 27 04:17:18 CentOS7 kernel: traps: gnome-session[19146] trap int3
   ip:7f89b3bde8d3 sp:7fff8c3409d0 error:0
4
5 Oct 27 04:17:18 CentOS7 gnome-session[19146]: ERROR: Failed to connect
   to system bus: Exhausted all available authentication mechanisms (

```

```
    tried: EXTERNAL, DBUS_COOKIE_SHA1, ANONYMOUS) (available: EXTERNAL,
    DBUS_COOKIE_SHA1, ANONYMOUS)#012aborting...
6
7 Oct 27 04:17:18 CentOS7 gnome-session: gnome-session[19146]: ERROR:
    Failed to connect to system bus: Exhausted all available
    authentication mechanisms (tried: EXTERNAL, DBUS_COOKIE_SHA1,
    ANONYMOUS) (available: EXTERNAL, DBUS_COOKIE_SHA1, ANONYMOUS)
8
9 Oct 27 04:17:18 CentOS7 gnome-session: aborting...
10
11 Oct 27 04:17:18 CentOS7 citrix-ctxgxfx[18981]: Exiting normally.
12
13 Oct 27 04:17:18 CentOS7 citrix-ctxhdx[8978]: Session stopped for user
    CITRIXLAB\ctxadmin.
14 <!--NeedCopy-->
```

Or, alternately for Ubuntu distributions, use the log `/var/log/syslog`:

```
1 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25326]: [pulseaudio] pid.c:
    Stale PID file, overwriting.
2
3 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25326]: [pulseaudio] bluez5-
    util.c: Failed to get D-Bus connection: Did not receive a reply.
    Possible causes include: the remote application did not send a reply
    , the message bus security policy blocked the reply, the reply
    timeout expired, or the network connection was broken.
4
5 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25326]: [pulseaudio] hashmap
    .c: Assertion 'h' failed at pulsecore/hashmap.c:116, function
    pa_hashmap_free(). Aborting.
6
7 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25352]: [pulseaudio] core-
    util.c: Failed to connect to system bus: Did not receive a reply.
    Possible causes include: the remote application did not send a reply
    , the message bus security policy blocked the reply, the reply
    timeout expired, or the network connection was broken.
8
9 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25352]: message repeated 10
    times: [ [pulseaudio] core-util.c: Failed to connect to system bus:
    Did not receive a reply. Possible causes include: the remote
    application did not send a reply, the message bus security policy
    blocked the reply, the reply timeout expired, or the network
    connection was broken.]
```

```
10
11 Nov  3 11:03:52 user01-HVM-domU pulseaudio[25352]: [pulseaudio] pid.c:
    Daemon already running.Nov  3 11:03:58 user01-HVM-domU citrix-ctxgxfx
    [24693]: Exiting normally
12 <!--NeedCopy-->
```

Some groups or modules do not take effect until a restart. If the **dbus** error messages appear in the log, we recommend that you restart the system and retry.

### SELinux prevents SSHD from accessing the home directory

The user can launch a session but cannot log on.

/var/log/ctxinstall.log:

```
 1 Jan 25 23:30:31 yz-rhel72-1 setroubleshoot[3945]: SELinux is preventing
    /usr/sbin/sshd from setattr access on the directory /root. For
    complete SELinux messages. run sealert -l 32f52c1f-8ff9-4566-a698
    -963a79f16b81
 2
 3 Jan 25 23:30:31 yz-rhel72-1 python[3945]: SELinux is preventing /usr/
    sbin/sshd from setattr access on the directory /root.
 4
 5 ***** Plugin catchall_boolean (89.3 confidence) suggests
    *****
 6
 7 If you want to allow polyinstantiation to enabled
 8
 9 Then you must tell SELinux about this by enabling the '
    polyinstantiation_enabled' boolean.
10
11 You can read 'None' man page for more details.
12
13 Do
14
15     setsebool -P polyinstantiation_enabled 1
16
17 ***** Plugin catchall (11.6 confidence) suggests
    *****
18
19 If you believe that sshd should be allowed setattr access on the root
    directory by default.
20
```

```
21 Then you should report this as a bug.
22
23 You can generate a local policy module to allow this access.
24
25     Do
26
27         allow this access for now by executing:
28
29         # grep sshd /var/log/audit/audit.log | audit2allow -M mypol
30
31 # semodule -i mypol.pp
32 <!--NeedCopy-->
```

To resolve this issue:

1. Disable SELinux by making the following change to /etc/selinux/config.  
SELINUX=disabled
2. Restart the VDA.

## Create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure

March 10, 2021

You can create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure to deliver virtual apps and desktops to any device from Microsoft Azure. For more information, see [Citrix Virtual Apps and Desktops Standard for Azure](#).

### Supported Linux distributions

The following Linux distributions support this feature:

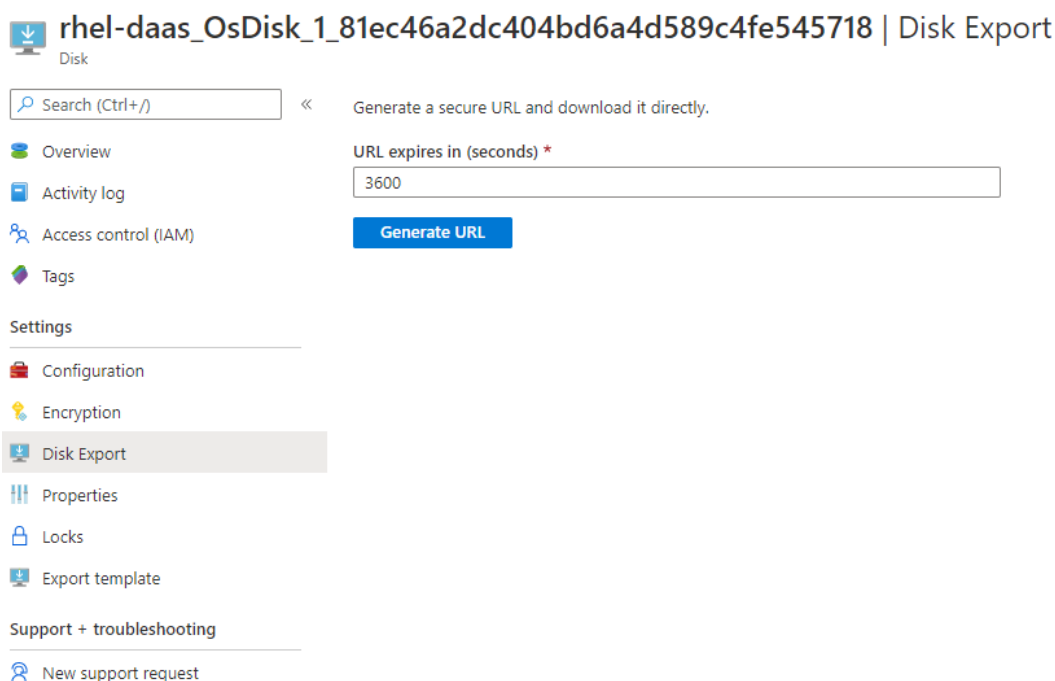
- RHEL 8.3
- RHEL 8.2
- RHEL 7.8
- Ubuntu 20.04
- Ubuntu 18.04
- Ubuntu 16.04



## Steps

To create non-domain-joined Linux VDAs in Citrix Virtual Apps and Desktops Standard for Azure, do the following:

1. Prepare a master image in Azure:
  - a) In Azure, create a Linux VM of a supported distribution.
  - b) Install a desktop environment on the Linux VM if necessary.
  - c) On the VM, install .NET Core Runtime 3.1 according to the instructions at <https://docs.microsoft.com/en-us/dotnet/core/install/linux-package-managers>.
  - d) (For Ubuntu18.04 only) Add the `source /etc/network/interfaces.d/*` line in the `/etc/network/interfaces` file.
  - e) Install the Linux VDA package.
  - f) Open `/etc/xdl/mcs/mcs.conf` to set `NON_DOMAIN_JOINED_MODE=Y`.  
**Note:** If you select the **Static** or **Random** type when creating a machine catalog, set `VDI_MODE=Y`.
  - g) Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
  - h) In Azure, stop (or deallocate) the VM. Click **Disk Export** to generate a SAS URL for the Virtual Hard Disk (VHD) file that you can use as a master image to create other VMs.



- i) (Optional) Make group policy settings on the master image.

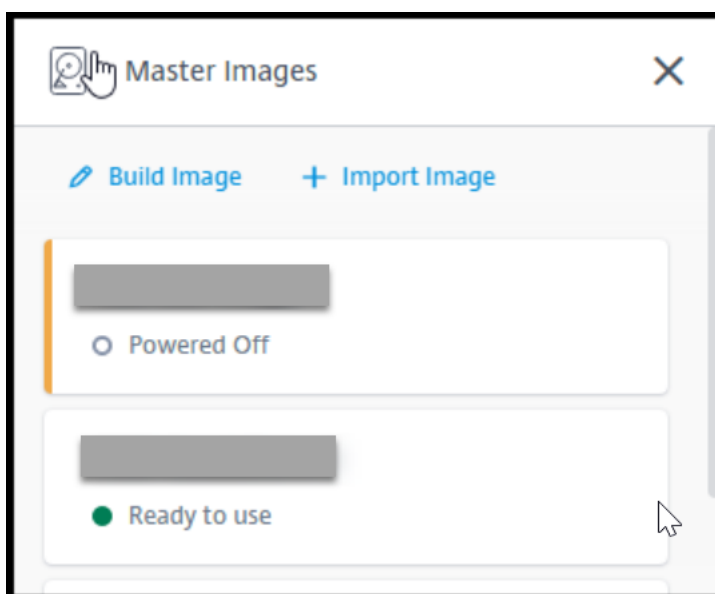
You can use the `ctxreg` tool to make group policy settings. For example, the following command enables the **Auto-create PDF Universal Printer** policy for PDF printing.

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\  
GroupPolicy\Defaults\PrintingPolicies" -t "REG_DWORD" -v "  
AutoCreatePDFPrinter" -d "0x00000001" - force  
2 <!--NeedCopy-->
```

2. Import the master image from Azure.

- a) From the [Manage](#) dashboard, expand **Master Images** on the right. The display lists the master images that Citrix provides, and images that you created and imported.

**Tip:** Most of the administrator activities for this service are managed through the **Manage** and **Monitor** dashboards. After you create your first catalog, the **Manage** dashboard launches automatically after you sign in to Citrix Cloud and select the **Managed Desktops** service.



- b) Click **Import Image**.
- c) Enter the SAS URL for the VHD file you generated in Azure. Select **Linux** for the master image type.

## Import Image from Azure

Enter the Azure-generated URL for the Virtual Hard Disk 

[How do I find my Url?](#)

Master image type

- Windows  
 Linux

Name The New Master Image

E.g. "Windows 10 + My Apps"

- d) Follow the instructions in the wizard to complete importing the master image.
3. Create a Machine Catalog.

Access the [Manage](#) dashboard and click **Create Catalog**. When creating the Machine Catalog, choose the master image you created earlier.

**Note:** You can create non-domain-joined Linux Machine Catalogs in Citrix-managed Azure subscription only.

## Use Machine Creation Services (MCS) to create Linux VMs

November 29, 2021

To use MCS to create Linux VMs, prepare a master image on your hypervisor. This process entails installing the VDA on the template VM, creating a Machine Catalog in Citrix Studio, creating a Delivery Group, and performing certain configuration tasks.

### Note:

Unexpected results can occur if you try to prepare a master image on hypervisors other than Citrix Hypervisor, Microsoft Azure, VMware vSphere, AWS, GCP, or Nutanix AHV.

Microsoft Azure, AWS, and GCP are not supported as of Citrix Virtual Apps and Desktops 7 2003. But you can continue using the hosts in the Citrix Virtual Apps and Desktops service.

## Supported distributions

	Winbind	SSSD	Centrify	PBIS
RHEL 8.3	Yes	No	No	No
RHEL 8.2	Yes	No	No	No
CentOS 8.2	Yes	No	No	No
RHEL 8.1	Yes	No	No	No
CentOS 8.1	Yes	No	No	No
RHEL 7.9	Yes	Yes	No	No
CentOS 7.9	Yes	Yes	No	No
RHEL 7.8	Yes	Yes	No	No
CentOS 7.8	Yes	Yes	No	No
Ubuntu 20.04	Yes	Yes	No	No
Ubuntu 18.04	Yes	Yes	No	No
Ubuntu 16.04	Yes	Yes	No	No
SUSE 12.5	Yes	No	No	No

## Use MCS to create Linux VMs on Citrix Hypervisor

### Step 1: Prepare a master image

A master image contains the operating system, non-virtualized applications, VDA, and other software. To prepare a master image, do the following:

#### Step 1a: Install Citrix VM Tools

Citrix VM Tools must be installed on the template VM for each VM to be able to use the xe CLI or XenCenter. VM performance can be slow unless the tools are installed. Without the tools, you cannot do any of the following:

- Cleanly shut down, restart, or suspend a VM.
- View the VM performance data in XenCenter.
- Migrate a running VM (through [XenMotion](#)).
- Create snapshots or snapshots with memory (checkpoints), and revert to snapshots.
- Adjust the number of vCPUs on a running Linux VM.

1. Run the following command to mount Citrix VM Tools named guest-tools.iso.

```
1 sudo mount /dev/cdrom /mnt
2 <!--NeedCopy-->
```

2. Run the following command to install the `xe-guest-utilities` package based on your Linux distribution.

**For RHEL/CentOS:**

```
1 sudo rpm -i /mnt/Linux/xe-guest-utilities_{
2   package-version }
3   _all.rpm
4 <!--NeedCopy-->
```

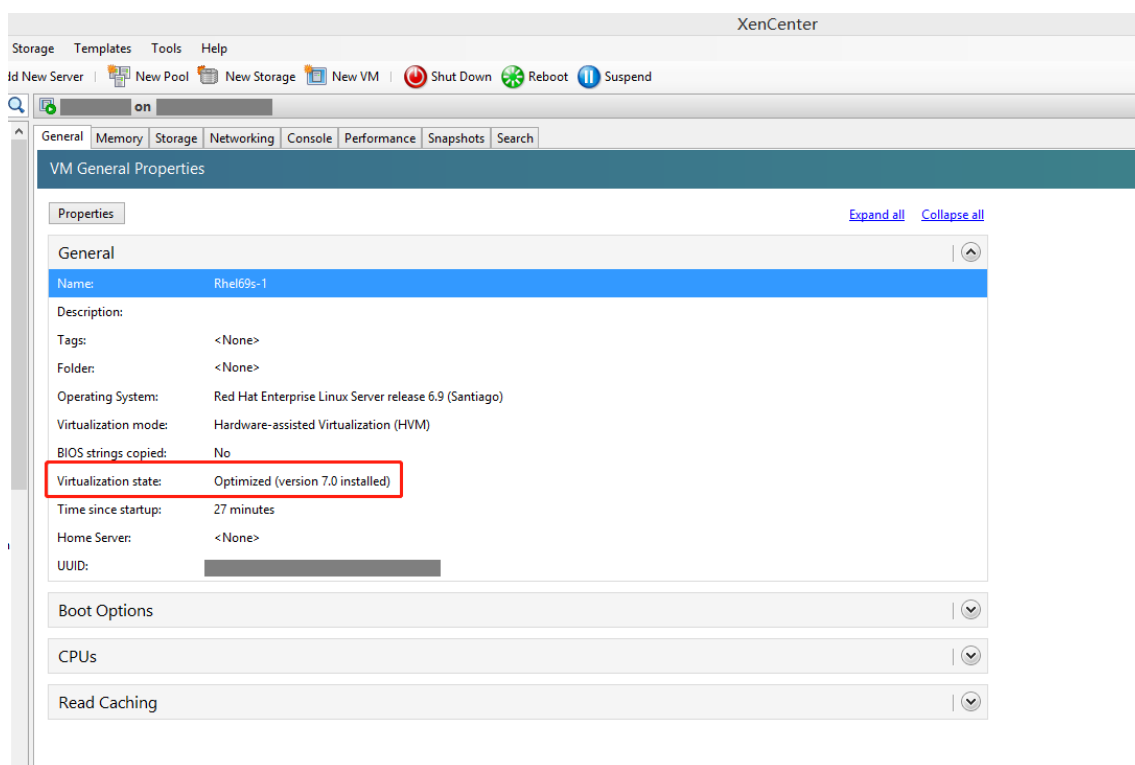
**For Ubuntu:**

```
1 sudo dpkg -i /mnt/Linux/xe-guest-utilities_{
2   package-version }
3   _all.deb
4 <!--NeedCopy-->
```

**For SUSE 12:**

```
1 sudo rpm -i /mnt/Linux/xe-guest-utilities_{
2   package-version }
3   _all.rpm
4 <!--NeedCopy-->
```

3. Check the virtualization state of the template VM on the **General** tab in XenCenter. If Citrix VM Tools are installed correctly, the virtualization state is **Optimized**:



## Step 1b: Install the Linux VDA package on the template VM

### Note:

To use a currently running VDA as the template VM, omit this step.

Before installing the Linux VDA package on the template VM, install .NET Core Runtime 3.1. For more information, see [Installation overview](#).

Based on your Linux distribution, run the following command to set up the environment for the Linux VDA:

### For RHEL/CentOS:

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

### For Ubuntu:

```
1 sudo dpkg -i <PATH>/<Linux VDA DEB>
2
3 apt-get install -f
```

```
4 <!--NeedCopy-->
```

#### For SUSE 12:

```
1 sudo zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

#### Step 1c: Enable repositories to install the tdb-tools package

##### For RHEL 7 server:

```
1 subscription-manager repos --enable=rhel-7-server-optional-rpms
2 <!--NeedCopy-->
```

##### For RHEL 7 workstation:

```
1 subscription-manager repos --enable=rhel-7-workstation-optional-rpms
2 <!--NeedCopy-->
```

#### Step 1d: Install the EPEL repository that contains ntfs-3g

Install the EPEL repository on RHEL 8/CentOS 8, RHEL 7/CentOS 7 so that running `deploymcs.sh` later installs the `ntfs-3g` package contained in it.

#### Step 1e: Manually install ntfs-3g on SUSE 12

On the SUSE 12 platform, there is no repository providing `ntfs-3g`. Download the source code, compile, and install `ntfs-3g` manually:

1. Install the GNU Compiler Collection (GCC) compiler system and the make package:

```
1 sudo zypper install gcc
2 sudo zypper install make
3 <!--NeedCopy-->
```

2. Download the `ntfs-3g` package.

3. Decompress the ntfs-3g package:

```
1 sudo tar -xvzf ntfs-3g_ntfsprogs-<package version>.tgz
2 <!--NeedCopy-->
```

4. Enter the path to the ntfs-3g package:

```
1 sudo cd ntfs-3g_ntfsprogs-<package version>
2 <!--NeedCopy-->
```

5. Install ntfs-3g:

```
1 ./configure
2 make
3 make install
4 <!--NeedCopy-->
```

### Step 1f: Set up the runtime environment

Before running `deploymcs.sh`, do the following:

- Change variables in `/etc/xdl/mcs/mcs.conf`. The `mcs.conf` configuration file contains variables for setting MCS and the Linux VDA. The following are variables you can set as required:
  - `Use_Existing_Configurations_Of_Current_VDA`: Determines whether to use the existing configurations of the currently running VDA. If set to Y, configuration files on MCS-created machines are the same as the equivalents on the currently running VDA. However, you still must configure the `dns` and `AD_INTEGRATION` variables. The default value is N, which means configuration files on MCS-created machines are determined by configuration templates on the master image.
  - `dns`: Sets the DNS IP address.
  - `AD_INTEGRATION`: Sets Winbind or SSSD (SSSD is not supported on SUSE).
  - `WORKGROUP`: Sets the workgroup name (case-sensitive) if it is configured in AD.
- On the template machine, add command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file for writing or updating registry values as required. This action prevents the loss of data and settings every time an MCS-provisioned machine restarts.

Each line in the `/etc/xdl/mcs/mcs_local_setting.reg` file is a command for setting or updating a registry value.



For example, you can add the following command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file to write or update a registry value respectively:

```
1 create -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -t "REG_DWORD" -  
v "Flags" -d "0x00000003" --force  
2 <!--NeedCopy-->
```

```
1 update -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -v "Flags" -d "0  
x00000003"  
2 <!--NeedCopy-->
```

### Step 1g: Create a master image

1. Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
2. (Optional) On the template VM, update the configuration templates to customize the relevant `/etc/krb5.conf`, `/etc/samba/smb.conf`, and `/etc/sss/sss.conf` files on all created VMs.

For Winbind users, update the `/etc/xdl/mcs/winbind_krb5.conf.tpl` and `/etc/xdl/mcs/winbind_smb.conf.tpl` templates.

For SSSD users, update the `/etc/xdl/mcs/sss.conf.tpl`, `/etc/xdl/mcs/sss_krb5.conf.tpl`, and `/etc/xdl/mcs/sss_smb.conf.tpl` templates.

**Note:** Keep the existing format used in the template files and use variables such as `$WORKGROUP`, `$REALM`, `$realm`, and `$AD_FQDN`.

3. On Citrix Hypervisor, shut down the template VM. Create and name a snapshot of your master image.

### Step 2: Create a Machine Catalog

In Citrix Studio, create a Machine Catalog and specify the number of VMs to create in the catalog. Do other configuration tasks as needed. For more information, see [Create a machine catalog using Studio](#).

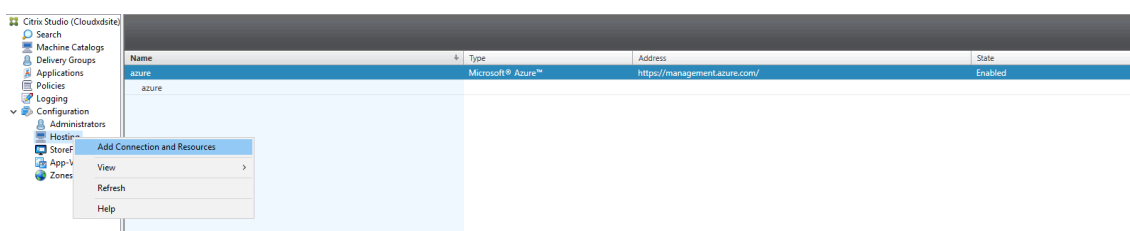
### Step 3: Create a Delivery Group

A Delivery Group is a collection of machines selected from one or more Machine Catalogs. The Delivery Group specifies which users can use those machines, and the applications and desktops available to those users. For more information, see [Create Delivery Groups](#).

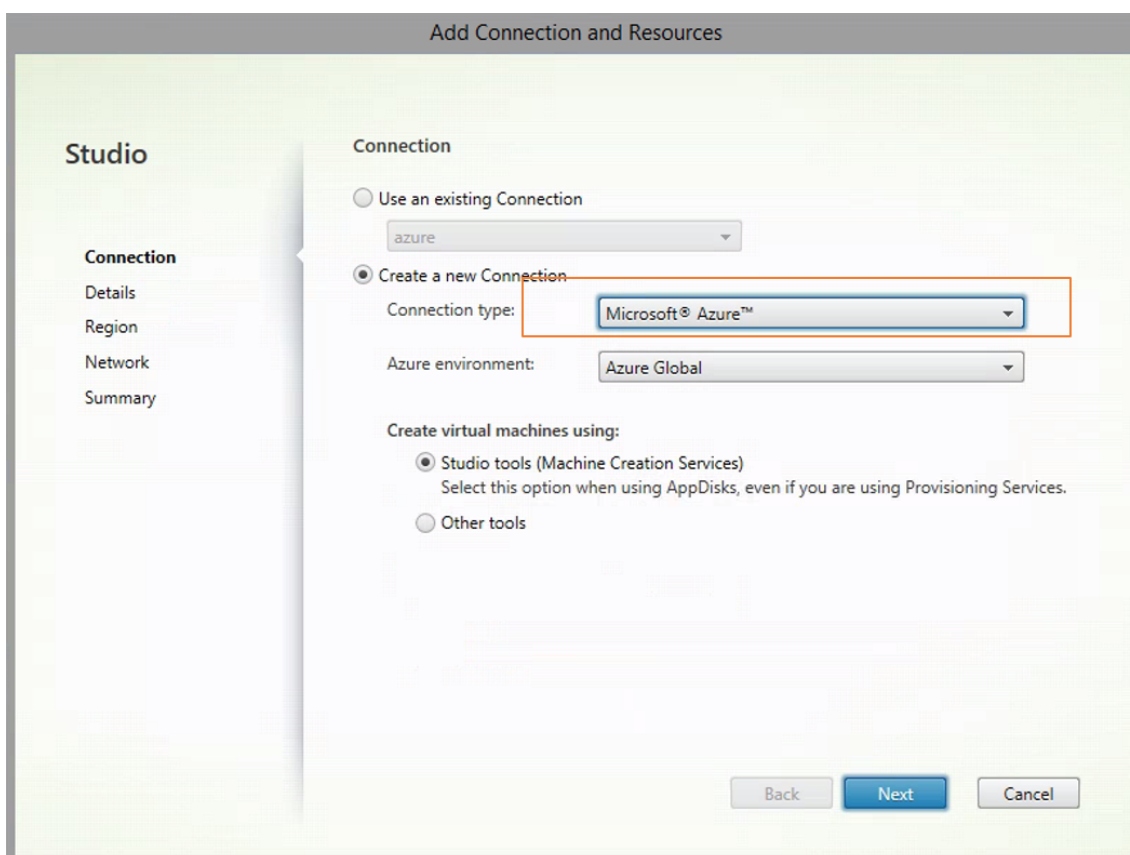
## Use MCS to create Linux VMs on Azure

### Step 1: Create a hosting connection to Azure in Citrix Studio

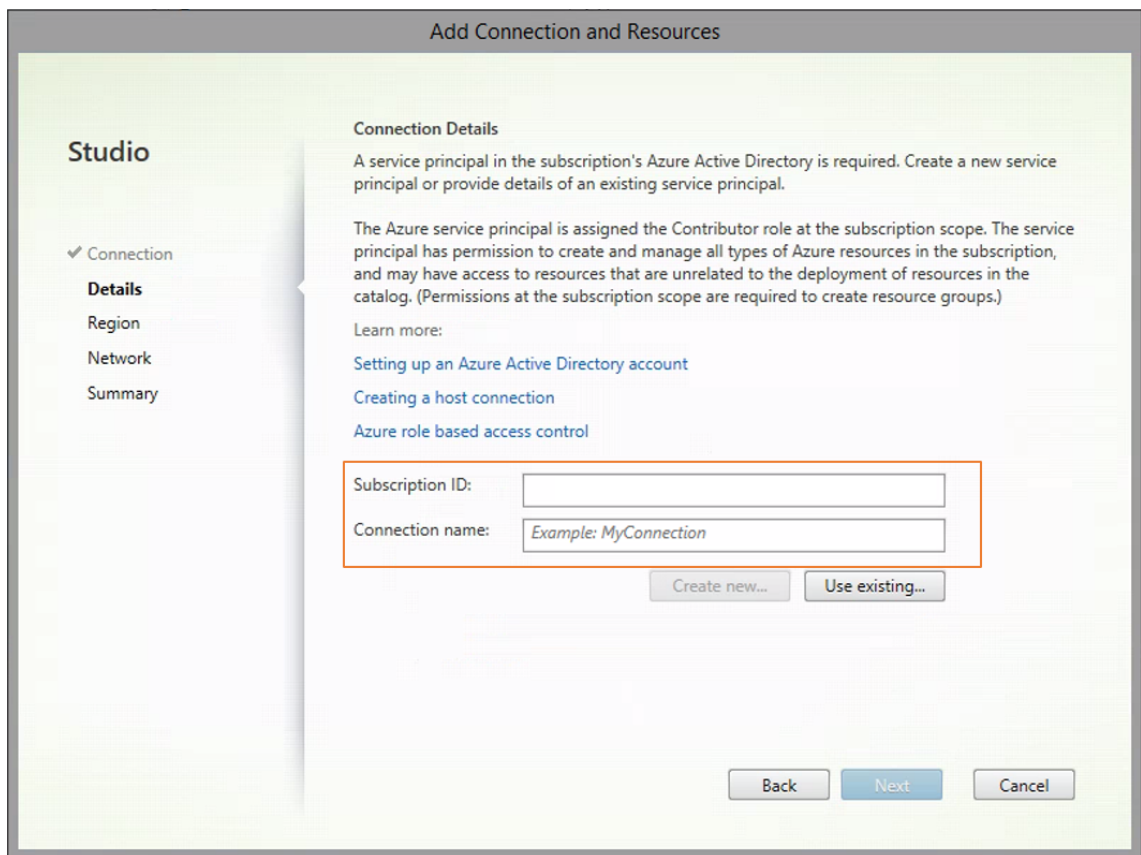
1. In Citrix Studio on Citrix Cloud, choose **Configuration > Hosting > Add Connection and Resources** to create a connection to Azure.



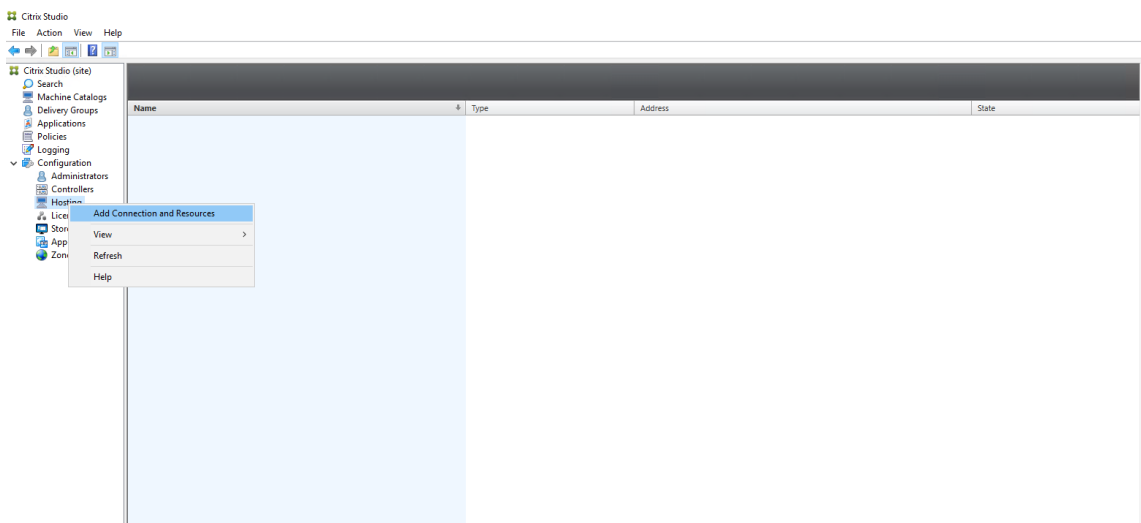
2. Choose Microsoft Azure as the connection type.



3. Type the subscription ID of your Azure account and your connection name.



A new connection appears in the hosting pane.



## Step 2: Prepare a master image on the template VM

A master image contains the operating system, non-virtualized applications, VDA, and other software. To prepare a master image, do the following:

### Step 2a: Configure cloud-init for Ubuntu 18.04

To ensure that a VDA host name persists when a VM is restarted or stopped, run the following command.

```
1 echo "preserve_hostname: true" > /etc/cloud/cloud.cfg.d/99_hostname.  
   cfg  
2 <!--NeedCopy-->
```

Ensure that the following lines are present under the **system\_info** section in the /etc/cloud/cloud.cfg file:

```
1 system_info:  
2   network:  
3     renderers: ['netplan', 'eni', 'sysconfig']  
4 <!--NeedCopy-->
```

### Step 2b: Install the Linux VDA package on the template VM

#### Note:

To use a currently running VDA as the template VM, omit this step.

Before installing the Linux VDA package on the template VM, install .NET Core Runtime 3.1. For more information, see [Installation overview](#).

Based on your Linux distribution, run the following command to set up the environment for the Linux VDA:

#### For RHEL/CentOS:

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>  
2 <!--NeedCopy-->
```

#### For Ubuntu:

```
1 sudo dpkg -i <PATH>/<Linux VDA DEB>  
2  
3 apt-get install -f  
4 <!--NeedCopy-->
```

### For SUSE 12:

```
1 sudo zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

### Step 2c: Install the EPEL repository that contains ntfs-3g

Install the EPEL repository on RHEL 8/CentOS 8, RHEL 7/CentOS 7 so that running `deploymcs.sh` later installs the `ntfs-3g` package contained in it.

### Step 2d: Manually install ntfs-3g on SUSE 12

On the SUSE 12 platform, there is no repository providing `ntfs-3g`. Download the source code, compile, and install `ntfs-3g` manually:

1. Install the GNU Compiler Collection (GCC) compiler system and the `make` package:

```
1 sudo zypper install gcc
2 sudo zypper install make
3 <!--NeedCopy-->
```

2. Download the `ntfs-3g` package.
3. Decompress the `ntfs-3g` package:

```
1 sudo tar -xvzf ntfs-3g_ntfsprogs-<package version>.tgz
2 <!--NeedCopy-->
```

4. Enter the path to the `ntfs-3g` package:

```
1 sudo cd ntfs-3g_ntfsprogs-<package version>
2 <!--NeedCopy-->
```

5. Install `ntfs-3g`:

```
1 ./configure
2 make
```

```
3 make install
4 <!--NeedCopy-->
```

## Step 2e: Set up the runtime environment

Before running `deploymcs.sh`, do the following:

- Change variables in `/etc/xdl/mcs/mcs.conf`. The `mcs.conf` configuration file contains variables for setting MCS and the Linux VDA. The following are some of the variables, of which `dns` and `AD_INTEGRATION` must be set:

**Note:** If a variable can be set with multiple values, put the values inside single quotes and separate them with spaces. For example, `LDAP_LIST='aaa.lab:389 bbb.lab:389'`.

- `Use_Existing_Configurations_Of_Current_VDA`: Determines whether to use the existing configurations of the currently running VDA. If set to Y, configuration files on MCS-created machines are the same as the equivalents on the currently running VDA. However, you still must configure the `dns` and `AD_INTEGRATION` variables. The default value is N, which means configuration files on MCS-created machines are determined by configuration templates on the master image.
  - `dns`: Sets the DNS IP address.
  - `AD_INTEGRATION`: Sets Winbind or SSSD (SSSD is not supported on SUSE).
  - `WORKGROUP`: Sets the workgroup name (case-sensitive) if it is configured in AD.
- On the template machine, add command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file for writing or updating registry values as required. This action prevents the loss of data and settings every time an MCS-provisioned machine restarts.

Each line in the `/etc/xdl/mcs/mcs_local_setting.reg` file is a command for setting or updating a registry value.

For example, you can add the following command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file to write or update a registry value respectively:

```
1 create -k "HKLM\System\CurrentControlSet\Control\Citrix\
   VirtualChannels\Clipboard\ClipboardSelection" -t "REG_DWORD" -
   v "Flags" -d "0x00000003" --force
2 <!--NeedCopy-->
```

```
1 update -k "HKLM\System\CurrentControlSet\Control\Citrix\
   VirtualChannels\Clipboard\ClipboardSelection" -v "Flags" -d "0
   x00000003"
```

2 &lt;!--NeedCopy--&gt;

**Step 2f: Create a master image**

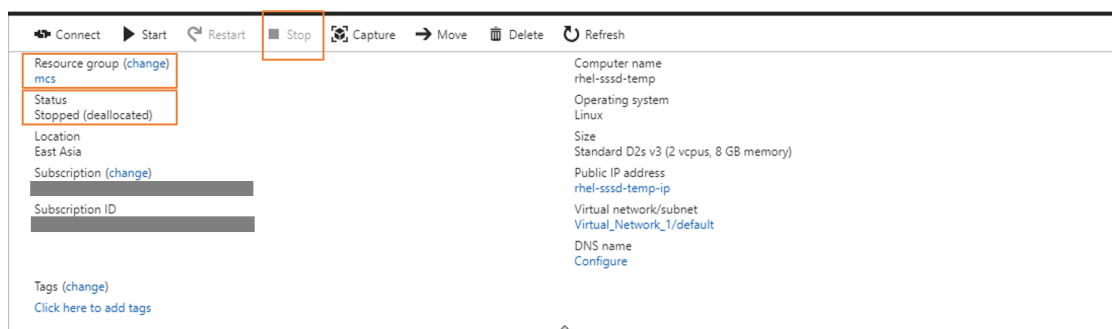
1. Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
2. (Optional) On the template VM, update the configuration templates to customize the relevant `/etc/krb5.conf`, `/etc/samba/smb.conf`, and `/etc/sss/sss.conf` files on all created VMs.

For Winbind users, update the `/etc/xdm/mcs/winbind_krb5.conf.tpl` and `/etc/xdm/mcs/winbind_smb.conf.tpl` templates.

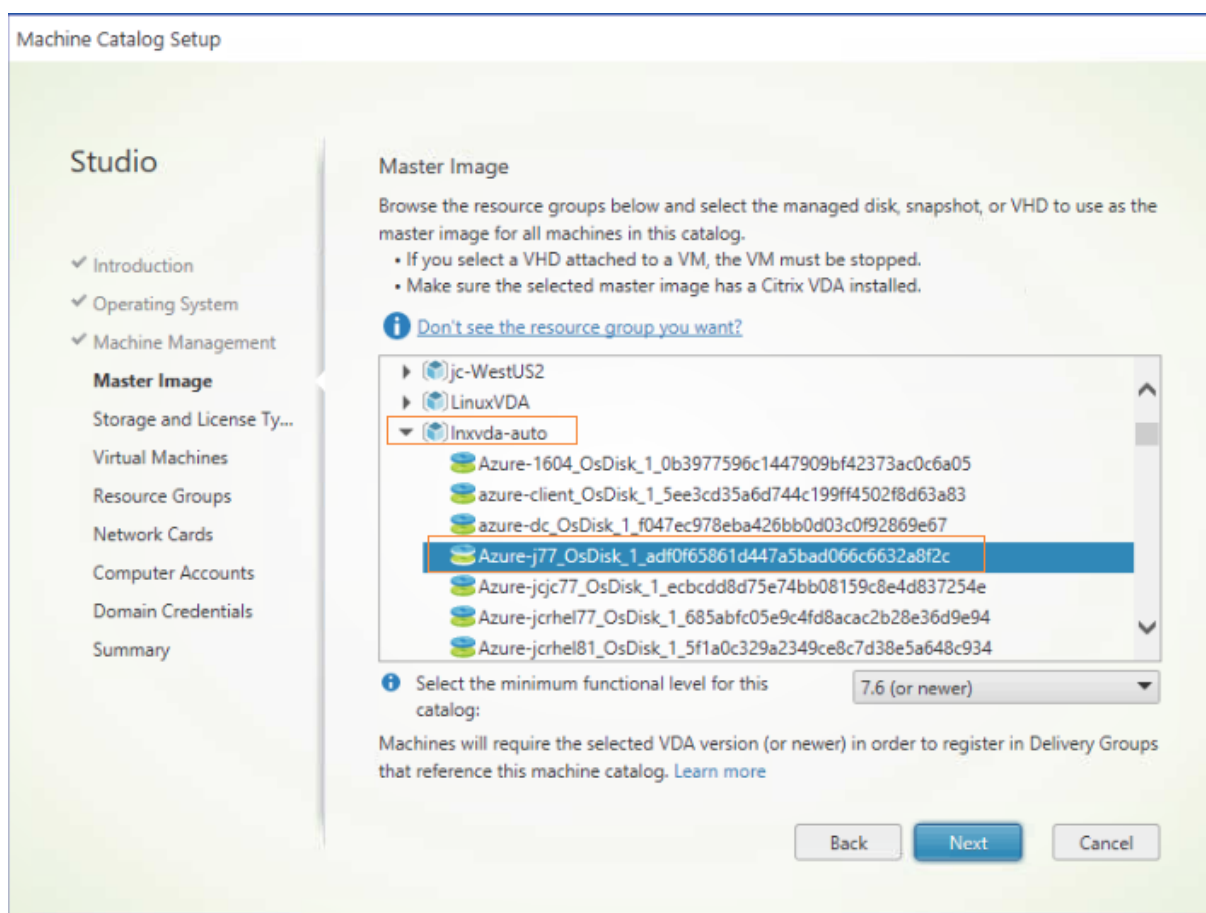
For SSSD users, update the `/etc/xdm/mcs/sss.conf.tpl`, `/etc/xdm/mcs/sss_krb5.conf.tpl`, and `/etc/xdm/mcs/sss_smb.conf.tpl` templates.

**Note:** Keep the existing format used in the template files and use variables such as `$WORKGROUP`, `$REALM`, `$realm`, and `$AD_FQDN`.

3. Install applications on the template VM and shut down the template VM from the Azure portal. Ensure that the power status of the template VM is **Stopped (deallocated)**. Remember the name of the resource group here. You need the name to locate your master image on Azure.

**Step 3: Create a Machine Catalog**

In Citrix Studio, create a Machine Catalog and specify the number of VMs to create in the catalog. When creating the Machine Catalog, choose your master image from the resource group where the template VM belongs and find the VHD of the template VM.



Do other configuration tasks as needed. For more information, see [Create a machine catalog using Studio](#).

#### Step 4: Create a Delivery Group

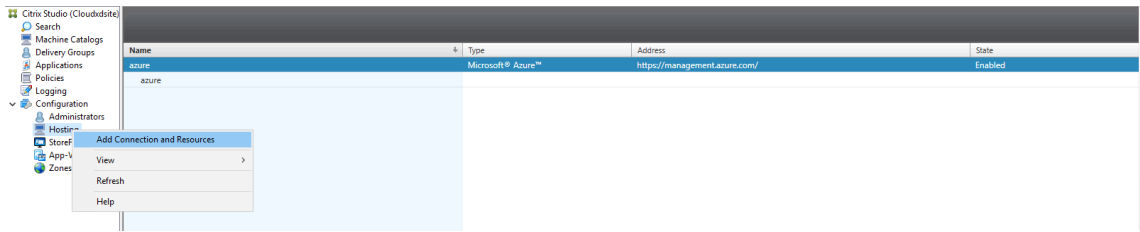
A Delivery Group is a collection of machines selected from one or more Machine Catalogs. The Delivery Group specifies which users can use those machines, and the applications and desktops available to those users. For more information, see [Create Delivery Groups](#).

### Use MCS to create Linux VMs on VMware vSphere

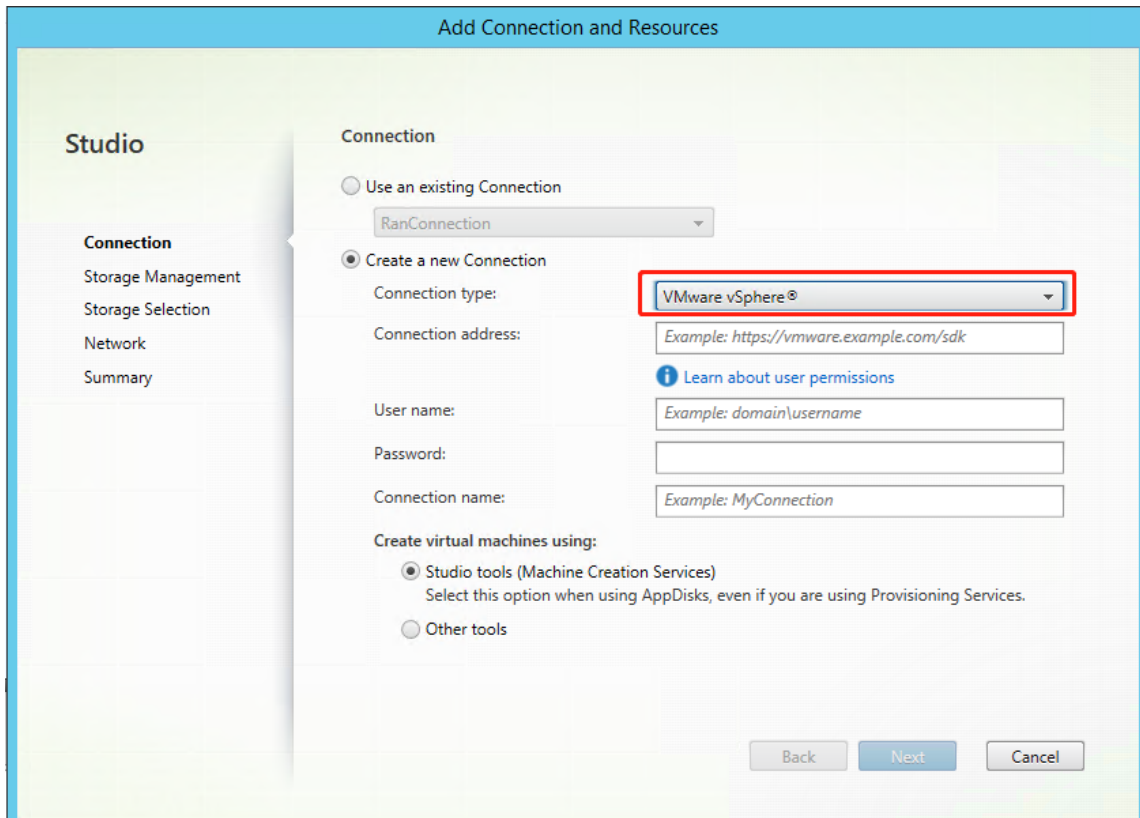
#### Step 1: Create a hosting connection to VMware in Citrix Studio

1. Install vCenter Server in the vSphere environment. For more information, see [VMware vSphere](#).
2. In Citrix Studio, choose **Configuration > Hosting > Add Connection and Resources** to create a connection to VMware vSphere.

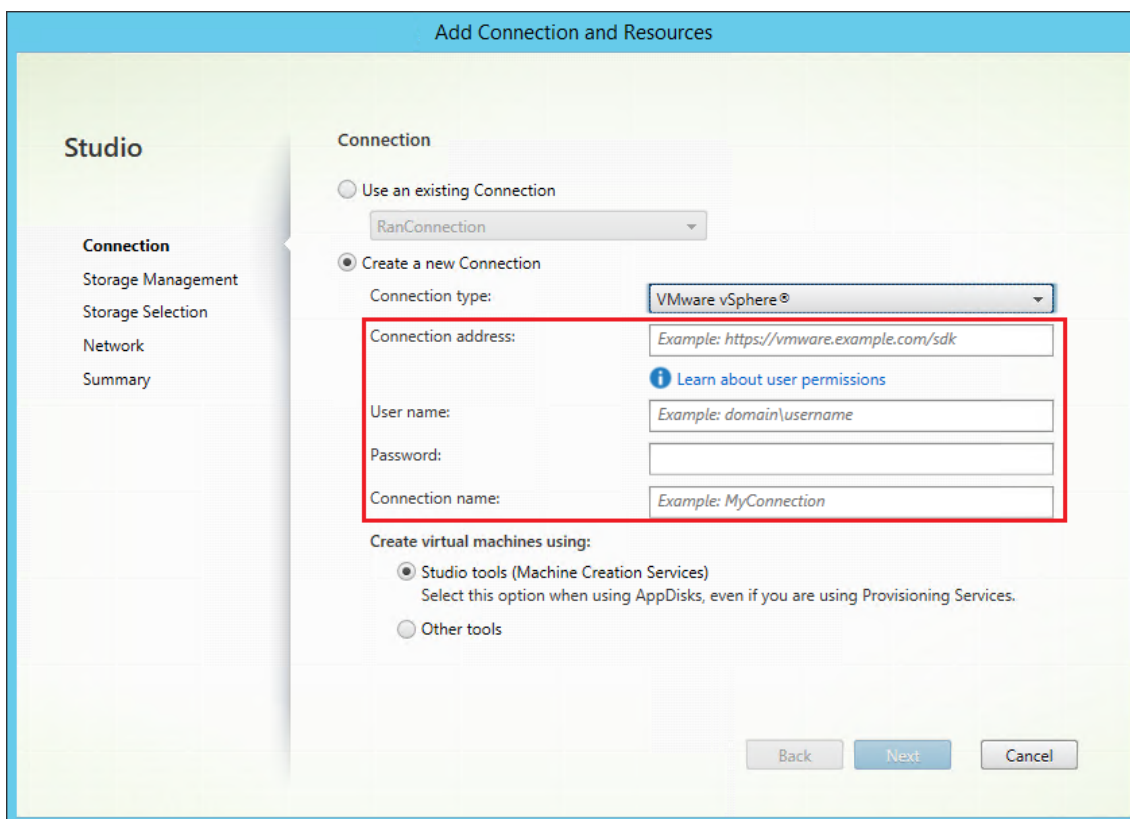




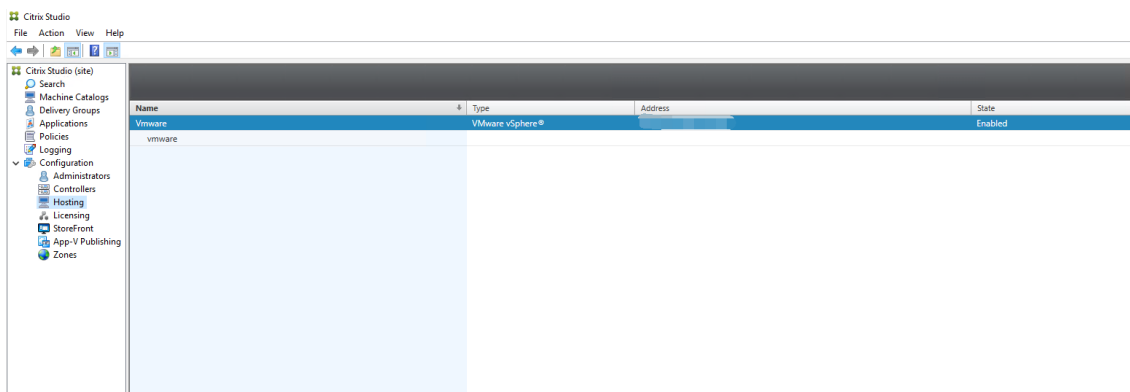
3. Choose VMware vSphere as the connection type.



4. Type the connection address (the vCenter Server URL) of your VMware account, your user name and password, and your connection name.



A new connection appears in the hosting pane.



## Step 2: Prepare a master image

A master image contains the operating system, non-virtualized applications, VDA, and other software. To prepare a master image, do the following:

### Step 2a: Install the Linux VDA package on the template VM

**Note:**

To use a currently running VDA as the template VM, omit this step.

Before installing the Linux VDA package on the template VM, install .NET Core Runtime 3.1. For more information, see [Installation overview](#).

Based on your Linux distribution, run the following command to set up the environment for the Linux VDA:

**For RHEL/CentOS:**

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

**For Ubuntu:**

```
1 sudo dpkg -i <PATH>/<Linux VDA DEB>
2
3 apt-get install -f
4 <!--NeedCopy-->
```

**For SUSE 12:**

```
1 sudo zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

**Step 2b: Install the EPEL repository that contains ntfs-3g**

Install the EPEL repository on RHEL 8/CentOS 8, RHEL 7/CentOS 7 so that running `deploymcs.sh` later installs the `ntfs-3g` package contained in it.

**Step 2c: Manually install ntfs-3g on SUSE 12**

On the SUSE 12 platform, there is no repository providing `ntfs-3g`. Download the source code, compile, and install `ntfs-3g` manually:

1. Install the GNU Compiler Collection (GCC) compiler system and the make package:

```
1 sudo zypper install gcc
2 sudo zypper install make
3 <!--NeedCopy-->
```

2. Download the ntfs-3g package.
3. Decompress the ntfs-3g package:

```
1 sudo tar -xvzf ntfs-3g_ntfsprogs-<package version>.tgz
2 <!--NeedCopy-->
```

4. Enter the path to the ntfs-3g package:

```
1 sudo cd ntfs-3g_ntfsprogs-<package version>
2 <!--NeedCopy-->
```

5. Install ntfs-3g:

```
1 ./configure
2 make
3 make install
4 <!--NeedCopy-->
```

## Step 2d: Set up the runtime environment

Before running `deploymcs.sh`, do the following:

- Change variables in `/etc/xdm/mcs/mcs.conf`. The `mcs.conf` configuration file contains variables for setting MCS and the Linux VDA. The following are some of the variables, of which `dns` and `AD_INTEGRATION` must be set:

**Note:** If a variable can be set with multiple values, put the values inside single quotes and separate them with spaces. For example, `LDAP_LIST='aaa.lab:389 bbb.lab:389.'`

- `Use_Existing_Configurations_Of_Current_VDA`: Determines whether to use the existing configurations of the currently running VDA. If set to `Y`, the configuration files on MCS-created machines are the same as the equivalents on the currently running VDA. However, you still must configure the `dns` and `AD_INTEGRATION` variables. The default value is `N`, which means configuration files on MCS-created machines are determined by configuration templates on the master image.

- `dns`: Sets the DNS IP address.
  - `AD_INTEGRATION`: Sets Winbind or SSSD (SSSD is not supported on SUSE).
  - `WORKGROUP`: Sets the workgroup name (case-sensitive) if it is configured in AD.
- On the template machine, add command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file for writing or updating registry values as required. This action prevents the loss of data and settings every time an MCS-provisioned machine restarts.

Each line in the `/etc/xdl/mcs/mcs_local_setting.reg` file is a command for setting or updating a registry value.

For example, you can add the following command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file to write or update a registry value respectively:

```
1 create -k "HKLM\System\CurrentControlSet\Control\Citrix\
  VirtualChannels\Clipboard\ClipboardSelection" -t "REG_DWORD" -
  v "Flags" -d "0x00000003" --force
2 <!--NeedCopy-->
```

```
1 update -k "HKLM\System\CurrentControlSet\Control\Citrix\
  VirtualChannels\Clipboard\ClipboardSelection" -v "Flags" -d "0
  x00000003"
2 <!--NeedCopy-->
```

### Step 2e: Create a master image

1. Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
2. (Optional) On the template VM, update the configuration templates to customize the relevant `/etc/krb5.conf`, `/etc/samba/smb.conf`, and `/etc/sss/sss.conf` files on all created VMs.

For Winbind users, update the `/etc/xdl/mcs/winbind_krb5.conf.tpl` and `/etc/xdl/mcs/winbind_smb.conf.tpl` templates.

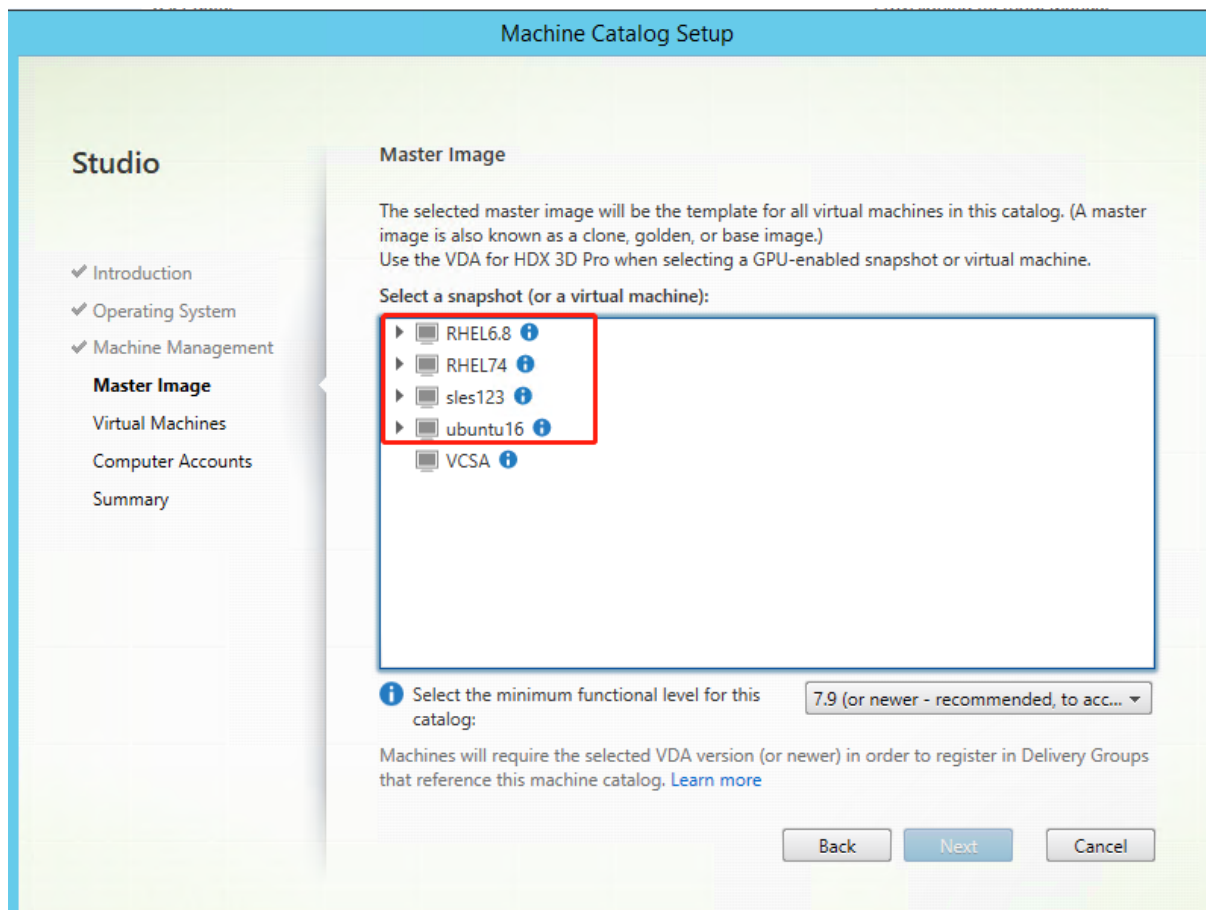
For SSSD users, update the `/etc/xdl/mcs/sss.conf.tpl`, `/etc/xdl/mcs/sss_krb5.conf.tpl`, and `/etc/xdl/mcs/sss_smb.conf.tpl` templates.

**Note:** Keep the existing format used in the template files and use variables such as `$WORKGROUP`, `$REALM`, `$realm`, and `$AD_FQDN`.

3. After you finish installing applications on the template VM, shut down the template VM from the VMware. Take a snapshot of the template VM.

### Step 3: Create a Machine Catalog

In Citrix Studio, create a Machine Catalog and specify the number of VMs to create in the catalog. When creating the Machine Catalog, choose your master image from the snapshot list.



Do other configuration tasks as needed. For more information, see [Create a machine catalog using Studio](#).

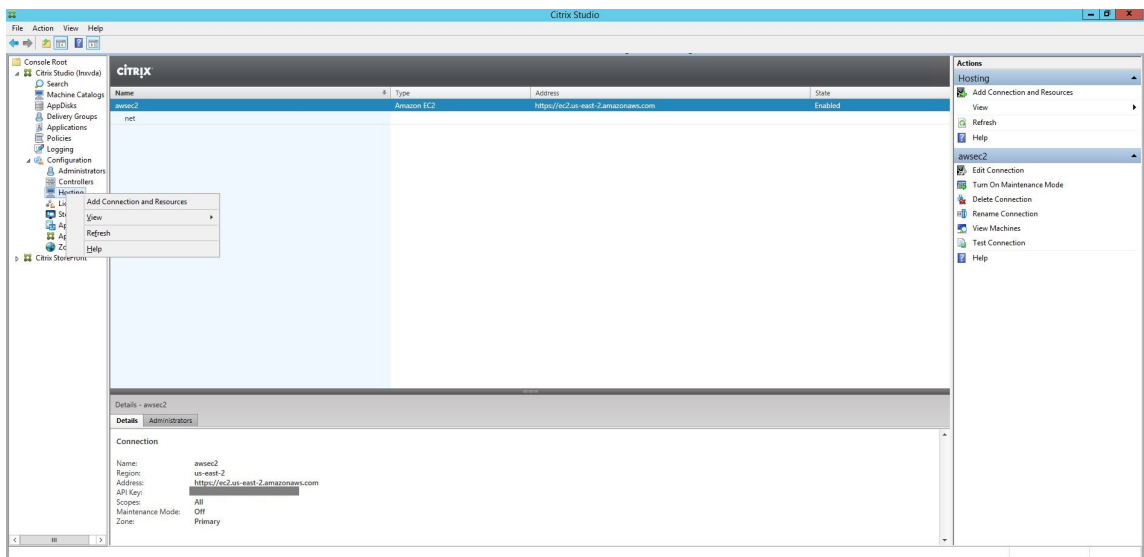
### Step 4: Create a Delivery Group

A Delivery Group is a collection of machines selected from one or more Machine Catalogs. The Delivery Group specifies which users can use those machines, and the applications and desktops available to those users. For more information, see [Create Delivery Groups](#).

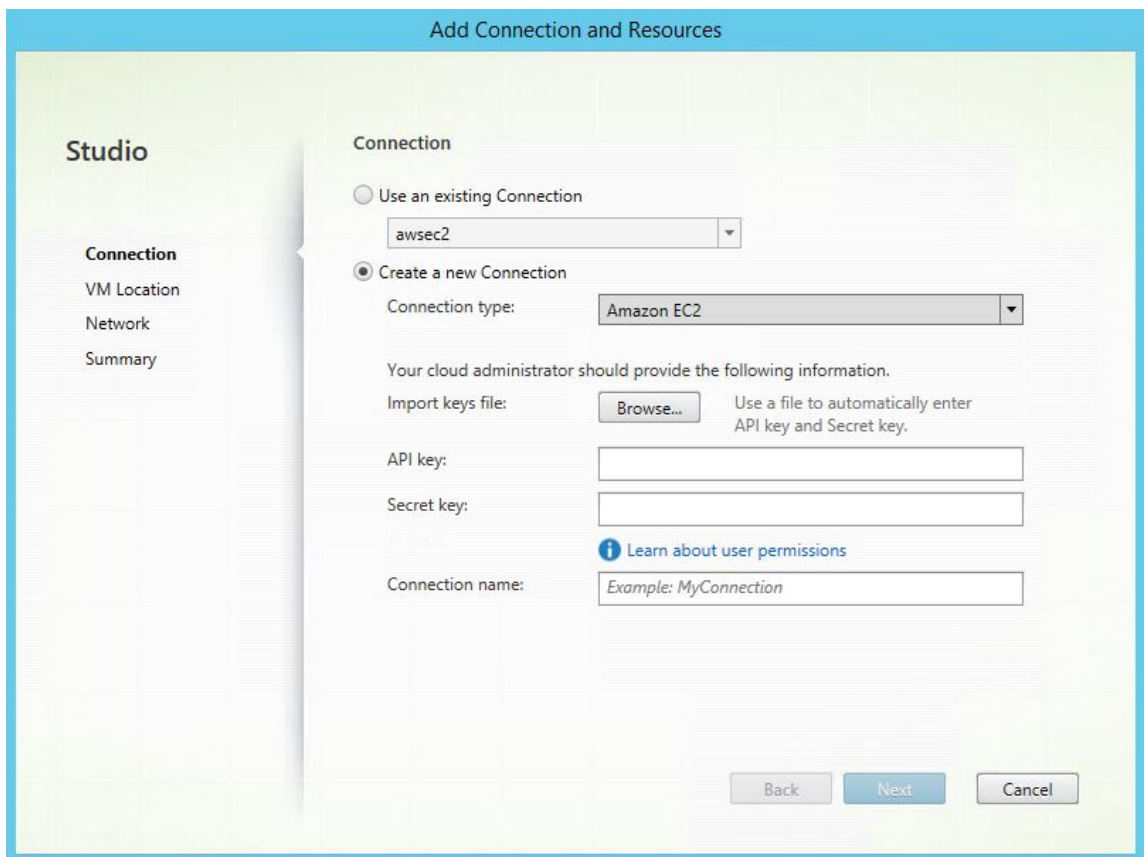
## Use MCS to create Linux VMs on AWS

### Step 1: Create a hosting connection to AWS in Citrix Studio

1. In Citrix Studio on Citrix Cloud, choose **Configuration > Hosting > Add Connection and Resources** to create a connection to AWS.



2. Choose **Amazon EC2** as the connection type.



3. Type the API key and secret key of your AWS account and type your connection name.

**Add Connection and Resources**

**Studio**

- Connection
- VM Location
- Network
- Summary

**Connection**

Use an existing Connection

awsec2

Create a new Connection

Connection type: Amazon EC2

Your cloud administrator should provide the following information.

Import keys file:  Use a file to automatically enter API key and Secret key.

API key:

Secret key:

[Learn about user permissions](#)

Connection name:

The **API key** is your access key ID and the **Secret key** is your secret access key. They are considered as an access key pair. If you lose your secret access key, you can delete the access key and create a new one. To create an access key, do the following:

- a) Sign in to the AWS services.
- b) Navigate to the Identity and Access Management (IAM) console.
- c) On the left navigation pane, choose **Users**.
- d) Select the target user and scroll down to select the **Security credentials** tab.
- e) Scroll down and click **Create access key**. A new window appears.
- f) Click **Download .csv file** and save the access key to a secure location.

A new connection appears in the hosting pane.

Name	Type	Address	State
aws	Amazon EC2	https://ec2.us-east-2.amazonaws.com	Enabled



## Step 2: Prepare a master image

A master image contains the operating system, non-virtualized applications, VDA, and other software. To prepare a master image, do the following:

### Step 2a: Configure cloud-init

1. To ensure that a VDA host name persists when an EC2 instance is restarted or stopped, run the following command to preserve the VDA host name.

```
1 echo "preserve_hostname: true" > /etc/cloud/cloud.cfg.d/99
  _hostname.cfg
2 <!--NeedCopy-->
```

For Ubuntu 18.04, ensure that the following lines are present under the `system_info` section in the `/etc/cloud/cloud.cfg` file:

```
1 system_info:
2     network:
3         renderers: ['netplan', 'eni', 'sysconfig']
4 <!--NeedCopy-->
```

2. To use SSH for remotely accessing MCS-created VMs on AWS, enable password authentication because no key name is attached to those VMs. Do the following as needed.
  - Edit the `cloud-init` configuration file, `/etc/cloud/cloud.cfg`. Ensure that the **ssh\_pwauth: true** line is present. Remove or comment the **set-password** line and the following lines if they exist.

```
1 users:
2 - default
3 <!--NeedCopy-->
```

- If you plan to use the default user `ec2-user` or `ubuntu` created by `cloud-init`, you can change the user password by using the `passwd` command. Keep the new password in mind for later use to log in to the MCS-created VMs.
- Edit the `/etc/ssh/sshd_config` file to ensure that the following line is present:

```
1 PasswordAuthentication yes
2 <!--NeedCopy-->
```

Save the file and run the `sudo service sshd restart` command.

### Step 2b: Install the Linux VDA package on the template VM

#### Note:

To use a currently running VDA as the template VM, omit this step.

Before installing the Linux VDA package on the template VM, install .NET Core Runtime 3.1. For more information, see [Installation overview](#).

Based on your Linux distribution, run the following command to set up the environment for the Linux VDA:

#### For RHEL/CentOS:

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

#### For Ubuntu:

```
1 sudo dpkg -i <PATH>/<Linux VDA DEB>
2
3 apt-get install -f
4 <!--NeedCopy-->
```

#### For SUSE 12:

```
1 sudo zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

### Step 2c: Install the EPEL repository that contains ntfs-3g

Install the EPEL repository on RHEL 8/CentOS 8, RHEL 7/CentOS 7 so that running `deploymcs.sh` later installs the `ntfs-3g` package contained in it.

### Step 2d: Manually install ntfs-3g on SUSE 12

On the SUSE 12 platform, there is no repository providing ntfs-3g. Download the source code, compile, and install ntfs-3g manually:

1. Install the GNU Compiler Collection (GCC) compiler system and the make package:

```
1 sudo zypper install gcc
2 sudo zypper install make
3 <!--NeedCopy-->
```

2. Download the ntfs-3g package.
3. Decompress the ntfs-3g package:

```
1 sudo tar -xvzf ntfs-3g_ntfsprogs-<package version>.tgz
2 <!--NeedCopy-->
```

4. Enter the path to the ntfs-3g package:

```
1 sudo cd ntfs-3g_ntfsprogs-<package version>
2 <!--NeedCopy-->
```

5. Install ntfs-3g:

```
1 ./configure
2 make
3 make install
4 <!--NeedCopy-->
```

### Step 2e: Set up the runtime environment

Before running `deploymcs.sh`, do the following:

- Change variables in `/etc/xdl/mcs/mcs.conf`. The `mcs.conf` configuration file contains variables for setting MCS and the Linux VDA. The following are some of the variables, of which `dns` and `AD_INTEGRATION` must be set:

**Note:** If a variable can be set with multiple values, put the values inside single quotes and separate them with spaces. For example, `LDAP_LIST='aaa.lab:389 bbb.lab:389.'`

- `Use_Existing_Configurations_Of_Current_VDA`: Determines whether to use the existing configurations of the currently running VDA. If set to Y, the configuration files on MCS-created machines are the same as the equivalents on the currently running VDA. However, you still must configure the `dns` and `AD_INTEGRATION` variables. The default value is N, which means configuration files on MCS-created machines are determined by configuration templates on the master image.
  - `dns`: Sets the DNS IP address.
  - `AD_INTEGRATION`: Sets Winbind or SSSD (SSSD is not supported on SUSE).
  - `WORKGROUP`: Sets the workgroup name (case-sensitive) if it is configured in AD.
- On the template machine, add command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file for writing or updating registry values as required. This action prevents the loss of data and settings every time an MCS-provisioned machine restarts.

Each line in the `/etc/xdl/mcs/mcs_local_setting.reg` file is a command for setting or updating a registry value.

For example, you can add the following command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file to write or update a registry value respectively:

```
1 create -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -t "REG_DWORD" -  
v "Flags" -d "0x00000003" --force  
2 <!--NeedCopy-->
```

```
1 update -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -v "Flags" -d "0  
x00000003"  
2 <!--NeedCopy-->
```

## Step 2f: Create a master image

1. Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
2. (Optional) On the template VM, update the configuration templates to customize the relevant `/etc/krb5.conf`, `/etc/samba/smb.conf`, and `/etc/sss/sss.conf` files on all created VMs.

For Winbind users, update the `/etc/xdl/mcs/winbind_krb5.conf.tpl` and `/etc/xdl/mcs/winbind_smb.conf.tpl` templates.

For SSSD users, update the `/etc/xdl/mcs/sss.conf.tpl`, `/etc/xdl/mcs/sss_krb5.conf.tpl`, and `/etc/xdl/mcs/sss_smb.conf.tpl` templates.

**Note:** Keep the existing format used in the template files and use variables such as `$WORKGROUP`, `$REALM`, `$realm`, and `$AD_FQDN`.

3. Install applications on the template VM and shut down the template VM from the AWS EC2 portal. Ensure that the instance state of the template VM is **Stopped**.
4. Right-click the template VM and select **Image > Create Image**. Type information and make settings as needed. Click **Create Image**.

**Create Image** [X]

Instance ID ⓘ i-011e...  
 Image name ⓘ   
 Image description ⓘ   
 No reboot ⓘ

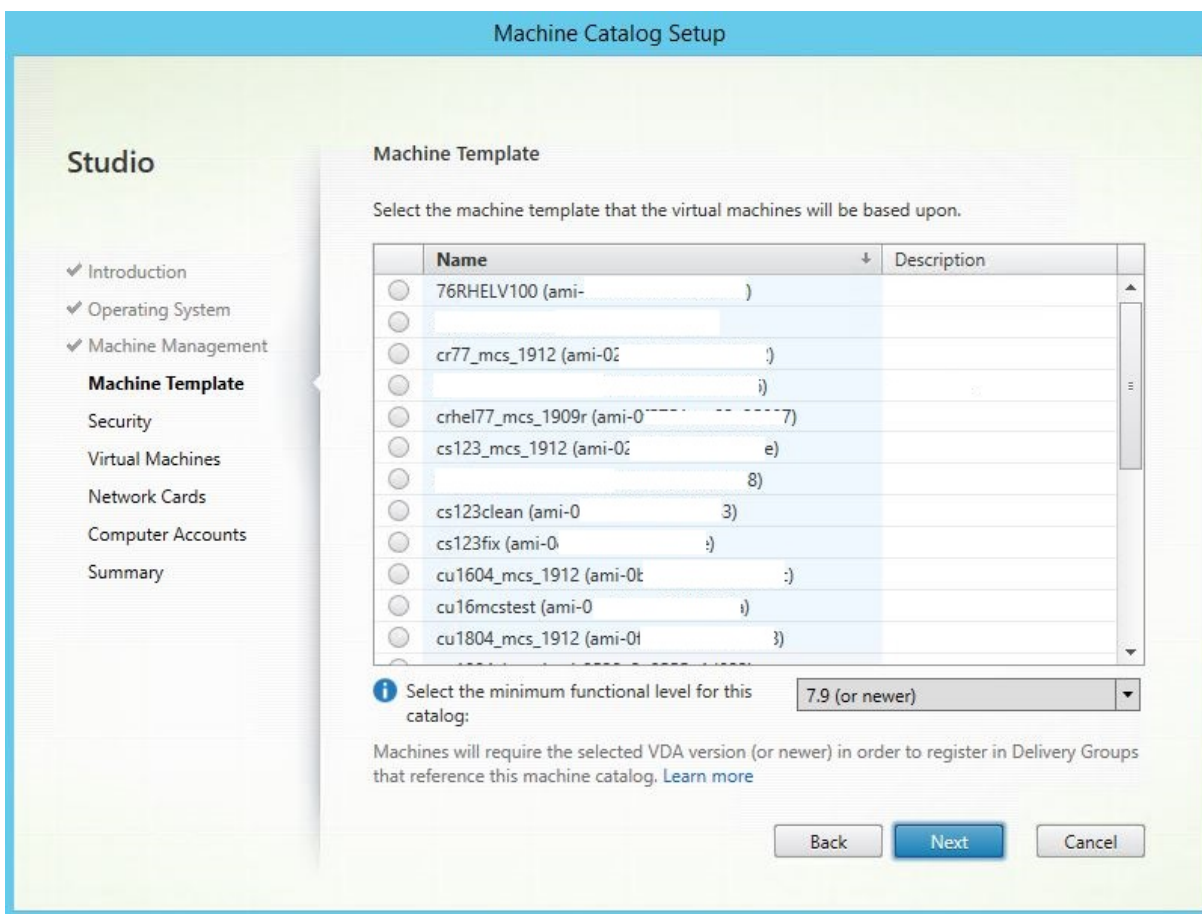
**Instance Volumes**

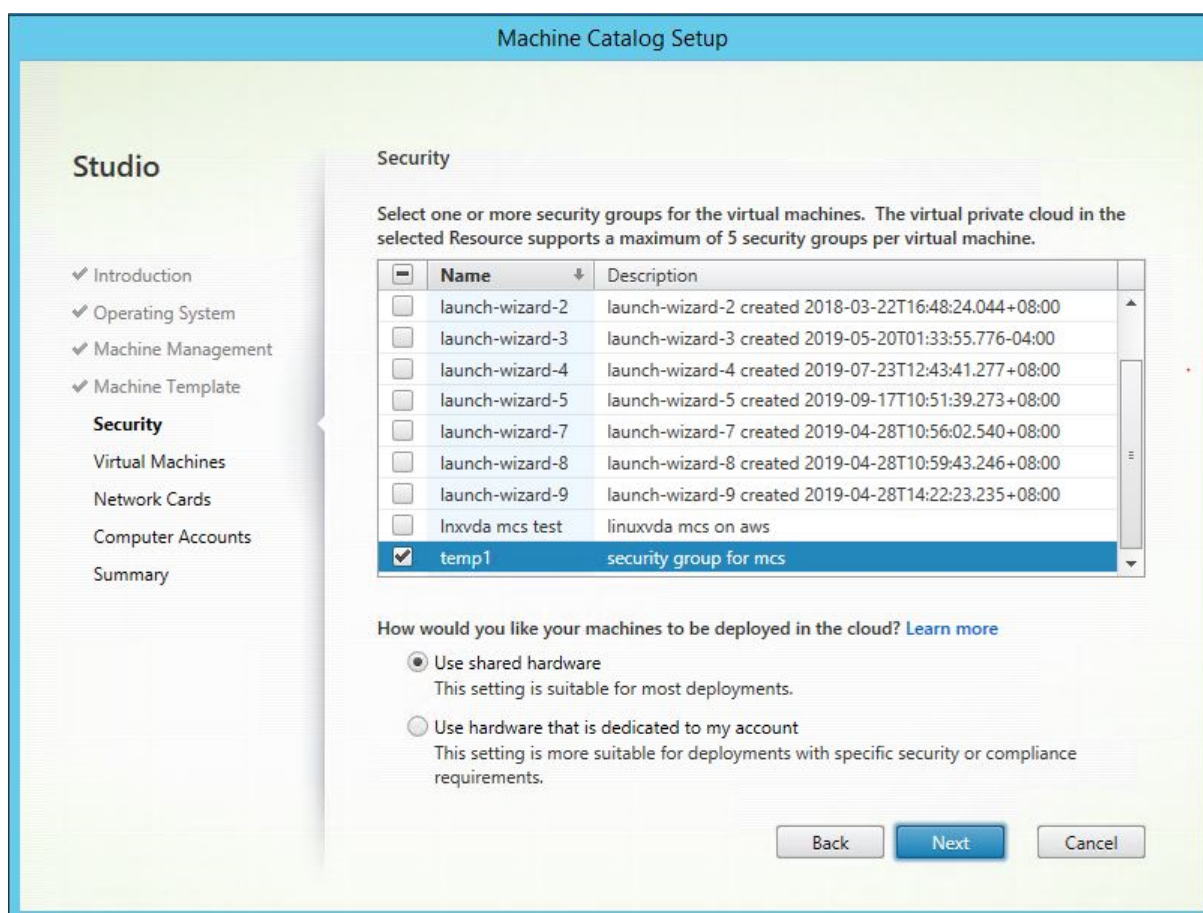
Volume Type ⓘ	Device ⓘ	Snapshot ⓘ	Size (GiB) ⓘ	Volume Type ⓘ	IOPS ⓘ	Throughput (MB/s) ⓘ	Delete on Termination ⓘ	Encrypted ⓘ
Root	/dev/sda1	snap-02	40	General Purpose SSD (gp2)	120 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypted

Total size of EBS Volumes: 40 GiB  
 When you create an EBS image, an EBS snapshot will also be created for each of the above volumes.

### Step 3: Create a Machine Catalog

In Citrix Studio, create a Machine Catalog and specify the number of VMs to create in the catalog. When creating the Machine Catalog, choose your machine template (the master image you created earlier) and select one or more security groups.





Do other configuration tasks as needed. For more information, see [Create a machine catalog using Studio](#).

#### Step 4: Create a Delivery Group

A Delivery Group is a collection of machines selected from one or more Machine Catalogs. The Delivery Group specifies which users can use those machines, and the applications and desktops available to those users. For more information, see [Create Delivery Groups](#).

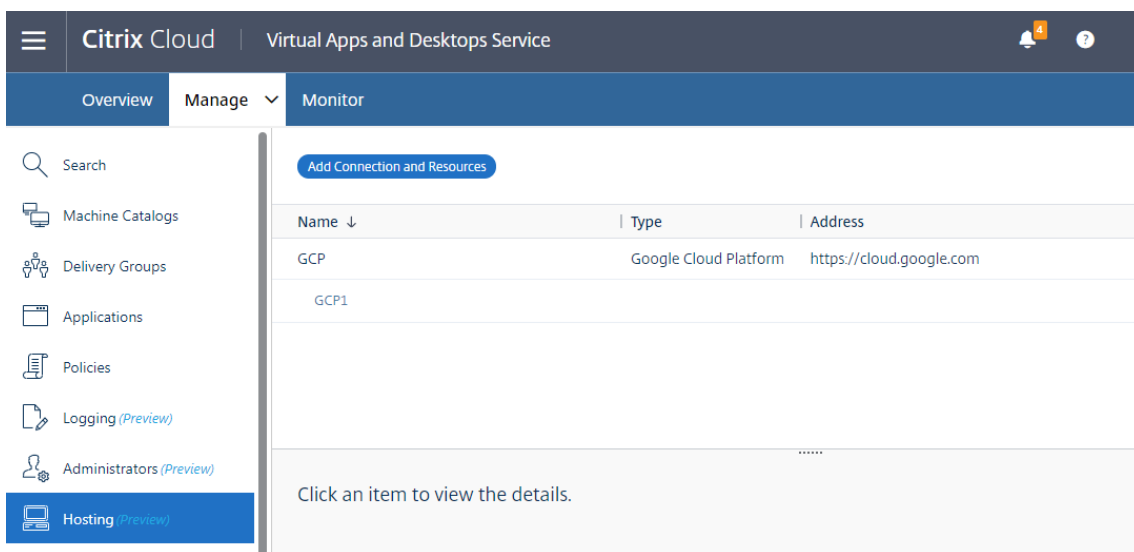
### Use MCS to create Linux VMs on GCP

#### Step 1: Set up your GCP environment

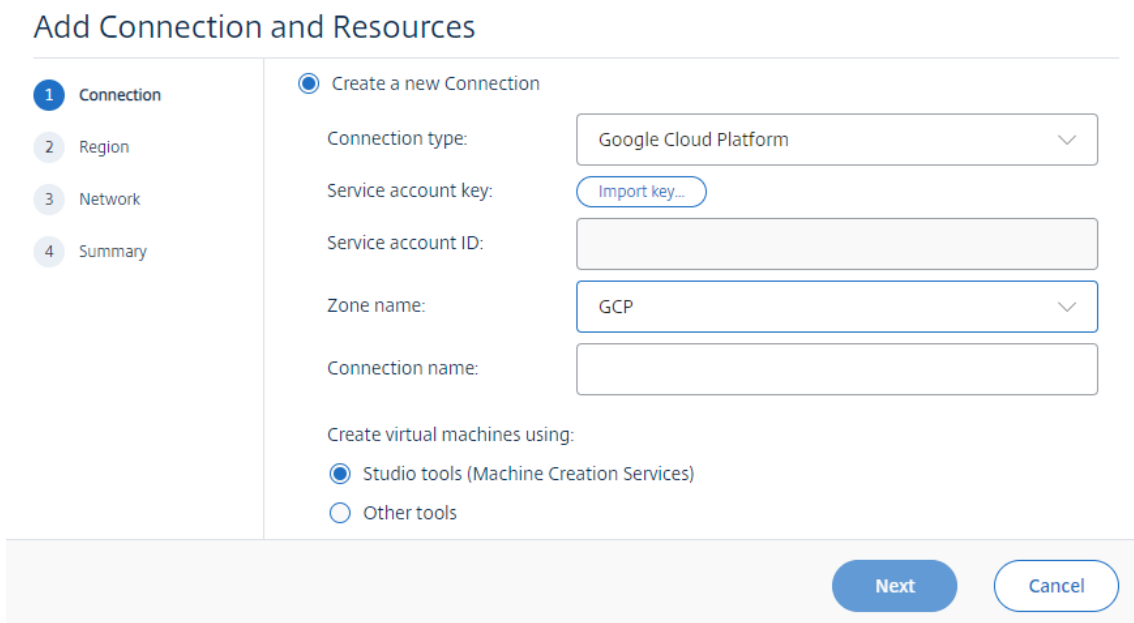
For more information, see [Google Cloud Platform virtualization environments](#).

#### Step 2: Create a hosting connection to GCP in Citrix Studio

1. In Citrix Studio on Citrix Cloud, choose **Configuration > Hosting > Add Connection and Resources** to create a connection to GCP.



2. Choose **Google Cloud Platform** as the connection type.



3. Import the service account key of your GCP account and type your connection name.



## Google Cloud Platform Service Account Credentials

Paste the key contained in your Google service account credential file (.json).

Save

Cancel

A new connection appears in the hosting pane.

The screenshot shows the Citrix Cloud interface. The top navigation bar includes 'Citrix Cloud' and 'Virtual Apps and Desktops Service'. Below this, there are tabs for 'Overview', 'Manage', and 'Monitor'. A left-hand navigation menu lists various options: Search, Machine Catalogs, Delivery Groups, Applications, Policies, Logging (Preview), Administrators (Preview), and Hosting (Preview). The 'Hosting (Preview)' option is selected. The main content area shows a table with columns for 'Name', 'Type', and 'Address'. A table row is visible with 'GCP' as the Name, 'Google Cloud Platform' as the Type, and 'https://cloud.google.com' as the Address. Below the table, there is a message: 'Click an item to view the details.'

Name ↓	Type	Address
GCP	Google Cloud Platform	https://cloud.google.com
GCP1		

### Step 3: Prepare a master image

A master image contains the operating system, non-virtualized applications, VDA, and other software. To prepare a master image, do the following:

#### Step 3a: Install the Linux VDA package on the template VM

**Note:**

To use a currently running VDA as the template VM, omit this step.

Before installing the Linux VDA package on the template VM, install .NET Core Runtime 3.1. For more information, see [Installation overview](#).

Based on your Linux distribution, run the following command to set up the environment for the Linux VDA:

**For RHEL/CentOS:**

```
1 sudo yum -y localinstall <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

**For Ubuntu:**

```
1 sudo dpkg -i <PATH>/<Linux VDA DEB>
2
3 apt-get install -f
4 <!--NeedCopy-->
```

**For SUSE 12:**

```
1 sudo zypper -i install <PATH>/<Linux VDA RPM>
2 <!--NeedCopy-->
```

**Step 3b: Install the EPEL repository that contains ntfs-3g**

Install the EPEL repository on RHEL 8/CentOS 8, RHEL 7/CentOS 7 so that running `deploymcs.sh` later installs the `ntfs-3g` package contained in it.

**Step 3c: Manually install ntfs-3g on SUSE 12**

On the SUSE 12 platform, there is no repository providing `ntfs-3g`. Download the source code, compile, and install `ntfs-3g` manually:

1. Install the GNU Compiler Collection (GCC) compiler system and the make package:

```
1 sudo zypper install gcc
2 sudo zypper install make
3 <!--NeedCopy-->
```

2. Download the ntfs-3g package.
3. Decompress the ntfs-3g package:

```
1 sudo tar -xvzf ntfs-3g_ntfsprogs-<package version>.tgz
2 <!--NeedCopy-->
```

4. Enter the path to the ntfs-3g package:

```
1 sudo cd ntfs-3g_ntfsprogs-<package version>
2 <!--NeedCopy-->
```

5. Install ntfs-3g:

```
1 ./configure
2 make
3 make install
4 <!--NeedCopy-->
```

### Step 3d: Set up the runtime environment

Before running `deploymcs.sh`, do the following:

- Change variables in `/etc/xdm/mcs/mcs.conf`. The `mcs.conf` configuration file contains variables for setting MCS and the Linux VDA. The following are some of the variables, of which `dns` and `AD_INTEGRATION` must be set:

**Note:** If a variable can be set with multiple values, put the values inside single quotes and separate them with spaces. For example, `LDAP_LIST='aaa.lab:389 bbb.lab:389.'`

- `Use_Existing_Configurations_Of_Current_VDA`: Determines whether to use the existing configurations of the currently running VDA. If set to Y, the configuration files on MCS-created machines are the same as the equivalents on the currently running VDA. However, you still must configure the `dns` and `AD_INTEGRATION` variables. The default value is N, which means configuration files on MCS-created machines are determined by configuration templates on the master image.

- `dns`: Sets the DNS IP address.
  - `AD_INTEGRATION`: Sets Winbind or SSSD (SSSD is not supported on SUSE).
  - `WORKGROUP`: Sets the workgroup name (case-sensitive) if it is configured in AD.
- On the template machine, add command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file for writing or updating registry values as required. This action prevents the loss of data and settings every time an MCS-provisioned machine restarts.

Each line in the `/etc/xdl/mcs/mcs_local_setting.reg` file is a command for setting or updating a registry value.

For example, you can add the following command lines to the `/etc/xdl/mcs/mcs_local_setting.reg` file to write or update a registry value respectively:

```
1 create -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -t "REG_DWORD" -  
v "Flags" -d "0x00000003" --force  
2 <!--NeedCopy-->
```

```
1 update -k "HKLM\System\CurrentControlSet\Control\Citrix\  
VirtualChannels\Clipboard\ClipboardSelection" -v "Flags" -d "0  
x00000003"  
2 <!--NeedCopy-->
```

### Step 3e: Create a master image

1. Run `/opt/Citrix/VDA/sbin/deploymcs.sh`.
2. (Optional) On the template VM, update the configuration templates to customize the relevant `/etc/krb5.conf`, `/etc/samba/smb.conf`, and `/etc/sss/sss.conf` files on all created VMs.

For Winbind users, update the `/etc/xdl/mcs/winbind_krb5.conf.tmpl` and `/etc/xdl/mcs/winbind_smb.conf.tmpl` templates.

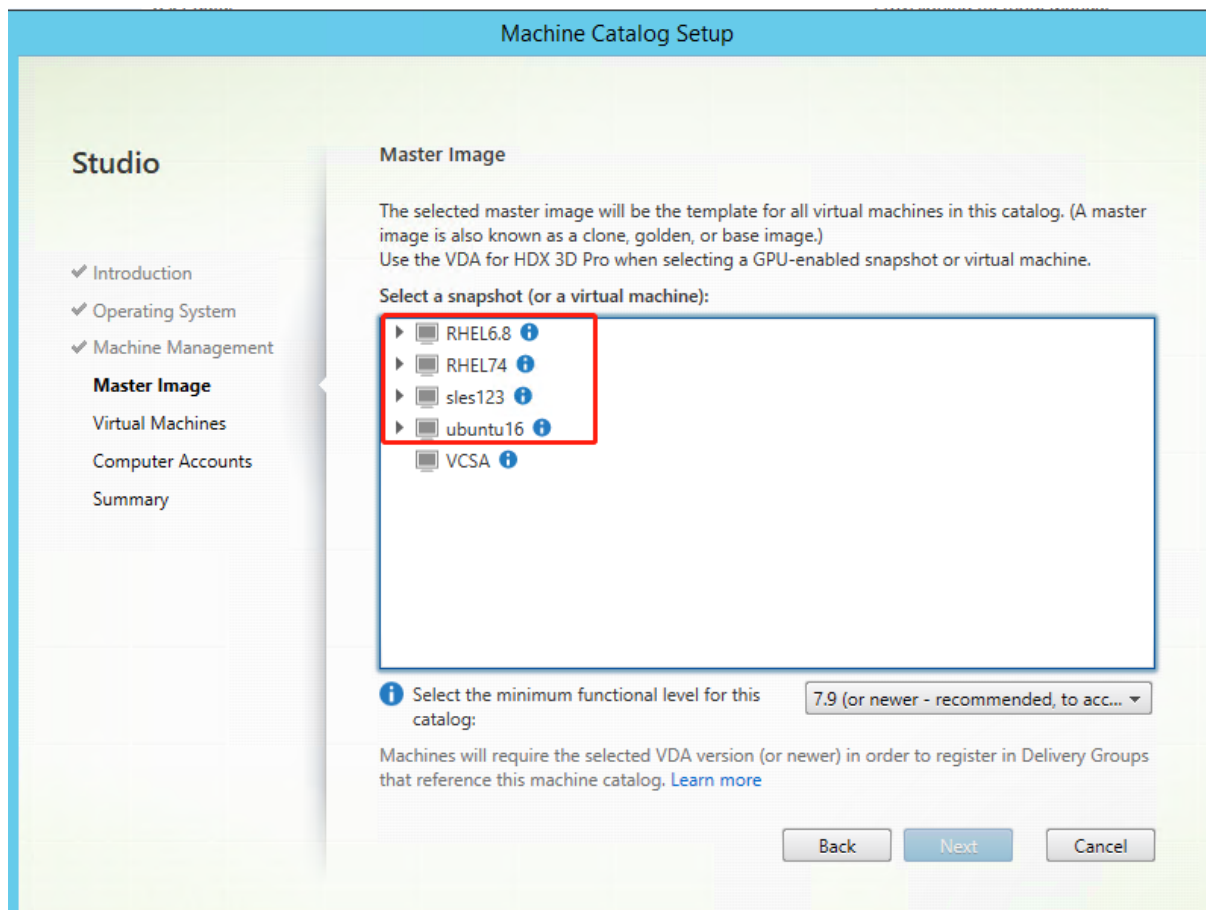
For SSSD users, update the `/etc/xdl/mcs/sss.conf.tmpl`, `/etc/xdl/mcs/sss_krb5.conf.tmpl`, and `/etc/xdl/mcs/sss_smb.conf.tmpl` templates.

**Note:** Keep the existing format used in the template files and use variables such as `$WORKGROUP`, `$REALM`, `$realm`, and `$AD_FQDN`.

3. After you finish installing applications on the template VM, shut down the template VM from the VMware. Take a snapshot of the template VM.

#### Step 4: Create a Machine Catalog

In Citrix Studio, create a Machine Catalog and specify the number of VMs to create in the catalog. When creating the Machine Catalog, choose your master image from the snapshot list.



Do other configuration tasks as needed. For more information, see [Create a machine catalog using Studio](#).

#### Step 5: Create a Delivery Group

A Delivery Group is a collection of machines selected from one or more Machine Catalogs. The Delivery Group specifies which users can use those machines, and the applications and desktops available to those users. For more information, see [Create Delivery Groups](#).

#### Use MCS to upgrade your Linux VDA

To use MCS to upgrade your Linux VDA, do the following:

1. Ensure that you installed .NET Core Runtime 3.1 before you upgrade your Linux VDA to the current release.

2. Upgrade your Linux VDA on the template machine:

**For RHEL 7 and CentOS 7:**

```
1 sudo rpm -U XenDesktopVDA-20.12.0.20-1.el7_x.x86_64.rpm
2 <!--NeedCopy-->
```

**For RHEL 8 and CentOS 8:**

```
1 sudo rpm -U XenDesktopVDA-20.12.0.20-1.el8_x.x86_64.rpm
2 <!--NeedCopy-->
```

**For SUSE 12:**

```
1 sudo rpm -U XenDesktopVDA-20.12.0.20-1.sle12_x.x86_64.rpm
2 <!--NeedCopy-->
```

**For Ubuntu 16.04:**

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu16.04_amd64.deb
2 <!--NeedCopy-->
```

**For Ubuntu 18.04:**

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu18.04_amd64.deb
2 <!--NeedCopy-->
```

**For Ubuntu 20.04:**

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu20.04_amd64.deb
2 <!--NeedCopy-->
```

3. Edit `/etc/xdl/mcs/mcs.conf` and `/etc/xdl/mcs/mcs_local_setting.reg`.
4. Take a new snapshot.
5. In Citrix Studio, select the new snapshot to update your Machine Catalog. Wait before each machine restarts. Do not restart a machine manually.

## Automate machine account password updates

Machine account passwords, by default, expire 30 days after the machine catalog is created. To prevent password expiration and to automate machine account password updates, do the following:

1. Add the following entry to `/etc/xdl/mcs/mcs.conf` before running `/opt/Citrix/VDA/sbin/deploymcs.sh`.  
`UPDATE_MACHINE_PW="enabled"`
2. After running `/opt/Citrix/VDA/sbin/deploymcs.sh`, open `/etc/cron.d/mcs_update_password_cronjob` to set the update time and frequency. The default setting updates machine account passwords weekly at 2:30AM, Sunday.

After each machine account password update, the ticket cache on the Delivery Controller becomes invalid and the following error might appear in `/var/log/xdl/jproxy.log`:

```
[ERROR] - AgentKerberosServiceAction.Run: GSSException occurred. Error: Failure unspecified at GSS-API level (Mechanism level: Checksum failed)
```

To eliminate the error, clear the ticket cache regularly. You can schedule a cache cleanup task on all Delivery Controllers or on the domain controller.

## Enable FAS on MCS-created VMs

You can enable FAS on MCS-created VMs that run on the following distributions:

---

	Winbind	SSSD	Centrify
RHEL 8, CentOS 8	Yes	No	No
RHEL 7, CentOS 7	Yes	Yes	No
Ubuntu 20.04	Yes	No	No
Ubuntu 18.04	Yes	No	No
Ubuntu 16.04	Yes	No	No
SUSE 12.5	Yes	No	No

---

## Enable FAS when you are preparing a master image on the template VM

1. Run the script `opt/Citrix/VDA/sbin/ctxinstall.sh` and set all environment variables such as the list of FAS servers. For more information about the environment variables, see [Easy install](#).

```
1 sudo /opt/Citrix/VDA/sbin/ctxinstall.sh
2 <!--NeedCopy-->
```

2. Import the root CA certificate.

```
1 sudo cp root.pem /etc/pki/CA/certs/
2 <!--NeedCopy-->
```

3. Run `ctxfascfg.sh`.
4. Set variables in `/etc/xdl/mcs/mcs.conf`.
  - a) Set the value of `Use_Existing_Configurations_Of_Current_VDA` to `Y`.
  - b) Set the `FAS_LIST` variable to your FAS server address or multiple FAS server addresses that are separated by semicolons and enclosed by double quotes, for example, `FAS_LIST ="<FAS_SERVER_FQDN>;<FAS_SERVER_FQDN>"`.
  - c) Set the other variables as required, such as `VDI_MODE`.
5. Run the script `/opt/Citrix/VDA/sbin/deploymcs.sh`.

### Enable FAS on an MCS-created VM

If FAS is not enabled on the template machine as described earlier, you can enable FAS on each MCS-created VM.

To enable FAS on an MCS-created VM, do the following:

1. Set variables in `/etc/xdl/mcs/mcs.conf`.
  - a) Set the value of `Use_Existing_Configurations_Of_Current_VDA` to `Y`.
  - b) Set the `FAS_LIST` variable to your FAS server address.
  - c) Set the other variables as required, such as `VDI_MODE`.
2. Import the root CA certificate.

```
1 sudo cp root.pem /etc/pki/CA/certs/
2 <!--NeedCopy-->
```

3. Run the `/opt/Citrix/VDA/sbin/ctxfascfg.sh` script.

#### Note:



You must set all necessary variables in `/etc/xdl/mcs/mcs.conf` because these variables are called upon VM startup.

## Install Linux Virtual Delivery Agent for RHEL/CentOS

June 10, 2022

You can choose to follow the steps in this article for manual installation or use [easy install](#) for automatic installation and configuration. Easy install saves time and labor and is less error-prone than the manual installation.

### Note:

Use [easy install](#) only for fresh installations. Do not use easy install to update an existing installation.

### Step 1: Prepare RHEL 8/CentOS 8, RHEL 7/CentOS 7 for VDA installation

#### Step 1a: Verify the network configuration

We recommend that the network is connected and configured correctly before proceeding.

#### Step 1b: Set the host name

To ensure that the host name of the machine is reported correctly, change the `/etc/hostname` file to contain only the host name of the machine.

```
hostname
```

#### Step 1c: Assign a loopback address to the host name

To ensure that the DNS domain name and Fully Qualified Domain Name (FQDN) of the machine are reported back correctly, change the following line of the `/etc/hosts` file to include the FQDN and host name as the first two entries:

```
127.0.0.1 hostname-fqdn hostname localhost localhost.localdomain localhost4 localhost4.localdomain4
```

For example:

```
127.0.0.1 vda01.example.com vda01 localhost localhost.localdomain localhost4 localhost4.localdomain4
```

Remove any other references to **hostname-fqdn** or **hostname** from other entries in the file.

**Note:**

The Linux VDA currently does not support NetBIOS name truncation. Therefore, the host name must not exceed 15 characters.

**Tip:**

Use a–z, A–Z, 0–9, and hyphen (-) characters only. Avoid underscores (\_), spaces, and other symbols. Do not start a host name with a number and do not end with a hyphen. This rule also applies to Delivery Controller host names.

**Step 1d: Check the host name**

Verify that the host name is set correctly:

```
1 hostname
2 <!--NeedCopy-->
```

This command returns only the machine's host name and not its fully qualified domain name (FQDN).

Verify that the FQDN is set correctly:

```
1 hostname -f
2 <!--NeedCopy-->
```

This command returns the FQDN of the machine.

**Step 1e: Check name resolution and service reachability**

Verify that you can resolve the FQDN and ping the domain controller and Delivery Controller:

```
1 nslookup domain-controller-fqdn
2
3 ping domain-controller-fqdn
4
5 nslookup delivery-controller-fqdn
6
7 ping delivery-controller-fqdn
8 <!--NeedCopy-->
```

If you cannot resolve the FQDN or ping either of these machines, review the steps before proceeding.

### Step 1f: Configure clock synchronization

Maintaining accurate clock synchronization between the VDAs, Delivery Controllers, and domain controllers is crucial. Hosting the Linux VDA as a virtual machine can cause clock skew problems. For this reason, synchronizing time with a remote time service is preferred.

An RHEL 8/RHEL 7 default environment uses the Chrony daemon (`chronyd`) for clock synchronization.

#### Configure the Chrony service

As a root user, edit `/etc/chrony.conf` and add a server entry for each remote time server:

```
1 server peer1-fqdn-or-ip-address iburst
2
3 server peer2-fqdn-or-ip-address iburst
4 <!--NeedCopy-->
```

In a typical deployment, synchronize time from the local domain controllers and not directly from public NTP pool servers. Add a server entry for each Active Directory domain controller in the domain.

Remove any other server entries listed including loopback IP address, localhost, and public server `*.pool.ntp.org` entries.

Save changes and restart the Chrony daemon:

```
1 sudo /sbin/service chronyd restart
2 <!--NeedCopy-->
```

### Step 1g: Install OpenJDK

The Linux VDA depends on OpenJDK. Typically, the runtime environment is installed as part of the operating system installation.

Confirm the correct version:

```
1 sudo yum info java-1.8.0-openjdk
2 <!--NeedCopy-->
```

The prepackaged OpenJDK might be an earlier version. Update to the latest version as required:

```
1 sudo yum -y update java-1.8.0-openjdk
2 <!--NeedCopy-->
```

Open a new shell and verify the version of Java:

```
1 java -version
2 <!--NeedCopy-->
```

**Tip:**

To avoid registration failure with the Delivery Controller, ensure that you installed only OpenJDK 1.8.0. Remove all other versions of Java from your system.

### Step 1h: Install PostgreSQL

The Linux VDA requires either PostgreSQL 10.5 or later on RHEL 8 or PostgreSQL 9.2 or later on RHEL 7.

Install the following packages:

```
1 sudo yum -y install postgresql-server
2
3 sudo yum -y install postgresql-jdbc
4 <!--NeedCopy-->
```

The following post-installation step is required to initialize the database and to ensure that the service starts upon machine startup. This action creates database files under **/var/lib/pgsql/data**. The command differs between PostgreSQL 10 and 9:

```
1 sudo postgresql-setup initdb
2 <!--NeedCopy-->
```

### Step 1i: Start PostgreSQL

Start the service upon machine startup and start the service immediately:

```
1 sudo systemctl enable postgresql
2
3 sudo systemctl start postgresql
4 <!--NeedCopy-->
```

Check the version of PostgreSQL by using:

```
1 psql --version
2 <!--NeedCopy-->
```

(RHEL 7 only) Verify that the data directory is set by using the **psql** command-line utility:

```
1 sudo -u postgres psql -c 'show data_directory'
2 <!--NeedCopy-->
```

## Step 2: Prepare the hypervisor

Some changes are required when running the Linux VDA as a virtual machine on a supported hypervisor. Make the following changes according to the hypervisor platform in use. No changes are required if you are running the Linux machine on bare metal hardware.

### Fix time synchronization on Citrix Hypervisor

When the Citrix Hypervisor Time Sync feature is enabled, within each paravirtualized Linux VM you experience issues with NTP and Citrix Hypervisor, both of which try to manage the system clock. To avoid the clock becoming out of sync with other servers, ensure that the system clock within each Linux guest is synchronized with the NTP. This case requires disabling host time synchronization. No changes are required in HVM mode.

On some Linux distributions, if you are running a paravirtualized Linux kernel with Citrix VM Tools installed, you can check whether the Citrix Hypervisor Time Sync feature is present and enabled from within the Linux VM:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns 0 or 1:

- 0 - The time sync feature is enabled, and must be disabled.
- 1 - The time sync feature is disabled, and no further action is required.

If the `/proc/sys/xen/indepent_wallclock` file is not present, the following steps are not required.

If enabled, disable the time sync feature by writing 1 to the file:

```
1 sudo echo 1 > /proc/sys/xen/independent_wallclock
2 <!--NeedCopy-->
```

To make this change permanent and persistent after restart, edit the `/etc/sysctl.conf` file and add the line:

```
xen.independent_wallclock = 1
```

To verify these changes, restart the system:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns the value 1.

### Fix time synchronization on Microsoft Hyper-V

The Linux VMs with Hyper-V Linux Integration Services installed can apply the Hyper-V time synchronization feature to use the time of the host operating system. To ensure that the system clock remains accurate, you must enable this feature alongside the NTP services.

From the management operating system:

1. Open the Hyper-V Manager console.
2. For the settings of a Linux VM, select **Integration Services**.
3. Ensure that **Time synchronization** is selected.

#### Note:

This approach is different from VMware and Citrix Hypervisor, where host time synchronization is disabled to avoid conflicts with NTP. Hyper-V time synchronization can coexist and supplement NTP time synchronization.

### Fix time synchronization on ESX and ESXi

When the VMware Time Synchronization feature is enabled, within each paravirtualized Linux VM you experience issues with the NTP and the hypervisor, both of which try to synchronize the system clock. To avoid the clock becoming out of sync with other servers, ensure that the system clock within each Linux guest is synchronized with the NTP. This case requires disabling host time synchronization.

If you are running a paravirtualized Linux kernel with VMware Tools installed:

1. Open the vSphere Client.
2. Edit settings for the Linux VM.
3. In the **Virtual Machine Properties** dialog, open the **Options** tab.
4. Select **VMware Tools**.
5. In the **Advanced** box, clear **Synchronize guest time with host**.

### Step 3: Add the Linux virtual machine (VM) to the Windows domain

The Linux VDA supports several methods for adding Linux machines to the Active Directory (AD) domain:

- [Samba Winbind](#)
- [Quest Authentication Services](#)
- [Centrify DirectControl](#)
- [SSSD](#)
- [PBIS](#) (compatible with RHEL 7 only)

Follow instructions based on your chosen method.

**Note:**

Session launches might fail when the same user name is used for the local account in the Linux VDA and the account in AD.

#### Samba Winbind

Install or update the required packages:

For RHEL 8/CentOS 8:

```
1 sudo yum -y install samba-winbind samba-winbind-clients krb5-  
   workstation oddjob-mkhomedir realmd authselect  
2 <!--NeedCopy-->
```

For RHEL 7/CentOS 7:

```
1 sudo yum -y install samba-winbind samba-winbind-clients krb5-  
   workstation authconfig oddjob-mkhomedir  
2 <!--NeedCopy-->
```

### Enable Winbind daemon to start upon machine startup

The Winbind daemon must be configured to start upon machine startup:

```
1 sudo /sbin/chkconfig winbind on  
2 <!--NeedCopy-->
```

### Configure Winbind Authentication

Configure the machine for Kerberos authentication by using Winbind:

1. Run the following command.

For RHEL 8:

```
1 sudo authselect select winbind with-mkhomedir --force  
2 <!--NeedCopy-->
```

For RHEL 7:

```
1 sudo authconfig --disablecache --disablesd --disablesdauth --  
   enablewinbind --enablewinbindauth --disablewinbindoffline --  
   smbsecurity=ads --smbworkgroup=domain --smbrealm=REALM --  
   krb5realm=REALM --krb5kdc=fqdn-of-domain-controller --  
   winbindtemplateshell=/bin/bash --enablemkhomedir --updateall  
2 <!--NeedCopy-->
```

Where **REALM** is the Kerberos realm name in uppercase and **domain** is the NetBIOS name of the domain.

If DNS-based lookup of the KDC server and realm name is required, add the following two options to the previous command:

```
--enablekrb5kcdns --enablekrb5realmdns
```



Ignore any errors returned from the `authconfig` command about the `winbind` service failing to start. The errors can occur when `authconfig` tries to start the `winbind` service without the machine yet being joined to the domain.

2. Open `/etc/samba/smb.conf` and add the following entries under the [Global] section, but after the section generated by the `authconfig` tool:

```
kerberos method = secrets and keytab
winbind refresh tickets = true
winbind offline logon = no
```

3. (RHEL 8 only) Open `/etc/krb5.conf` and add entries under the [libdefaults], [realms], and [domain\_realm] sections:

Under the [libdefaults] section:

```
default_ccache_name = FILE:/tmp/krb5cc_%{ uid }
default_realm = REALM
dns_lookup_kdc = true
```

Under the [realms] section:

```
REALM = {
kdc = fqdn-of-domain-controller
}
```

Under the [domain\_realm] section:

```
realm = REALM
.realm = REALM
```

The Linux VDA requires the system keytab file `/etc/krb5.keytab` to authenticate and register with the Delivery Controller. The previous `kerberos method` setting forces Winbind to create the system keytab file when the machine is first joined to the domain.

### Join Windows domain

Your domain controller must be reachable and you must have an Active Directory user account with permissions to add computers to the domain:

RHEL 8:

```
1 sudo realm join -U user --client-software=winbind REALM
2 <!--NeedCopy-->
```

RHEL 7:

```
1 sudo net ads join REALM -U user
2 <!--NeedCopy-->
```

**REALM** is the Kerberos realm name in uppercase, and **user** is a domain user who has permissions to add computers to the domain.

### Configure PAM for Winbind

By default, the configuration for the Winbind PAM module (`pam_winbind`) does not enable Kerberos ticket caching and home directory creation. Open `/etc/security/pam_winbind.conf` and add or change the following entries under the [Global] section:

```
krb5_auth = yes
krb5_ccache_type = FILE
mkhomedir = yes
```

Ensure that any leading semi-colons from each setting are removed. These changes require restarting the Winbind daemon:

```
1 sudo /sbin/service winbind restart
2 <!--NeedCopy-->
```

#### Tip:

The `winbind` daemon stays running only if the machine is joined to a domain.

Open `/etc/krb5.conf` and change the following setting under the [libdefaults] section from KEYRING to FILE type:

```
default_ccache_name = FILE:/tmp/krb5cc_%{ uid }
```

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory.

Run the **net ads** command of Samba to verify that the machine is joined to a domain:

```
1 sudo net ads testjoin
2 <!--NeedCopy-->
```

Run the following command to verify extra domain and computer object information:

```
1 sudo net ads info
2 <!--NeedCopy-->
```

### Verify Kerberos configuration

To ensure that Kerberos is configured correctly for use with the Linux VDA, verify that the system keytab file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos `kinit` command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\$$@REALM
2 <!--NeedCopy-->
```

The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT ticket for the machine account has been cached using:

```
1 sudo klist
2 <!--NeedCopy-->
```

Examine the account details of the machine using:

```
1 sudo net ads status
2 <!--NeedCopy-->
```

## Verify user authentication

Use the **wbinfo** tool to verify that domain users can authenticate with the domain:

```
1 wbinfo --krb5auth=domain\\username%password
2 <!--NeedCopy-->
```

The domain specified here is the AD domain name, not the Kerberos realm name. For the bash shell, the backslash (\) character must be escaped with another backslash. This command returns a message indicating success or failure.

To verify that the Winbind PAM module is configured correctly, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2 id -u
3 <!--NeedCopy-->
```

Verify that the tickets in the Kerberos credential cache are valid and not expired:

```
1 klist
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to the Gnome or KDE console directly. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Quest Authentication Services

### Configure Quest on domain controller

Assume that you have installed and configured the Quest software on the Active Directory domain controllers, and have been granted administrative privileges to create computer objects in Active Directory.

## Enable domain users to log on to Linux VDA machines

To enable domain users to establish HDX sessions on a Linux VDA machine:

1. In the Active Directory Users and Computers management console, open Active Directory user properties for that user account.
2. Select the **Unix Account** tab.
3. Check **Unix-enabled**.
4. Set the **Primary GID Number** to the group ID of an actual domain user group.

### Note:

These instructions are equivalent for setting up domain users for logon using the console, RDP, SSH, or any other remoting protocol.

## Configure Quest on Linux VDA

### Work around SELinux policy enforcement

The default RHEL environment has SELinux fully enforced. This enforcement interferes with the Unix domain socket IPC mechanisms used by Quest, and prevents domain users from logging on.

The convenient way to work around this issue is to disable SELinux. As a root user, edit **/etc/selinux/-config** and change the **SELinux** setting:

```
SELINUX=permissive
```

This change requires a machine restart:

```
1 reboot
2 <!--NeedCopy-->
```

### Important:

Use this setting carefully. Reenabling SELinux policy enforcement after disabling can cause a complete lockout, even for the root user and other local users.

## Configure VAS daemon

Auto-renewal of Kerberos tickets must be enabled and disconnected. Authentication (offline logon) must be disabled.

```
1 sudo /opt/quest/bin/vastool configure vas vasd auto-ticket-renew-  
   interval 32400  
2  
3 sudo /opt/quest/bin/vastool configure vas vas_auth allow-disconnected-  
   auth false  
4 <!--NeedCopy-->
```

This command sets the renewal interval to nine hours (32,400 seconds) which is one hour less than the default 10-hour ticket lifetime. Set this parameter to a lower value on systems with a shorter ticket lifetime.

### Configure PAM and NSS

To enable domain user logon through HDX and other services such as su, ssh, and RDP, run the following commands to manually configure PAM and NSS:

```
1 sudo /opt/quest/bin/vastool configure pam  
2  
3 sudo /opt/quest/bin/vastool configure nss  
4 <!--NeedCopy-->
```

### Join Windows domain

Join the Linux machine to the Active Directory domain using the Quest **vastool** command:

```
1 sudo /opt/quest/bin/vastool -u user join domain-name  
2 <!--NeedCopy-->
```

The user is any domain user who has permissions to join computers to the Active Directory domain. The **domain-name** is the DNS name of the domain, for example, example.com.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a Quest-joined Linux machine is on the domain:

```
1 sudo /opt/quest/bin/vastool info domain  
2 <!--NeedCopy-->
```

If the machine is joined to a domain, this command returns the domain name. If the machine is not joined to any domain, the following error appears:

```
ERROR: No domain could be found.  
ERROR: VAS_ERR_CONFIG: at ctx.c:414 in _ctx_init_default_realm  
default_realm not configured in vas.conf. Computer may not be joined to  
domain
```

### Verify user authentication

To verify that Quest can authenticate domain users through PAM, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username  
2 id -u  
3 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the UID returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid  
2 <!--NeedCopy-->
```

Verify that the tickets in the Kerberos credential cache are valid and not expired:

```
1 /opt/quest/bin/vastool klist  
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit  
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to the Gnome or KDE console directly. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Centrify DirectControl

### Join Windows domain

With the Centrify DirectControl Agent installed, join the Linux machine to the Active Directory domain using the Centrify `adjoin` command:

```
1 su -
2 adjoin -w -V -u user domain-name
3 <!--NeedCopy-->
```

The user parameter is any Active Directory domain user who has permissions to join computers to the Active Directory domain. The **domain-name** is the name of the domain to join the Linux machine to.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a Centrify-joined Linux machine is on the domain:

```
1 su -
2 adinfo
3 <!--NeedCopy-->
```

Verify that the Joined to domain value is valid and the CentrifyDC mode returns connected. If the mode remains stuck in the starting state, then the Centrify client is experiencing server connection or authentication problems.

More comprehensive system and diagnostic information is available using:

```
1 adinfo --sysinfo all
2 adinfo -diag
3 <!--NeedCopy-->
```

Test connectivity to the various Active Directory and Kerberos services.

```
1 adinfo --test
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.



## SSSD

If you are using SSSD, follow the instructions in this section. This section includes instructions for joining a Linux VDA machine to a Windows domain and provides guidance for configuring Kerberos authentication.

To set up SSSD on RHEL and CentOS, do the following:

1. Join the domain and create host keytab
2. Set up SSSD
3. Enable SSSD
4. Verify the Kerberos configuration
5. Verify user authentication

### Join the domain and create host keytab

SSSD does not provide Active Directory client functions for joining the domain and managing the system keytab file. You can use `adcli`, `realmd`, or `Samba` instead.

This section describes the `Samba` and the `adcli` approaches for RHEL 7 and RHEL 8 respectively. For `realmd`, see the RHEL or CentOS documentation. These steps must be followed before configuring SSSD.

- **Samba (RHEL 7):**

Install or update the required packages:

```
1 sudo yum -y install krb5-workstation authconfig oddjob-mkhomedir
  samba-common-tools
2 <!--NeedCopy-->
```

On the Linux client with properly configured files:

- `/etc/krb5.conf`
- `/etc/samba/smb.conf`:

Configure the machine for Samba and Kerberos authentication:

```
1 sudo authconfig --smbsecurity=ads --smbworkgroup=domain --
  smbrealm=REALM --krb5realm=REALM --krb5kdc=fqdn-of-domain-
  controller --update
2 <!--NeedCopy-->
```

Where **REALM** is the Kerberos realm name in uppercase and **domain** is the short NetBIOS name of the Active Directory domain.

If DNS-based lookup of the KDC server and realm name is required, add the following two options to the preceding command:

```
--enablekrb5kdc dns --enablekrb5realmdns
```

Open **/etc/samba/smb.conf** and add the following entries under the **[Global]** section, but after the section generated by the **authconfig** tool:

```
kerberos method = secrets and keytab  
winbind offline logon = no
```

Join the Windows domain. Ensure that your domain controller is reachable and you have an Active Directory user account with permissions to add computers to the domain:

```
1 sudo net ads join REALM -U user  
2 <!--NeedCopy-->
```

**REALM** is the Kerberos realm name in uppercase and **user** is a domain user who has permissions to add computers to the domain.

- **Adcli (RHEL 8):**

Install or update the required packages:

```
1 sudo yum -y install samba-common samba-common-tools krb5-  
workstation authconfig oddjob-mkhomedir realmd oddjob  
authselect  
2 <!--NeedCopy-->
```

Configure the machine for Samba and Kerberos authentication:

```
1 sudo authselect select sssd with-mkhomedir --force  
2 <!--NeedCopy-->
```

Open **/etc/krb5.conf** and add the entries under the **[realms]** and **[domain\_realm]** sections.

Under the **[realms]** section:

```
REALM = {  
kdc = fqdn-of-domain-controller  
}
```

Under the [domain\_realm] section:

```
realm = REALM
.realm = REALM
```

Join the Windows domain. Ensure that your domain controller is reachable and you have an Active Directory user account with permissions to add computers to the domain:

```
1 sudo realm join REALM -U user
2 <!--NeedCopy-->
```

**REALM** is the Kerberos realm name in uppercase and **user** is a domain user who has permissions to add computers to the domain.

### Set up SSSD

Setting up SSSD consists of the following steps:

- Install the **sssd-ad** package on the Linux VDA by running the `sudo yum -y install sssd` command.
- Make configuration changes to various files (for example, `sssd.conf`).
- Start the **sssd** service.

An example **sssd.conf** configuration for RHEL 7 (extra options can be added as needed):

```
1 [sssd]
2 config_file_version = 2
3 domains = ad.example.com
4 services = nss, pam
5
6 [domain/ad.example.com]
7 # Uncomment if you need offline logins
8 # cache_credentials = true
9
10 id_provider = ad
11 auth_provider = ad
12 access_provider = ad
13 ldap_id_mapping = true
14 ldap_schema = ad
15
16 # Should be specified as the lower-case version of the long version of
    the Active Directory domain.
17 ad_domain = ad.example.com
```

```
18
19 # Kerberos settings
20 krb5_ccachedir = /tmp
21 krb5_ccname_template = FILE:%d/krb5cc_%U
22
23 # Uncomment if service discovery is not working
24 # ad_server = server.ad.example.com
25
26 # Comment out if the users have the shell and home dir set on the AD
   side
27 default_shell = /bin/bash
28 fallback_homedir = /home/%d/%u
29
30 # Uncomment and adjust if the default principal SHORTNAME$@REALM is not
   available
31 # ldap_sasl_authid = host/client.ad.example.com@AD.EXAMPLE.COM
32 <!--NeedCopy-->
```

Replace **ad.example.com**, **server.ad.example.com** with the corresponding values. For more details, see [sssd-ad\(5\) - Linux man page](#).

(RHEL 8 only)

Open **/etc/sss/sss.conf** and add the following entries under the [domain/ad.example.com] section:

```
ad_gpo_access_control = permissive
full_name_format = %2$s\\%1$s
fallback_homedir = /home/%d/%u
## Kerberos settings
krb5_ccachedir = /tmp
krb5_ccname_template = FILE:%d/krb5cc_%U
```

Set the file ownership and permissions on sssd.conf:

```
chown root:root /etc/sss/sss.conf
chmod 0600 /etc/sss/sss.conf
restorecon /etc/sss/sss.conf
```

## Enable SSSD

### RHEL 8:

Run the following commands to enable SSSD:

```
1 sudo systemctl restart sssd
```

```
2 sudo systemctl enable sssd.service
3 sudo chkconfig sssd on
4 <!--NeedCopy-->
```

### RHEL 7/CentOS 7:

Use `authconfig` to enable SSSD. Install **oddjob-mkhomedir** to ensure that the home directory creation is compatible with SELinux:

```
1 authconfig --enablesssd --enablesssdauth --enablemkhomedir - -update
2
3 sudo service sssd start
4
5 sudo chkconfig sssd on
6 <!--NeedCopy-->
```

### Verify Kerberos configuration

Verify that the system **keytab** file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos **kinit** command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\${@REALM}
2 <!--NeedCopy-->
```

The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT ticket for the machine account has been cached using:

```
1 sudo klist
2 <!--NeedCopy-->
```

## Verify user authentication

Use the **getent** command to verify that the logon format is supported and the NSS works:

```
1 sudo getent passwd DOMAIN\\username
2 <!--NeedCopy-->
```

The **DOMAIN** parameter indicates the short version domain name. If another logon format is needed, verify by using the **getent** command first.

The supported logon formats are:

- Down-level logon name: `DOMAIN\username`
- UPN: `username@domain.com`
- NetBIOS Suffix format: `username@DOMAIN`

To verify that the SSSD PAM module is configured correctly, log on to the Linux VDA using a domain user account that has not been used before.

```
1 sudo ssh localhost -l DOMAIN\\username
2
3 id -u
4 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the **uid** returned by the command:

```
1 ls /tmp/krb5cc_{
2   uid }
3
4 <!--NeedCopy-->
```

Verify that the tickets in the user's Kerberos credential cache are valid and not expired.

```
1 klist
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## PBIS

### Download the required PBIS package

For example:

```
1 wget https://github.com/BeyondTrust/pbis-open/releases/download/8.8.0/  
  pbis-open-8.8.0.506.linux.x86_64.rpm.sh  
2 <!--NeedCopy-->
```

### Make the PBIS installation script executable

For example:

```
1 chmod +x pbis-open-8.8.0.506.linux.x86_64.rpm.sh  
2 <!--NeedCopy-->
```

### Run the PBIS installation script

For example:

```
1 sh pbis-open-8.8.0.506.linux.x86_64.rpm.sh  
2 <!--NeedCopy-->
```

### Join Windows domain

Your domain controller must be reachable and you must have an Active Directory user account with permissions to add computers to the domain:

```
1 /opt/pbis/bin/domainjoin-cli join domain-name user  
2 <!--NeedCopy-->
```

The **user** is a domain user who has permissions to add computers to the Active Directory domain. The **domain-name** is the DNS name of the domain, for example, example.com.

**Note:** To set Bash as the default shell, run the **/opt/pbis/bin/config LoginShellTemplate/bin/bash** command.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a PBIS-joined Linux machine is on the domain:

```
1 /opt/pbis/bin/domainjoin-cli query
2 <!--NeedCopy-->
```

If the machine is joined to a domain, this command returns the information about the currently joined AD domain and OU. Otherwise, only the host name appears.

### Verify user authentication

To verify that PBIS can authenticate domain users through PAM, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\user
2
3 id -u
4 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the UID returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

### Step 4: Install the Linux VDA

You can do a fresh installation or upgrade an existing installation from the previous two versions and from an LTSR release.



## To do a fresh installation

### 1. (Optional) Uninstall the old version

If you installed an earlier version other than the previous two and an LTSR release, uninstall it before installing the new version.

#### a) Stop the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
3 sudo /sbin/service ctxhdx stop
4 <!--NeedCopy-->
```

#### Note:

Before you stop the `ctxvda` and `ctxhdx` services, run the **service ctxmonitorservice stop** command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

#### b) Uninstall the package:

```
1 sudo rpm -e XenDesktopVDA
2 <!--NeedCopy-->
```

#### Note:

To run a command, the full path is needed; alternately, you can add `/opt/Citrix/VDA/sbin` and `/opt/Citrix/VDA/bin` to the system path.

### 2. Download the Linux VDA package

Go to the [Citrix Virtual Apps and Desktops download page](#). Expand the appropriate version of Citrix Virtual Apps and Desktops and click **Components** to download the Linux VDA package that matches your Linux distribution.

### 3. Install the Linux VDA

- Install the Linux VDA software using Yum:

#### For RHEL 8/CentOS 8:

```
1 sudo yum install -y XenDesktopVDA-20.12.0.20-1.el8_x.x86_64.
   rpm
2 <!--NeedCopy-->
```

**For RHEL 7/CentOS 7:**

```
1 sudo yum install -y XenDesktopVDA-20.12.0.20-1.el7_x.x86_64.  
rpm  
2 <!--NeedCopy-->
```

- Install the Linux VDA software using the RPM package manager. Before doing so, you must resolve the following dependencies:

**For RHEL 8/CentOS 8:**

```
1 sudo rpm -i XenDesktopVDA-20.12.0.20-1.el8_x.x86_64.rpm  
2 <!--NeedCopy-->
```

**For RHEL 7/CentOS 7:**

```
1 sudo rpm -i XenDesktopVDA-20.12.0.20-1.el7_x.x86_64.rpm  
2 <!--NeedCopy-->
```

**RPM dependency list for RHEL 8.2/CentOS 8.2:**

```
1 postgresql-jdbc >= 42.2.3  
2  
3 postgresql-server >= 10.6  
4  
5 java-1.8.0-openjdk >= 1.8.0  
6  
7 icoutils >= 0.32  
8  
9 firewalld >= 0.8.0  
10  
11 policycoreutils-python-utils >= 2.9  
12  
13 python3-policycoreutils >= 2.9  
14  
15 dbus >= 1.12.8  
16  
17 dbus-common >= 1.12.8  
18  
19 dbus-daemon >= 1.12.8
```

```
20
21  dbus-tools  >= 1.12.8
22
23  dbus-x11 >= 1.12.8
24
25  xorg-x11-server-utils >= 7.7
26
27  xorg-x11-xinit >= 1.3.4
28
29  libXpm >= 3.5.12
30
31  libXrandr >= 1.5.1
32
33  libXtst >= 1.2.3
34
35  motif >= 2.3.4
36
37  pam >= 1.3.1
38
39  util-linux >= 2.32.1
40
41  util-linux-user  >= 2.32.1
42
43  xorg-x11-utils  >= 7.5
44
45  bash >= 4.4
46
47  findutils >= 4.6
48
49  gawk >= 4.2
50
51  sed >= 4.5
52
53  cups >= 2.2
54
55  foomatic-filters >= 4.0.9
56
57  cups-filters >= 1.20.0
58
59  ghostscript  >= 9.25
60
61  libxml2 >= 2.9
62
63  libmspack >= 0.7
64  <!--NeedCopy-->
```

**RPM dependency list for RHEL 7/CentOS 7:**

```
1  postgresql-server >= 9.2
2
3  postgresql-jdbc >= 9.2
4
5  java-1.8.0-openjdk >= 1.8.0
6
7  ImageMagick >= 6.7.8.9
8
9  firewalld >= 0.3.9
10
11  policycoreutils-python >= 2.0.83
12
13  dbus >= 1.6.12
14
15  dbus-x11 >= 1.6.12
16
17  xorg-x11-server-utils >= 7.7
18
19  xorg-x11-xinit >= 1.3.2
20
21  libXpm >= 3.5.10
22
23  libXrandr >= 1.4.1
24
25  libXtst >= 1.2.2
26
27  motif >= 2.3.4
28
29  pam >= 1.1.8
30
31  util-linux >= 2.23.2
32
33  bash >= 4.2
34
35  findutils >= 4.5
36
37  gawk >= 4.0
38
39  sed >= 4.2
40
```

```
41 cups >= 1.6.0
42
43 foomatic-filters >= 4.0.9
44
45 openldap >= 2.4
46
47 cyrus-sasl >= 2.1
48
49 cyrus-sasl-gssapi >= 2.1
50
51 libxml2 >= 2.9
52
53 python-requests >= 2.6.0
54
55 gperftools-libs >= 2.4
56
57 rpmlib(FileDigests) <= 4.6.0-1
58
59 rpmlib(PayloadFilesHavePrefix) <= 4.0-1
60
61 rpmlib(CompressedFileNames) <= 3.0.4-1
62
63 rpmlib(PayloadIsXz) <= 5.2-1
64 <!--NeedCopy-->
```

**Note:**

For a matrix of the Linux distributions and the Xorg versions that this version of the Linux VDA supports, see [System requirements](#).

**Note:**

After installing the Linux VDA on RHEL 7.x, run the `sudo yum install -y python-websocketify x11vnc` command. The purpose is to install `python-websocketify` and `x11vnc` manually for using the session shadowing feature. For more information, see [Shadow sessions](#).

### To upgrade an existing installation

You can upgrade an existing installation from the previous two versions and from an LTSR release.

- To upgrade your software using `Yum`:

**For RHEL 7/CentOS 7:**

```
1 sudo yum install -y XenDesktopVDA-20.12.0.20-1.el7_x.x86_64.rpm
2 <!--NeedCopy-->
```

- To upgrade your software using the RPM package manager:

**For RHEL 7/CentOS 7:**

```
1 sudo rpm -U XenDesktopVDA-20.12.0.20-1.el7_x.x86_64.rpm
2 <!--NeedCopy-->
```

**Note:**

If you are using RHEL 7, make sure to complete the following steps after you run the preceding upgrade commands:

1. run `/opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\VirtualDesktopAgent"-t "REG_SZ"-v "DotNetRuntimePath"-d "/opt/rh/rh-dotnet31/root/usr/bin/"--force` to set the right .NET runtime path.
2. Restart the `ctxvda` service.

**Important:**

Restart the Linux VDA machine after upgrading the software.

## Step 5: Install NVIDIA GRID drivers

Enabling HDX 3D Pro requires extra installation steps to install the requisite graphics drivers on the hypervisor and on the VDA machines.

Configure the following:

1. Citrix Hypervisor
2. VMware ESX

Follow the instructions for your chosen hypervisor.

**Citrix Hypervisor:**

This detailed section walks through the install and configuration of the NVIDIA GRID drivers on [Citrix Hypervisor](#).

**VMware ESX:**

Follow the information contained in this guide to install and configure the NVIDIA GRID drivers for [VMware ESX](#).

**VDA machines:**

Follow these steps to install and configure the drivers for each of the Linux VM guests:

1. Before starting, ensure that the Linux VM is shut down.
2. In XenCenter, add a GPU in GPU pass-through mode to the VM.
3. Start the RHEL VM.

To prepare the machine for the NVIDIA GRID drivers, run the following commands:

```
1 yum install gcc
2
3 yum install "kernel-devel-$(uname -r)"
4
5 systemctl set-default multi-user.target
6 <!--NeedCopy-->
```

Follow the steps in the [Red Hat Enterprise Linux document](#) to install the NVIDIA GRID driver.

**Note:**

During the GPU driver install, select the default ('no') for each question.

**Important:**

After GPU pass-through is enabled, the Linux VM is no longer accessible through XenCenter. Use SSH to connect.

```
nvidia-smi
```

```
+-----+
| NVIDIA-SMI 352.70      Driver Version: 352.70      |
+-----+-----+
| GPU  Name            Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf     Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
+-----+-----+
|   0   Tesla M60                Off | 0000:00:05.0   Off |                    Off |
| N/A   20C    P0              37W / 150W |  19MiB /  8191MiB |         0%      Default |
+-----+-----+

+-----+
| Processes:
| GPU      PID   Type   Process name                               GPU Memory
|          |   |   |   |                               | Usage |
+-----+-----+
| No running processes found
+-----+
```

Set the correct configuration for the card:

```
etc/X11/ctx-nvidia.sh
```

To take advantage of large resolutions and multi-monitor capabilities, you need a valid NVIDIA license. To apply for the license, follow the product documentation from “GRID Licensing Guide.pdf - DU-07757-001 September 2015.”

## Step 6: Configure the Linux VDA

After installing the package, you must configure the Linux VDA by running the `ctxsetup.sh` script. Before making any changes, the script verifies the environment and ensures that all dependencies are installed. If necessary, you can rerun the script at any time to change settings.

You can run the script manually with prompting, or automatically with preconfigured responses. Review Help about the script before proceeding:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh --help
2 <!--NeedCopy-->
```

### Prompted configuration

Run a manual configuration with prompted questions:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh
2 <!--NeedCopy-->
```

### Automated configuration

For an automated install, provide the options required by the setup script with environment variables. If all required variables are present, the script does not prompt for any information.

Supported environment variables include:

- **CTX\_XDL\_SUPPORT\_DDC\_AS\_CNAME=Y | N** – The Linux VDA supports specifying a Delivery Controller name using a DNS CNAME record. Set to N by default.
- **CTX\_XDL\_DDC\_LIST='list-ddc-fqdns'** – The Linux VDA requires a space-separated list of Delivery Controller Fully Qualified Domain Names (FQDNs) to use for registering with a Delivery Controller. At least one FQDN or CNAME alias must be specified.
- **CTX\_XDL\_VDA\_PORT=port-number** – The Linux VDA communicates with Delivery Controllers through a TCP/IP port, which is port 80 by default.
- **CTX\_XDL\_REGISTER\_SERVICE=Y | N** – The Linux Virtual Desktop services are started after machine startup. The value is set to Y by default.
- **CTX\_XDL\_ADD\_FIREWALL\_RULES=Y | N** – The Linux Virtual Desktop services require incoming network connections to be allowed through the system firewall. You can automatically open the required ports (ports 80 and 1494 by default) in the system firewall for the Linux Virtual Desktop. Set to Y by default.



- **CTX\_XDL\_AD\_INTEGRATION=1 | 2 | 3 | 4 | 5** – The Linux VDA requires Kerberos configuration settings to authenticate with the Delivery Controllers. The Kerberos configuration is determined from the installed and configured Active Directory integration tool on the system. Specify the supported Active Directory integration method to use:
  - 1 – Samba Winbind
  - 2 – Quest Authentication Services
  - 3 – Centrify DirectControl
  - 4 – SSSD
  - 5 – PBIS
- **CTX\_XDL\_HDX\_3D\_PRO=Y | N** – The Linux VDA supports HDX 3D Pro, a set of GPU acceleration technologies designed to optimize the virtualization of rich graphics applications. If HDX 3D Pro is selected, the VDA is configured for VDI desktops (single-session) mode – (that is, CTX\_XDL\_VDI\_MODE=Y).
- **CTX\_XDL\_VDI\_MODE=Y | N** – Whether to configure the machine as a dedicated desktop delivery model (VDI) or hosted shared desktop delivery model. For HDX 3D Pro environments, set this variable to Y. This variable is set to N by default.
- **CTX\_XDL\_SITE\_NAME=dns-name** – The Linux VDA discovers LDAP servers through DNS. To limit the DNS search results to a local site, specify a DNS site name. This variable is set to **<none>** by default.
- **CTX\_XDL\_LDAP\_LIST='list-ldap-servers'** – The Linux VDA queries DNS to discover LDAP servers. If DNS cannot provide LDAP service records, you can provide a space-separated list of LDAP FQDNs with LDAP ports. For example, ad1.mycompany.com:389. This variable is set to **<none>** by default.
- **CTX\_XDL\_SEARCH\_BASE=search-base-set** – The Linux VDA queries LDAP through a search base set to the root of the Active Directory Domain (for example, DC=mycompany,DC=com). To improve search performance, you can specify a search base (for example, OU=VDI,DC=mycompany,DC=com). This variable is set to **<none>** by default.
- **CTX\_XDL\_FAS\_LIST='list-fas-servers'** – The Federated Authentication Service (FAS) servers are configured through the AD Group Policy. The Linux VDA does not support AD Group Policy, but you can provide a semicolon-separated list of FAS servers instead. The sequence must be the same as configured in the AD Group Policy. If any server address is removed, fill its blank with the **<none>** text string and do not modify the order of server addresses.
- **CTX\_XDL\_DOTNET\_RUNTIME\_PATH=path-to-install-dotnet-runtime** – The path to install .NET Core Runtime 3.1 for supporting the new broker agent service (`ctxvda`). The default path is `/usr/bin`.
- **CTX\_XDL\_START\_SERVICE=Y | N** – Whether or not the Linux VDA services are started when the Linux VDA configuration is complete. Set to Y by default.
- **CTX\_XDL\_TELEMETRY\_SOCKET\_PORT** – The socket port for listening for Citrix Scout. The default port is 7503.

- **CTX\_XDL\_TELEMETRY\_PORT** – The port for communicating with Citrix Scout. The default port is 7502.

Set the environment variable and run the configure script:

```
1 export CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N
2
3 export CTX_XDL_DDC_LIST= 'list-ddc-fqdns'
4
5 export CTX_XDL_VDA_PORT=port-number
6
7 export CTX_XDL_REGISTER_SERVICE=Y|N
8
9 export CTX_XDL_ADD_FIREWALL_RULES=Y|N
10
11 export CTX_XDL_AD_INTEGRATION=1|2|3|4|5
12
13 export CTX_XDL_HDX_3D_PRO=Y|N
14
15 export CTX_XDL_VDI_MODE=Y|N
16
17 export CTX_XDL_SITE_NAME=dns-site-name | '<none>'
18
19 export CTX_XDL_LDAP_LIST= 'list-ldap-servers' | '<none>'
20
21 export CTX_XDL_SEARCH_BASE=search-base-set | '<none>'
22
23 export CTX_XDL_FAS_LIST= 'list-fas-servers' | '<none>'
24
25 export CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime
26
27 export CTX_XDL_TELEMETRY_SOCKET_PORT=port-number
28
29 export CTX_XDL_TELEMETRY_PORT=port-number
30
31 export CTX_XDL_START_SERVICE=Y|N
32
33 sudo -E /opt/Citrix/VDA/sbin/ctxsetup.sh
34 <!--NeedCopy-->
```

When running the sudo command, type the **-E** option to pass the existing environment variables to the new shell it creates. We recommend that you create a shell script file from the preceding commands with **#!/bin/bash** as the first line.

Alternatively, you can specify all parameters by using a single command:

```
1 sudo CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N \  
2 \  
3 CTX_XDL_DDC_LIST= 'list-ddc-fqdns' \  
4 \  
5 CTX_XDL_VDA_PORT=port-number \  
6 \  
7 CTX_XDL_REGISTER_SERVICE=Y|N \  
8 \  
9 CTX_XDL_ADD_FIREWALL_RULES=Y|N \  
10 \  
11 CTX_XDL_AD_INTEGRATION=1|2|3|4|5 \  
12 \  
13 CTX_XDL_HDX_3D_PRO=Y|N \  
14 \  
15 CTX_XDL_VDI_MODE=Y|N \  
16 \  
17 CTX_XDL_SITE_NAME=dns-name \  
18 \  
19 CTX_XDL_LDAP_LIST= 'list-ldap-servers' \  
20 \  
21 CTX_XDL_SEARCH_BASE=search-base-set \  
22 \  
23 CTX_XDL_FAS_LIST= 'list-fas-servers' \  
24 \  
25 CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime \  
26 \  
27 CTX_XDL_TELEMETRY_SOCKET_PORT=port-number \  
28 \  
29 CTX_XDL_TELEMETRY_PORT=port-number \  
30 \  
31 CTX_XDL_START_SERVICE=Y|N \  
32 \  
33 /opt/Citrix/VDA/sbin/ctxsetup.sh  
34 <!--NeedCopy-->
```

### Remove configuration changes

In some scenarios, you might have to remove the configuration changes made by the **ctxsetup.sh** script without uninstalling the Linux VDA package.

Review Help about this script before proceeding:

```
1 sudo /opt/Citrix/VDA/sbin/ctxcleanup.sh --help
2 <!--NeedCopy-->
```

To remove configuration changes:

```
1 sudo /opt/Citrix/VDA/sbin/ctxcleanup.sh
2 <!--NeedCopy-->
```

**Important:**

This script deletes all configuration data from the database and renders the Linux VDA inoperable.

### Configuration logs

The **ctxsetup.sh** and **ctxcleanup.sh** scripts display errors on the console, with additional information written to the configuration log file **/tmp/xdl.configure.log**.

Restart the Linux VDA services to have the changes take effect.

### Step 7: Run the Linux VDA

After configuring the Linux VDA by using the **ctxsetup.sh** script, you can run the following commands to control the Linux VDA.

#### Start the Linux VDA:

To start the Linux VDA services:

```
1 sudo /sbin/service ctxhdx start
2
3 sudo /sbin/service ctxvda start
4 <!--NeedCopy-->
```

#### Stop the Linux VDA:

To stop the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
```

```
3 sudo /sbin/service ctxhdx stop
4 <!--NeedCopy-->
```

**Note:**

Before you stop the `ctxvda` and `ctxhdx` services, run the `service ctxmonitorservice stop` command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

**Restart the Linux VDA:**

To restart the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
3 sudo /sbin/service ctxhdx restart
4
5 sudo /sbin/service ctxvda start
6 <!--NeedCopy-->
```

**Check the status of the Linux VDA:**

To check the running status of the Linux VDA services:

```
1 sudo /sbin/service ctxvda status
2
3 sudo /sbin/service ctxhdx status
4 <!--NeedCopy-->
```

**Step 8: Create the machine catalog in Citrix Virtual Apps or Citrix Virtual Desktops**

The process for creating machine catalogs and adding Linux VDA machines is similar to the traditional Windows VDA approach. For a more detailed description of how to complete these tasks, see [Create machine catalogs](#) and [Manage machine catalogs](#).

For creating machine catalogs that contain Linux VDA machines, there are a few restrictions that differentiate the process from creating machine catalogs for Windows VDA machines:

- For the operating system, select:
  - The **Multi-session OS** option for a hosted shared desktops delivery model.
  - The **Single-session OS** option for a VDI dedicated desktop delivery model.
- Do not mix Linux and Windows VDA machines in the same machine catalog.

**Note:**

Early versions of Citrix Studio did not support the notion of a “Linux OS.” However, selecting the **Windows Server OS** or **Server OS** option implies an equivalent hosted shared desktops delivery model. Selecting the **Windows Desktop OS** or **Desktop OS** option implies a single user per machine delivery model.

**Tip:**

If you remove and rejoin a machine to the Active Directory domain, you must remove and add the machine to the machine catalog again.

### **Step 9: Create the delivery group in Citrix Virtual Apps or Citrix Virtual Desktops**

The process for creating a delivery group and adding machine catalogs containing Linux VDA machines is almost identical to Windows VDA machines. For a more detailed description of how to complete these tasks, see [Create Delivery Groups](#).

For creating delivery groups that contain Linux VDA machine catalogs, the following restrictions apply:

- Ensure that the AD users and groups you select have been properly configured to log on to the Linux VDA machines.
- Do not allow logon of unauthenticated (anonymous) users.
- Do not mix the delivery group with machine catalogs that contain Windows machines.

**Important:**

Publishing applications is supported with Linux VDA Version 1.4 and later. However, the Linux VDA does not support the delivery of desktops and apps to the same machine.

For information about how to create machine catalogs and delivery groups, see [Citrix Virtual Apps and Desktops 7 2012](#).

## **Install Linux Virtual Delivery Agent for SUSE**

June 10, 2022

You can choose to follow the steps in this article for manual installation or use [easy install](#) for automatic installation and configuration. Easy install saves time and labor and is less error-prone than the manual installation.

**Note:**

Use easy install only for fresh installations. Do not use easy install to update an existing installa-

tion.

## Step 1: Prepare for installation

### Step 1a: Launch the YaST tool

The SUSE Linux Enterprise YaST tool is used for configuring all aspects of the operating system.

To launch the text-based YaST tool:

```
1 su -
2
3 yast
4 <!--NeedCopy-->
```

Alternatively, launch the UI-based YaST tool:

```
1 su -
2
3 yast2 &
4 <!--NeedCopy-->
```

### Step 1b: Configure networking

The following sections provide information on configuring the various networking settings and services used by the Linux VDA. Configuring networking is carried out via the YaST tool, not via other methods such as Network Manager. These instructions are based on using the UI-based YaST tool. The text-based YaST tool can be used but has a different method of navigation that is not documented here.

#### Configure host name and DNS

1. Open YaST Network Settings.
2. SLED 12 Only: On the **Global Options** tab, change the **Network Setup Method** to **Wicked Service**.
3. Open the **Hostname/DNS** tab.
4. Clear **Change hostname via DHCP**.
5. Check **Assign Hostname to Loopback IP**.
6. Edit the following to reflect your networking setup:
  - Host name – Add the DNS host name of the machine.

- Domain name – Add the DNS domain name of the machine.
- Name server – Add the IP address of the DNS server. It is typically the IP address of the AD Domain Controller.
- Domain search list – Add the DNS domain name.

**Note:**

The Linux VDA currently does not support NetBIOS name truncation. Therefore, the host name must not exceed 15 characters.

**Tip:**

Use a–z, A–Z, 0–9, and hyphen (-) characters only. Avoid underscores (\_), spaces, and other symbols. Do not start a host name with a number and do not end with a hyphen. This rule also applies to Delivery Controller host names.

### Disable multicast DNS

On SLED only, the default settings have multicast DNS (mDNS) enabled, which can lead to inconsistent name resolution results. mDNS is not enabled on SLES by default, so no action is required.

To disable mDNS, edit `/etc/nsswitch.conf` and change the line containing:

```
hosts: files mdns_minimal [NOTFOUND=return] dns
```

To:

```
hosts: files dns
```

### Check the host name

Verify that the host name is set correctly:

```
1 hostname
2 <!--NeedCopy-->
```

This command returns only the machine's host name and not its fully qualified domain name (FQDN).

Verify that the FQDN is set correctly:

```
1 hostname -f
2 <!--NeedCopy-->
```

This command returns the machine's FQDN.



### Check name resolution and service reachability

Verify that you can resolve the FQDN and ping the domain controller and Delivery Controller:

```
1 nslookup domain-controller-fqdn
2
3 ping domain-controller-fqdn
4
5 nslookup delivery-controller-fqdn
6
7 ping delivery-controller-fqdn
8 <!--NeedCopy-->
```

If you cannot resolve the FQDN or ping either of these machines, review the steps before proceeding.

### Step 1c: Configure the NTP service

It is crucial to maintain accurate clock synchronization between the VDAs, Delivery Controllers, and domain controllers. Hosting the Linux VDA as a virtual machine can cause clock skew problems. For this reason, maintaining time using a remote NTP service is preferred. Some changes might be required to the default NTP settings:

1. Open YaST NTP Configuration and select the **General Settings** tab.
2. In the Start NTP Daemon section, check **Now and on Boot**.
3. If present, select the **Undisciplined Local Clock (LOCAL)** item and click **Delete**.
4. Add an entry for an NTP server by clicking **Add**.
5. Select the **Server Type** and click **Next**.
6. Type the DNS name of the NTP server in the Address field. This service is normally hosted on the Active Directory domain controller.
7. Leave the Options field unchanged.
8. Click **Test** to verify that the NTP service is reachable.
9. Click **OK** through the set of windows to save the changes.

#### Note:

For SLES 12 implementations, the NTP daemon might fail to start due to a known SUSE issue with AppArmor policies. Follow the [resolution](#) for additional information.

### Step 1d: Install Linux VDA dependent packages

The Linux VDA software for SUSE Linux Enterprise depends on the following packages:

- postgresql10-server 10.12 or later

- OpenJDK 1.8.0
- OpenMotif Runtime Environment 2.3.1 or later
- Cups 1.6.0 or later
- Foomatic filters 3.0.0 or later
- ImageMagick 6.8 or later

### Add repositories

You can obtain some required packages, such as PostgreSQL and ImageMagick, from the SUSE Linux Enterprise Software Development Kit (SDK). To obtain the packages, add the SDK repository by using YaST or download the SDK image file and then mount it locally by using the following commands:

```
1 sudo mkdir -p /mnt/sdk
2
3 sudo mount -t iso9660 path-to-iso/SLE-12-SP5-SDK-DVD-x86_64-GM-DVD1.iso
   /mnt/sdk
4
5 sudo zypper ar -f /mnt/sdk sdk
6 <!--NeedCopy-->
```

### Install the Kerberos client

Install the Kerberos client for mutual authentication between the Linux VDA and the Delivery Controllers:

```
1 sudo zypper install krb5-client
2 <!--NeedCopy-->
```

The Kerberos client configuration depends on which Active Directory integration approach is used. See the following description.

### Install OpenJDK

The Linux VDA depends on OpenJDK 1.8.0.

#### Tip:

To avoid registration failure with the Delivery Controller, ensure that you installed only OpenJDK 1.8.0. Remove all other versions of Java from your system.

- **SLED:**

1. On SLED, the Java runtime environment is typically installed with the operating system. Check whether it has been installed:

```
1 sudo zypper info java-1_8_0-openjdk
2 <!--NeedCopy-->
```

2. Update to the latest version if the status is reported as out-of-date:

```
1 sudo zypper update java-1_8_0-openjdk
2 <!--NeedCopy-->
```

3. Check the Java version:

```
1 java -version
2 <!--NeedCopy-->
```

- **SLES:**

1. On SLES, install the Java runtime environment:

```
1 sudo zypper install java-1_8_0-openjdk
2 <!--NeedCopy-->
```

2. Check the Java version:

```
1 java -version
2 <!--NeedCopy-->
```

## Install PostgreSQL

On SLED/SLES 12, install the packages:

```
1 sudo zypper install postgresql-init
2
3 sudo zypper install postgresql10-server
4
```

```
5 sudo zypper install postgresql-jdbc
6 <!--NeedCopy-->
```

Post-installation steps are required to initialize the database service and to ensure that PostgreSQL is started upon machine startup:

```
1 sudo systemctl enable postgresql
2
3 sudo systemctl restart postgresql
4 <!--NeedCopy-->
```

Database files locate at /var/lib/pgsql/data.

### Remove repositories

With dependent packages installed, run the following commands to remove the SDK repository that was set up earlier and the media mounted:

```
1 sudo zypper rr sdk
2
3 sudo umount /mnt/sdk
4
5 sudo rmdir /mnt/sdk
6 <!--NeedCopy-->
```

## Step 2: Prepare Linux VM for Hypervisor

Some changes are required when running the Linux VDA as a virtual machine on a supported hypervisor. Make the following changes according to the hypervisor platform in use. No changes are required if you are running the Linux machine on bare metal hardware.

### Fix time synchronization on Citrix Hypervisor

If the Citrix Hypervisor Time Sync feature is enabled, within each paravirtualized Linux VM you experience issues with NTP and Citrix Hypervisor both trying to manage the system clock. To avoid the clock becoming out of sync with other servers, the system clock within each Linux guest must be synchronized with NTP. This case requires disabling host time synchronization. No changes are required in HVM mode.

On some Linux distributions, if you are running a paravirtualized Linux kernel with Citrix VM Tools installed, you can check whether the Citrix Hypervisor Time Sync feature is present and enabled from within the Linux VM:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns 0 or 1:

- 0 - The time sync feature is enabled, and must be disabled.
- 1 - The time sync feature is disabled, and no further action is required.

If the **/proc/sys/xen/independent\_wallclock** file is not present, the following steps are not required.

If enabled, disable the time sync feature by writing **1** to the file:

```
1 sudo echo 1 > /proc/sys/xen/independent_wallclock
2 <!--NeedCopy-->
```

To make this change permanent and persistent after restart, edit the **/etc/sysctl.conf** file and add the line:

```
xen.independent_wallclock = 1
```

To verify these changes, restart the system:

```
1 reboot
2 <!--NeedCopy-->
```

After restart, verify that the setting is correct:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns the value 1.

### Fix time synchronization on Microsoft Hyper-V

Linux VMs with Hyper-V Linux Integration Services installed can apply the Hyper-V time synchronization feature to use the host operating system's time. To ensure that the system clock remains accurate, enable this feature alongside the NTP services.

From the management operating system:

1. Open the Hyper-V Manager console.
2. For the settings of a Linux VM, select **Integration Services**.
3. Ensure that **Time synchronization** is selected.

#### Note:

This approach is different from VMware and Citrix Hypervisor, where host time synchronization is disabled to avoid conflicts with NTP. Hyper-V time synchronization can coexist and supplement NTP time synchronization.

### Fix time synchronization on ESX and ESXi

If the VMware Time Synchronization feature is enabled, within each paravirtualized Linux VM you experience issues with NTP and the hypervisor both trying to synchronize the system clock. To avoid the clock becoming out of sync with other servers, synchronize the system clock within each Linux guest with NTP. This case requires disabling host time synchronization.

If you are running a paravirtualized Linux kernel with VMware Tools installed:

1. Open the vSphere Client.
2. Edit settings for the Linux VM.
3. In the **Virtual Machine Properties** dialog, open the **Options** tab.
4. Select **VMware Tools**.
5. In the **Advanced** box, clear **Synchronize guest time with host**.

### Step 3: Add the Linux virtual machine (VM) to the Windows domain

The Linux VDA supports several methods for adding Linux machines to the Active Directory (AD) domain:

- [Samba Winbind](#)
- [Quest Authentication Service](#)
- [Centrify DirectControl](#)

Follow instructions based on your chosen method.

**Note:**

Session launches might fail when the same user name is used for the local account in the Linux VDA and the account in AD.

## Samba Winbind

### Join Windows domain

Your domain controller must be reachable and you must have an Active Directory user account with permissions to add machines to the domain:

1. Open YaST Windows Domain Membership.
2. Make the following changes:
  - Set the **Domain or Workgroup** to the name of your Active Directory domain or the IP address of the domain controller. Ensure that the domain name is in uppercase.
  - Check **Also Use SMB information for Linux Authentication**.
  - Check **Create Home Directory on Login**.
  - Check **Single Sign-on for SSH**.
  - Ensure that **Offline Authentication** is not checked. This option is not compatible with the Linux VDA.
3. Click **OK**. If prompted to install some packages, click **Install**.
4. If a domain controller is found, it asks whether you want to join the domain. Click **Yes**.
5. When prompted, type the credentials of a domain user with permission to add computers to the domain and click **OK**.
6. A message indicating success is displayed.
7. If prompted to install some samba and krb5 packages, click **Install**.

YaST might have indicated that these changes require some services or the machine to be restarted. We recommend you restart the machine:

```
1 su -
2
3 reboot
4 <!--NeedCopy-->
```

### SUSE 12 Only: Patch Kerberos credential cache name

SUSE 12 has changed the default Kerberos credential cache name specification from the usual **FILE:/tmp/krb5cc\_%{uid}** to **DIR:/run/user/%{uid}/krb5cc**. This new DIR caching method is not compatible with the Linux VDA and must be manually changed. As a root user, edit **/etc/krb5.conf** and add the following setting under the **[libdefaults]** section if not set:

```
default_ccache_name = FILE:/tmp/krb5cc_%{ uid }
```

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory.

Run the **net ads** command of Samba to verify that the machine is joined to a domain:

```
1 sudo net ads testjoin
2 <!--NeedCopy-->
```

Run the following command to verify extra domain and computer object information:

```
1 sudo net ads info
2 <!--NeedCopy-->
```

### Verify Kerberos configuration

To ensure that Kerberos is configured correctly for use with the Linux VDA, verify that the system keytab file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos **kinit** command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\${@REALM}
2 <!--NeedCopy-->
```



The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT ticket for the machine account has been cached using:

```
1 sudo klist
2 <!--NeedCopy-->
```

Examine the machine account details using:

```
1 sudo net ads status
2 <!--NeedCopy-->
```

### Verify user authentication

Use the `wbinfo` tool to verify that domain users can authenticate with the domain:

```
1 wbinfo --krb5auth=domain\\username%password
2 <!--NeedCopy-->
```

The domain specified here is the AD domain name, not the Kerberos realm name. For the bash shell, the backslash (\) character must be escaped with another backslash. This command returns a message indicating success or failure.

To verify that the Winbind PAM module is configured correctly, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2 id -u
3 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the uid returned by the `id -u` command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Verify that the tickets in the user's Kerberos credential cache are valid and not expired:

```
1 klist
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to the Gnome or KDE console directly. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Quest authentication service

### Configure Quest on domain controller

Assume that you have installed and configured the Quest software on the Active Directory domain controllers, and have been granted administrative privileges to create computer objects in Active Directory.

### Enable domain users to log on to Linux VDA machines

To enable domain users to establish HDX sessions on a Linux VDA machine:

1. In the Active Directory Users and Computers management console, open Active Directory user properties for that user account.
2. Select the **Unix Account** tab.
3. Check **Unix-enabled**.
4. Set the **Primary GID Number** to the group ID of an actual domain user group.

#### Note:

These instructions are equivalent for setting up domain users for logon using the console, RDP, SSH, or any other remoting protocol.

### Configure Quest on Linux VDA

### Configure VAS daemon

Auto-renewal of Kerberos tickets must be enabled and disconnected. Authentication (offline logon) must be disabled:

```
1 sudo /opt/quest/bin/vastool configure vas vasd auto-ticket-renew-  
   interval 32400  
2  
3 sudo /opt/quest/bin/vastool configure vas vas_auth allow-disconnected-  
   auth false  
4 <!--NeedCopy-->
```

This command sets the renewal interval to nine hours (32,400 seconds) which is one hour less than the default 10-hour ticket lifetime. Set this parameter to a lower value on systems with a shorter ticket lifetime.

### Configure PAM and NSS

To enable domain user logon through HDX and other services such as su, ssh, and RDP, run the following commands to manually configure PAM and NSS:

```
1 sudo /opt/quest/bin/vastool configure pam  
2  
3 sudo /opt/quest/bin/vastool configure nss  
4 <!--NeedCopy-->
```

### Join Windows domain

Join the Linux machine to the Active Directory domain using the Quest `vastool` command:

```
1 sudo /opt/quest/bin/vastool -u user join domain-name  
2 <!--NeedCopy-->
```

The **user** is any domain user who has permissions to join computers to the Active Directory domain. The **domain-name** is the DNS name of the domain, for example, example.com.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a Quest-joined Linux machine is on the domain:

```
1 sudo /opt/quest/bin/vastool info domain
2 <!--NeedCopy-->
```

If the machine is joined to a domain, this command returns the domain name. If the machine is not joined to any domain, the following error appears:

```
ERROR: No domain could be found.
ERROR: VAS_ERR_CONFIG: at ctx.c:414 in _ctx_init_default_realm
default_realm not configured in vas.conf. Computer may not be joined to
domain
```

### Verify user authentication

To verify that Quest can authenticate domain users through PAM, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2 id -u
3 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the uid returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Verify that the tickets in the Kerberos credential cache are valid and not expired:

```
1 /opt/quest/bin/vastool klist
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to the Gnome or KDE console directly. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Centrify DirectControl

### Join Windows domain

With the Centrify DirectControl Agent installed, join the Linux machine to the Active Directory domain using the Centrify **adjoin** command:

```
1 su -
2 adjoin -w -V -u user domain-name
3 <!--NeedCopy-->
```

The **user** is any Active Directory domain user who has permissions to join computers to the Active Directory domain. The **domain-name** is the name of the domain to join the Linux machine to.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a Centrify-joined Linux machine is on the domain:

```
1 su -
2
3 adinfo
4 <!--NeedCopy-->
```

Verify that the **Joined to domain** value is valid and the **CentrifyDC mode** returns **connected**. If the mode remains stuck in the starting state, then the Centrify client is experiencing server connection or authentication problems.

More comprehensive system and diagnostic information is available using:

```
1 adinfo --sysinfo all
2
3 adinfo -diag
4 <!--NeedCopy-->
```

Test connectivity to the various Active Directory and Kerberos services.

```
1 adinfo --test
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Step 4: Install the Linux VDA

### Step 4a: Uninstall the old version

If you installed an earlier version other than the previous two and an LTSR release, uninstall it before installing the new version.

1. Stop the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
3 sudo /sbin/service ctxhdx stop
4 <!--NeedCopy-->
```

#### Note:

Before you stop the `ctxvda` and `ctxhdx` services, run the `service ctxmonitorservice stop` command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

2. Uninstall the package:

```
1 sudo rpm -e XenDesktopVDA
2 <!--NeedCopy-->
```

#### Important:

Upgrading from the latest two versions is supported.

#### Note:

Installation components are located in `/opt/Citrix/VDA/`.

To run a command, the full path is needed; alternatively, you can add `/opt/Citrix/VDA/sbin` and `/opt/Citrix/VDA/bin` to the system path.

#### Step 4b: Download the Linux VDA package

Go to the [Citrix Virtual Apps and Desktops download page](#). Expand the appropriate version of Citrix Virtual Apps and Desktops and click **Components** to download the Linux VDA package that matches your Linux distribution.

#### Step 4c: Install the Linux VDA

Install the Linux VDA software using Zypper:

##### For SUSE 12:

```
1 sudo zypper install XenDesktopVDA-20.12.0.20-1.sle12_x.x86_64.rpm
2 <!--NeedCopy-->
```

Install the Linux VDA software using the RPM package manager. Before doing so, resolve the following dependencies:

##### For SUSE 12:

```
1 sudo rpm -i XenDesktopVDA-20.12.0.20-1.sle12_x.x86_64.rpm
2 <!--NeedCopy-->
```

#### Step 4d: Upgrade the Linux VDA (optional)

You can upgrade an existing installation from the previous two versions and from an LTSR release.

##### For SUSE 12:

```
1 sudo rpm -U XenDesktopVDA-20.12.0.20-1.sle12_x.x86_64.rpm
2 <!--NeedCopy-->
```

#### RPM Dependency list for SUSE 12:

```
1 postgresql-server >= 9.3
2
3 postgresql-jdbc >= 9.2
4
5 java-1.8.0-openjdk >= 1.8.0
```

```
6
7 ImageMagick >= 6.8
8
9 dbus-1 >= 1.8.8
10
11 dbus-1-x11 >= 1.8.8
12
13 libXpm4 >= 3.5.11
14
15 libXrandr2 >= 1.4.2
16
17 libXtst6 >= 1.2.2
18
19 motif >= 2.3
20
21 pam >= 1.1.8
22
23 bash >= 4.2
24
25 findutils >= 4.5
26
27 gawk >= 4.1
28
29 sed >= 4.2
30
31 cups >= 1.6.0
32
33 cups-filters-foomatic-rip >= 1.0.0
34
35 openldap2 >= 2.4
36
37 cyrus-sasl >= 2.1
38
39 cyrus-sasl-gssapi >= 2.1
40
41 libxml2 >= 2.9
42
43 python-requests >= 2.8.1
44
45 rpmlib(PayloadFilesHavePrefix) <= 4.0-1
46
47 rpmlib(CompressedFileNames) <= 3.0.4-1
48
49 rpmlib(PayloadIsLzma) <= 4.4.6-1
50
```



```
51 libtcmalloc4 >= 2.5
52
53 libcap-progs >= 2.22
54
55 xorg-x11-server >= 7.6_1.18.3-76.15
56
57 ibus >= 1.5
58
59 xorg-x11-server = 7.6_1.19.6
60
61 xorg-x11 = 7.6_1
62
63 postgresql10-server >= 10.12
64
65 libgtk-2_0-0 >= 2.24
66
67 libgthread-2_0-0 >= 2.48
68
69 pulseaudio-utils >= 5.0
70
71 lsb-release >= 2.0
72 <!--NeedCopy-->
```

**Important:**

Restart the Linux VDA machine after upgrading.

**Step 5: Configure the Linux VDA**

After installing the package, you must configure the Linux VDA by running the `ctxsetup.sh` script. Before making any changes, the script verifies the environment and ensures that all dependencies are installed. If necessary, you can rerun the script at any time to change settings.

You can run the script manually with prompting, or automatically with preconfigured responses. Review Help about the script before proceeding:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh - help
2 <!--NeedCopy-->
```

**Prompted configuration**

Run a manual configuration with prompted questions:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh
2 <!--NeedCopy-->
```

### Automated configuration

For an automated installation, provide the options required by the setup script with environment variables. If all required variables are present, the script does not prompt for any information.

Supported environment variables include:

- **CTX\_XDL\_SUPPORT\_DDC\_AS\_CNAME=Y | N** – The Linux VDA supports specifying a Delivery Controller name using a DNS CNAME record. Set to N by default.
- **CTX\_XDL\_DDC\_LIST='list-ddc-fqdns'** – The Linux VDA requires a space-separated list of Delivery Controller Fully Qualified Domain Names (FQDNs) to use for registering with a Delivery Controller. At least one FQDN or CNAME alias must be specified.
- **CTX\_XDL\_VDA\_PORT=port-number** – The Linux VDA communicates with Delivery Controllers through a TCP/IP port, which is port 80 by default.
- **CTX\_XDL\_REGISTER\_SERVICE=Y | N** – The Linux Virtual Desktop services are started after machine startup. The value is set to Y by default.
- **CTX\_XDL\_ADD\_FIREWALL\_RULES=Y | N** – The Linux Virtual Desktop services require incoming network connections to be allowed through the system firewall. You can automatically open the required ports (ports 80 and 1494 by default) in the system firewall for the Linux Virtual Desktop. Set to Y by default.
- **CTX\_XDL\_AD\_INTEGRATION=1 | 2 | 3 | 4** – The Linux VDA requires Kerberos configuration settings to authenticate with the Delivery Controllers. The Kerberos configuration is determined from the installed and configured Active Directory integration tool on the system. Specify the supported Active Directory integration method to use:
  - 1 – Samba Winbind
  - 2 – Quest Authentication Service
  - 3 – Centrify DirectControl
  - 4 – SSSD
- **CTX\_XDL\_HDX\_3D\_PRO=Y | N** – The Linux VDA supports HDX 3D Pro, a set of GPU acceleration technologies designed to optimize the virtualization of rich graphics applications. If HDX 3D Pro is selected, the VDA is configured for VDI desktops (single-session) mode – (that is, CTX\_XDL\_VDI\_MODE=Y).
- **CTX\_XDL\_VDI\_MODE=Y | N** – Whether to configure the machine as a dedicated desktop delivery model (VDI) or hosted shared desktop delivery model. For HDX 3D Pro environments, set this variable to Y. This variable is set to N by default.
- **CTX\_XDL\_SITE\_NAME=dns-name** – The Linux VDA discovers LDAP servers through DNS. To

limit the DNS search results to a local site, specify a DNS site name. This variable is set to **<none>** by default.

- **CTX\_XDL\_LDAP\_LIST='list-ldap-servers'** – The Linux VDA queries DNS to discover LDAP servers. If DNS cannot provide LDAP service records, you can provide a space-separated list of LDAP FQDNs with LDAP ports. For example, ad1.mycompany.com:389. This variable is set to **<none>** by default.
- **CTX\_XDL\_SEARCH\_BASE=search-base-set** – The Linux VDA queries LDAP through a search base set to the root of the Active Directory Domain (for example, DC=mycompany,DC=com). To improve search performance, you can specify a search base (for example, OU=VDI,DC=mycompany,DC=com). This variable is set to **<none>** by default.
- **CTX\_XDL\_FAS\_LIST='list-fas-servers'** – The Federated Authentication Service (FAS) servers are configured through AD Group Policy. The Linux VDA does not support AD Group Policy, but you can provide a semicolon-separated list of FAS servers instead. The sequence must be the same as configured in AD Group Policy. If any server address is removed, fill its blank with the **<none>** text string and do not modify the order of server addresses.
- **CTX\_XDL\_DOTNET\_RUNTIME\_PATH=path-to-install-dotnet-runtime** – The path to install .NET Core Runtime 3.1 for supporting the new broker agent service (`ctxvda`). The default path is `/usr/bin`.
- **CTX\_XDL\_START\_SERVICE=Y | N** – Whether or not the Linux VDA services are started when the Linux VDA configuration is complete. Set to Y by default.
- **CTX\_XDL\_TELEMETRY\_SOCKET\_PORT** – The socket port for listening for Citrix Scout. The default port is 7503.
- **CTX\_XDL\_TELEMETRY\_PORT** – The port for communicating with Citrix Scout. The default port is 7502.

Set the environment variable and run the configure script:

```
1 export CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N
2
3 export CTX_XDL_DDC_LIST= 'list-ddc-fqdns'
4
5 export CTX_XDL_VDA_PORT=port-number
6
7 export CTX_XDL_REGISTER_SERVICE=Y|N
8
9 export CTX_XDL_ADD_FIREWALL_RULES=Y|N
10
11 export CTX_XDL_AD_INTEGRATION=1|2|3|4
12
13 export CTX_XDL_HDX_3D_PRO=Y|N
14
```

```
15 export CTX_XDL_VDI_MODE=Y|N
16
17 export CTX_XDL_SITE_NAME=dns-site-name | '<none>'
18
19 export CTX_XDL_LDAP_LIST= 'list-ldap-servers' | '<none>'
20
21 export CTX_XDL_SEARCH_BASE=search-base-set | '<none>'
22
23 export CTX_XDL_FAS_LIST= 'list-fas-servers' | '<none>'
24
25 export CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime
26
27 export CTX_XDL_TELEMETRY_SOCKET_PORT=port-number
28
29 export CTX_XDL_TELEMETRY_PORT=port-number
30
31 export CTX_XDL_START_SERVICE=Y|N
32
33 sudo -E /opt/Citrix/VDA/sbin/ctxsetup.sh
34 <!--NeedCopy-->
```

When running the sudo command, type the **-E** option to pass the existing environment variables to the new shell it creates. We recommend that you create a shell script file from the preceding commands with **#!/bin/bash** as the first line.

Alternatively, you can specify all parameters by using a single command:

```
1 sudo CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N \
2
3 CTX_XDL_DDC_LIST= 'list-ddc-fqdns' \
4
5 CTX_XDL_VDA_PORT=port-number \
6
7 CTX_XDL_REGISTER_SERVICE=Y|N \
8
9 CTX_XDL_ADD_FIREWALL_RULES=Y|N \
10
11 CTX_XDL_AD_INTEGRATION=1|2|3|4 \
12
13 CTX_XDL_HDX_3D_PRO=Y|N \
14
15 CTX_XDL_VDI_MODE=Y|N \
16
17 CTX_XDL_SITE_NAME=dns-name \
```

```
18
19 CTX_XDL_LDAP_LIST= 'list-ldap-servers' \
20
21 CTX_XDL_SEARCH_BASE=search-base-set \
22
23 CTX_XDL_FAS_LIST= 'list-fas-servers' \
24
25 CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime \
26
27 CTX_XDL_TELEMETRY_SOCKET_PORT=port-number \
28
29 CTX_XDL_TELEMETRY_PORT=port-number \
30
31 CTX_XDL_START_SERVICE=Y|N \
32
33 /opt/Citrix/VDA/sbin/ctxsetup.sh
34 <!--NeedCopy-->
```

### Remove configuration changes

In some scenarios, you might have to remove the configuration changes made by the **ctxsetup.sh** script without uninstalling the Linux VDA package.

Review Help about this script before proceeding:

```
1 sudo /usr/local/sbin/ctxcleanup.sh --help
2 <!--NeedCopy-->
```

To remove configuration changes:

```
1 sudo /usr/local/sbin/ctxcleanup.sh
2 <!--NeedCopy-->
```

#### Important:

This script deletes all configuration data from the database and renders the Linux VDA inoperable.

### Configuration logs

The **ctxsetup.sh** and **ctxcleanup.sh** scripts display errors on the console, with additional information written to a configuration log file:

```
/tmp/xd1.configure.log
```

Restart the Linux VDA services to have the changes take effect.

### Step 6: Run the Linux VDA

After configuring the Linux VDA by using the **ctxsetup.sh** script, you can run the following commands to control the Linux VDA.

#### Start the Linux VDA:

To start the Linux VDA services:

```
1 sudo /sbin/service ctxhdx start
2
3 sudo /sbin/service ctxvda start
4 <!--NeedCopy-->
```

#### Stop the Linux VDA:

To stop the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
3 sudo /sbin/service ctxhdx stop
4 <!--NeedCopy-->
```

#### Note:

Before you stop the `ctxvda` and `ctxhdx` services, run the `service ctxmonitorservice stop` command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

#### Restart the Linux VDA:

To restart the Linux VDA services:

```
1 sudo /sbin/service ctxvda stop
2
3 sudo /sbin/service ctxhdx restart
4
5 sudo /sbin/service ctxvda start
6 <!--NeedCopy-->
```

### Check the Linux VDA status:

To check the running status of the Linux VDA services:

```
1 sudo /sbin/service ctxvda status
2
3 sudo /sbin/service ctxhdx status
4 <!--NeedCopy-->
```

## Step 7: Create the machine catalog in Citrix Virtual Apps or Citrix Virtual Desktops

The process for creating machine catalogs and adding Linux VDA machines is similar to the traditional Windows VDA approach. For a more detailed description of how to complete these tasks, see [Create machine catalogs](#) and [Manage machine catalogs](#).

For creating machine catalogs that contain Linux VDA machines, there are a few restrictions that differentiate the process from creating machine catalogs for Windows VDA machines:

- For the operating system, select:
  - The **Multi-session OS** option for a hosted shared desktops delivery model.
  - The **Single-session OS** option for a VDI dedicated desktop delivery model.
- Do not mix Linux and Windows VDA machines in the same machine catalog.

#### Note:

Early versions of Citrix Studio did not support the notion of a “Linux OS.” However, selecting the **Windows Server OS** or **Server OS** option implies an equivalent hosted shared desktops delivery model. Selecting the **Windows Desktop OS** or **Desktop OS** option implies a single user per machine delivery model.

#### Tip:

If you remove and rejoin a machine to the Active Directory domain, you must remove and add the machine to the machine catalog again.

## Step 8: Create the delivery group in Citrix Virtual Apps or Citrix Virtual Desktops

The process for creating a delivery group and adding machine catalogs containing Linux VDA machines is almost identical to Windows VDA machines. For a more detailed description of how to complete these tasks, see [Create Delivery Groups](#).

For creating delivery groups that contain Linux VDA machine catalogs, the following restrictions apply:

- Ensure that the AD users and groups you select have been properly configured to log on to the Linux VDA machines.

- Do not allow logon of unauthenticated (anonymous) users.
- Do not mix the delivery group with machine catalogs that contain Windows machines.

**Important:**

Publishing applications is supported with Linux VDA Version 1.4 and later. However, the Linux VDA does not support the delivery of desktops and apps to the same machine.

For information about how to create machine catalogs and delivery groups, see [Citrix Virtual Apps and Desktops 7 2012](#).

## Install Linux Virtual Delivery Agent for Ubuntu

June 10, 2022

You can choose to follow the steps in this article for manual installation or use [easy install](#) for automatic installation and configuration. Easy install saves time and labor and is less error-prone than the manual installation.

**Note:**

Use easy install only for fresh installations. Do not use easy install to update an existing installation.

### Step 1: Prepare Ubuntu for VDA installation

#### Step 1a: Verify the network configuration

We recommend that the network is connected and configured correctly before proceeding.

If you are using a Ubuntu 18.04 Live Server, make the following change in the `/etc/cloud/cloud.cfg` configuration file before setting the host name:

```
preserve_hostname: true
```

#### Step 1b: Set the host name

To ensure that the host name of the machine is reported correctly, change the `/etc/hostname` file to contain only the host name of the machine.

```
hostname
```



### Step 1c: Assign a loopback address to the host name

Ensure that the DNS domain name and Fully Qualified Domain Name (FQDN) of the machine are reported back correctly. The way is to change the following line of the `/etc/hosts` file to include the FQDN and host name as the first two entries:

```
127.0.0.1 hostname-fqdn hostname localhost
```

For example:

```
127.0.0.1 vda01.example.com vda01 localhost
```

Remove any other references to `hostname-fqdn` or `hostname` from other entries in the file.

#### Note:

The Linux VDA currently does not support NetBIOS name truncation. Therefore, the host name must not exceed 15 characters.

#### Tip:

Use a-z, A-Z, 0-9, and hyphen (-) characters only. Avoid underscores (\_), spaces, and other symbols. Do not start a host name with a number and do not end with a hyphen. This rule also applies to Delivery Controller host names.

### Step 1d: Check the host name

Verify that the host name is set correctly:

```
1 hostname
2 <!--NeedCopy-->
```

This command returns only the host name of the machine and not its FQDN.

Verify that the FQDN is set correctly:

```
1 hostname -f
2 <!--NeedCopy-->
```

This command returns the FQDN of the machine.

### Step 1e: Disable multicast DNS

The default settings have multicast DNS (**mDNS**) enabled, which can lead to inconsistent name resolution results.

To disable **mDNS**, edit **/etc/nsswitch.conf** and change the line containing:

```
hosts: files mdns_minimal [NOTFOUND=return] dns
```

To:

```
hosts: files dns
```

### Step 1f: Check name resolution and service reachability

Verify that you can resolve the FQDN and ping the domain controller and Delivery Controller:

```
1 nslookup domain-controller-fqdn
2
3 ping domain-controller-fqdn
4
5 nslookup delivery-controller-fqdn
6
7 ping delivery-controller-fqdn
8 <!--NeedCopy-->
```

If you cannot resolve the FQDN or ping either of these machines, review the steps before proceeding.

### Step 1g: Configure clock synchronization (chrony)

Maintaining accurate clock synchronization between the VDAs, Delivery Controllers and domain controllers is crucial. Hosting the Linux VDA as a virtual machine can cause clock skew problems. For this reason, synchronizing time with a remote time service is preferred.

Install chrony:

```
1 apt-get install chrony
2 <!--NeedCopy-->
```

As a root user, edit **/etc/chrony/chrony.conf** and add a server entry for each remote time server:

```
server peer1-fqdn-or-ip-address iburst
server peer2-fqdn-or-ip-address iburst
```

In a typical deployment, synchronize time from the local domain controllers and not directly from public NTP pool servers. Add a server entry for each Active Directory domain controller in the domain.

Remove any other **server** or **pool** entries listed including loopback IP address, localhost, and public server **\*.pool.ntp.org** entries.

Save changes and restart the Chrony daemon:

```
1 sudo systemctl restart chrony
2 <!--NeedCopy-->
```

### Step 1h: Install OpenJDK

The Linux VDA depends on OpenJDK. Typically, the runtime environment is installed as part of the operating system installation.

On Ubuntu 16.04, install OpenJDK by using:

```
1 sudo apt-get install -y default-jdk
2 <!--NeedCopy-->
```

On Ubuntu 18.04, install OpenJDK by using:

```
1 sudo apt-get install -y openjdk-8-jdk
2 <!--NeedCopy-->
```

### Step 1i: Install PostgreSQL

The Linux VDA requires PostgreSQL Version 9.x on Ubuntu:

```
1 sudo apt-get install -y postgresql
2
3 sudo apt-get install -y libpostgresql-jdbc-java
4 <!--NeedCopy-->
```

### Step 1j: Install Motif

```
1 sudo apt-get install -y libxm4
2 <!--NeedCopy-->
```

### Step 1k: Install other packages

```
1 sudo apt-get install -y libsasl2-2
2
3 sudo apt-get install -y libsasl2-modules-gssapi-mit
4
5 sudo apt-get install -y libldap-2.4-2
6
7 sudo apt-get install -y krb5-user
8
9 sudo apt-get install -y libgtk2.0-0
10 <!--NeedCopy-->
```

### Step 2: Prepare the hypervisor

Some changes are required when running the Linux VDA as a virtual machine on a supported hypervisor. Make the following changes according to the hypervisor platform in use. No changes are required if you are running the Linux machine on bare metal hardware.

#### Fix time synchronization on Citrix Hypervisor

When the Citrix Hypervisor Time Sync feature is enabled, within each paravirtualized Linux VM you experience issues with NTP and Citrix Hypervisor, both of which try to manage the system clock. To avoid the clock becoming out of sync with other servers, ensure that the system clock within each Linux guest is synchronized with the NTP. This case requires disabling host time synchronization. No changes are required in HVM mode.

On some Linux distributions, if you are running a paravirtualized Linux kernel with Citrix VM Tools installed, you can check whether the Citrix Hypervisor Time Sync feature is present and enabled from within the Linux VM:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns 0 or 1:

- 0 - The time sync feature is enabled, and must be disabled.
- 1 - The time sync feature is disabled, and no further action is required.

If the `/proc/sys/xen/indepent_wallclock` file is not present, the following steps are not required.

If enabled, disable the time sync feature by writing 1 to the file:

```
1 sudo echo 1 > /proc/sys/xen/independent_wallclock
2 <!--NeedCopy-->
```

To make this change permanent and persistent after restart, edit the `/etc/sysctl.conf` file and add the line:

```
xen.independent_wallclock = 1
```

To verify these changes, restart the system:

```
1 su -
2
3 cat /proc/sys/xen/independent_wallclock
4 <!--NeedCopy-->
```

This command returns the value 1.

### Fix time synchronization on Microsoft Hyper-V

Linux VMs with Hyper-V Linux Integration Services installed can use the Hyper-V time synchronization feature to use the host operating system's time. To ensure that the system clock remains accurate, enable this feature alongside NTP services.

From the management operating system:

1. Open the Hyper-V Manager console.
2. For the settings of a Linux VM, select **Integration Services**.
3. Ensure that **Time synchronization** is selected.

#### Note:

This approach is different from VMware and Citrix Hypervisor, where host time synchronization is disabled to avoid conflicts with NTP. Hyper-V time synchronization can coexist and supplement NTP time synchronization.

### Fix time synchronization on ESX and ESXi

When the VMware Time Synchronization feature is enabled, within each paravirtualized Linux VM you experience issues with the NTP and the hypervisor, both of which try to synchronize the system clock.

To avoid the clock becoming out of sync with other servers, ensure that the system clock within each Linux guest is synchronized with the NTP. This case requires disabling host time synchronization.

If you are running a paravirtualized Linux kernel with VMware Tools installed:

1. Open the vSphere Client.
2. Edit settings for the Linux VM.
3. In the **Virtual Machine Properties** dialog, open the **Options** tab.
4. Select **VMware Tools**.
5. In the **Advanced** box, clear **Synchronize guest time with host**.

### Step 3: Add the Linux virtual machine (VM) to the Windows domain

The Linux VDA supports several methods for adding Linux machines to the Active Directory (AD) domain:

- [Samba Winbind](#)
- [Quest Authentication Service](#)
- [Centrify DirectControl](#)
- [SSSD](#)
- [PBIS](#)

Follow instructions based on your chosen method.

#### Note:

Session launches might fail when the same user name is used for the local account in the Linux VDA and the account in AD.

### Samba Winbind

#### Install or update the required packages

```
1 sudo apt-get install winbind samba libnss-winbind libpam-winbind krb5-  
   config krb5-locales krb5-user  
2 <!--NeedCopy-->
```

#### Enable the Winbind daemon to start on machine startup

The Winbind daemon must be configured to start on machine startup:

```
1 sudo systemctl enable winbind
2 <!--NeedCopy-->
```

**Note:**

Ensure that the winbind script is located under `/etc/init.d`.

### Configure Kerberos

Open `/etc/krb5.conf` as a root user, and make the following settings:

```
[libdefaults]
default_realm = REALM
dns_lookup_kdc = false

[realms]
REALM = {
admin_server = domain-controller-fqdn
kdc = domain-controller-fqdn
}

[domain_realm]
domain-dns-name = REALM
.domain-dns-name = REALM
```

The **domain-dns-name** parameter in this context is the DNS domain name, such as **example.com**. The **REALM** is the Kerberos realm name in uppercase, such as **EXAMPLE.COM**.

### Configure Winbind Authentication

Configure Winbind manually because Ubuntu does not have a tool like `authconfig` in RHEL and `yast2` in SUSE.

Open `/etc/samba/smb.conf`, and make the following settings:

```
[global]
workgroup = WORKGROUP
security = ADS
realm = REALM
encrypt passwords = yes
```

```
idmap config *:range = 16777216-33554431
winbind trusted domains only = no
kerberos method = secrets and keytab
winbind refresh tickets = yes
template shell = /bin/bash
```

**WORKGROUP** is the first field in **REALM**, and **REALM** is the Kerberos realm name in uppercase.

### Configure nsswitch

Open **/etc/nsswitch.conf**, and append `winbind` to the following lines:

```
passwd: compat winbind
group: compat winbind
```

### Join Windows Domain

Your domain controller must be reachable and you must have an Active Directory user account with permissions to add computers to the domain:

```
1 sudo net ads join REALM -U user
2 <!--NeedCopy-->
```

Where **REALM** is the Kerberos realm name in uppercase, and **user** is a domain user with permissions to add computers to the domain.

### Restart winbind

```
1 sudo systemctl restart winbind
2 <!--NeedCopy-->
```

### Configure PAM for Winbind

Run the following command and ensure that the **Winbind NT/Active Directory authentication** and **Create home directory on login** options are selected:



```
1 sudo pam-auth-update
2 <!--NeedCopy-->
```

**Tip:**

The `winbind` daemon stays running only if the machine is joined to a domain.

### Verify Domain Membership

The Delivery Controller requires that all VDA machines, whether Windows or Linux, have a computer object in Active Directory.

Run the **net ads** command of Samba to verify that the machine is joined to a domain:

```
1 sudo net ads testjoin
2 <!--NeedCopy-->
```

Run the following command to verify extra domain and computer object information:

```
1 sudo net ads info
2 <!--NeedCopy-->
```

### Verify Kerberos Configuration

To verify that Kerberos is configured correctly for use with the Linux VDA, verify that the system **keytab** file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos `kinit` command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\@$REALM
2 <!--NeedCopy-->
```

The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT ticket for the machine account has been cached using:

```
1 sudo klist
2 <!--NeedCopy-->
```

Examine the account details of the machine using:

```
1 sudo net ads status
2 <!--NeedCopy-->
```

### Verify user authentication

Use the **wbinfo** tool to verify that domain users can authenticate with the domain:

```
1 wbinfo --krb5auth=domain\\username%password
2 <!--NeedCopy-->
```

The domain specified here is the AD domain name, not the Kerberos realm name. For the bash shell, the backslash (\) character must be escaped with another backslash. This command returns a message indicating success or failure.

To verify that the Winbind PAM module is configured correctly, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2
3 id -u
4 <!--NeedCopy-->
```

#### Note:

To run an SSH command successfully, ensure that SSH is enabled and working properly.

Verify that a corresponding Kerberos credential cache file was created for the uid returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Verify that the tickets in the user's Kerberos credential cache are valid and not expired:

```
1 klist
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to the Gnome or KDE console directly. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

**Tip:**

If you succeed in user authentication but cannot show your desktop when logging on with a domain account, restart the machine and then try again.

## Quest authentication service

### Configure Quest on domain controller

Assume that you have installed and configured the Quest software on the Active Directory domain controllers, and have been granted administrative privileges to create computer objects in Active Directory.

### Enable domain users to log on to Linux VDA machines

To enable domain users to establish HDX sessions on a Linux VDA machine:

1. In the Active Directory Users and Computers management console, open Active Directory user properties for that user account.
2. Select the **Unix Account** tab.
3. Check **Unix-enabled**.
4. Set the **Primary GID Number** to the group ID of an actual domain user group.

**Note:**

These instructions are equivalent for setting up domain users for logon using the console, RDP, SSH, or any other remoting protocol.

## Configure Quest on Linux VDA

### Work around SELinux policy enforcement

The default RHEL environment has SELinux fully enforced. This enforcement interferes with the Unix domain socket IPC mechanisms used by Quest, and prevents domain users from logging on.

The convenient way to work around this issue is to disable SELinux. As a root user, edit `/etc/selinux/config` and change the **SELinux** setting:

```
SELINUX=disabled
```

This change requires a machine restart:

```
1 reboot
2 <!--NeedCopy-->
```

**Important:**

Use this setting carefully. Reenabling SELinux policy enforcement after disabling can cause a complete lockout, even for the root user and other local users.

### Configure VAS daemon

Auto-renewal of Kerberos tickets must be enabled and disconnected. Authentication (offline logon) must be disabled:

```
1 sudo /opt/quest/bin/vastool configure vas vasd auto-ticket-renew-
   interval 32400
2
3 sudo /opt/quest/bin/vastool configure vas vas_auth allow-disconnected-
   auth false
4 <!--NeedCopy-->
```

This command sets the renewal interval to nine hours (32,400 seconds) which is one hour less than the default 10-hour ticket lifetime. Set this parameter to a lower value on systems with a shorter ticket lifetime.

### Configure PAM and NSS

To enable domain user logon through HDX and other services such as su, ssh, and RDP, run the following commands to manually configure PAM and NSS:

```
1 sudo /opt/quest/bin/vastool configure pam
2
3 sudo /opt/quest/bin/vastool configure nss
4 <!--NeedCopy-->
```

### Join Windows domain

Join the Linux machine to the Active Directory domain using the Quest `vastool` command:

```
1 sudo /opt/quest/bin/vastool -u user join domain-name
2 <!--NeedCopy-->
```

The user is any domain user with permissions to join computers to the Active Directory domain. The domain-name is the DNS name of the domain, for example, example.com.

### Verify domain membership

The Delivery Controller requires that all VDA machines, whether Windows or Linux, have a computer object in Active Directory. To verify that a Quest-joined Linux machine is on the domain:

```
1 sudo /opt/quest/bin/vastool info domain
2 <!--NeedCopy-->
```

If the machine is joined to a domain, this command returns the domain name. If the machine is not joined to any domain, the following error appears:

```
ERROR: No domain could be found.
ERROR: VAS_ERR_CONFIG: at ctx.c:414 in _ctx_init_default_realm
default_realm not configured in vas.conf. Computer may not be joined to
domain
```

### Verify user authentication

To verify that Quest can authenticate domain users through PAM, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2
3 id -u
4 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the UID returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Verify that the tickets in the Kerberos credential cache are valid and not expired:

```
1 /opt/quest/bin/vastool klist
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Centrify DirectControl

### Join Windows domain

With the Centrify DirectControl Agent installed, join the Linux machine to the Active Directory domain using the Centrify `adjoin` command:

```
1 su -
2 adjoin -w -V -u user domain-name
3 <!--NeedCopy-->
```

The **user** parameter is any Active Directory domain user with permissions to join computers to the Active Directory domain. The **domain-name** parameter is the name of the domain to join the Linux machine to.

### Verify domain membership

The Delivery Controller requires that all VDA machines, whether Windows or Linux, have a computer object in Active Directory. To verify that a Centrify-joined Linux machine is on the domain:

```
1 su -
2
3 adinfo
4 <!--NeedCopy-->
```

Verify that the **Joined to domain** value is valid and the **CentrifyDC mode** returns **connected**. If the mode remains stuck in the starting state, then the Centrify client is experiencing server connection or authentication problems.

More comprehensive system and diagnostic information is available using:

```
1 adinfo --sysinfo all
2
3 adinfo --diag
4 <!--NeedCopy-->
```

Test connectivity to the various Active Directory and Kerberos services.

```
1 adinfo --test
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## SSSD

### Configure Kerberos

Run the following command to install Kerberos:

```
1 sudo apt-get install krb5-user
2 <!--NeedCopy-->
```

To configure Kerberos, open **/etc/krb5.conf** as root and set the parameters:

```
[libdefaults]
default_realm = REALM
dns_lookup_kdc = false

[realms]
REALM = {
admin_server = domain-controller-fqdn
kdc = domain-controller-fqdn
}

[domain_realm]
domain-dns-name = REALM
.domain-dns-name = REALM
```

The `domain-dns-name` parameter in this context is the DNS domain name, such as `example.com`. The `REALM` is the Kerberos realm name in uppercase, such as `EXAMPLE.COM`.

### Join the domain

SSSD must be configured to use Active Directory as its identity provider and Kerberos for authentication. However, SSSD does not provide AD client functions for joining the domain and managing the system keytab file. You can use `adcli`, `realmd`, or `Samba` instead.

**Note:**

This section only provides information for `adcli` and `Samba`.

### Use `adcli` to join the domain:

#### Install `adcli`:

Install the required package:

```
1 sudo apt-get install adcli
2 <!--NeedCopy-->
```



### Join the domain with adcli:

Remove the old system keytab file and join the domain using:

```
1 su -
2
3 rm -rf /etc/krb5.keytab
4
5 adcli join domain-dns-name -U user -H hostname-fqdn
6 <!--NeedCopy-->
```

The **user** is a domain user with permissions to add machines to the domain. The **hostname-fqdn** is the host name in FQDN format for the machine.

The **-H** option is necessary for `adcli` to generate SPN in the format of `host/hostname-fqdn@REALM`, which the Linux VDA requires.

### Verify system keytab:

For a Ubuntu 20.04 machine, run the `adcli testjoin` command to test whether it is joined to the domain.

For a Ubuntu 18.04 or Ubuntu 16.04 machine, run the `sudo klist -ket` command to ensure that the system keytab file has been created.

Verify that the timestamp for each key matches the time the machine was joined to the domain.

### Use Samba to join the domain:

#### Install the package:

```
1 sudo apt-get install samba krb5-user
2 <!--NeedCopy-->
```

#### Configure Samba:

Open `/etc/samba/smb.conf`, and make the following settings:

```
[global]
workgroup = WORKGROUP
security = ADS
realm = REALM
client signing = yes
```

```
client use spnego = yes
```

```
kerberos method = secrets and keytab
```

**WORKGROUP** is the first field in **REALM**, and **REALM** is the Kerberos realm name in uppercase.

### Join the domain with Samba:

Your domain controller must be reachable and you must have a Windows account with permissions to add computers to the domain.

```
1 sudo net ads join REALM -U user
2 <!--NeedCopy-->
```

Where **REALM** is the Kerberos realm name in uppercase, and **user** is a domain user with permissions to add computers to the domain.

### Set up SSSD

#### Install or update required packages:

Install the required SSSD and configuration packages if not already installed:

```
1 sudo apt-get install sssd
2 <!--NeedCopy-->
```

If the packages are already installed, an update is recommended:

```
1 sudo apt-get install --only-upgrade sssd
2 <!--NeedCopy-->
```

#### Note:

By default, the install process in Ubuntu automatically configures **nsswitch.conf** and the PAM login module.

### Configure SSSD

SSSD configuration changes are required before starting the SSSD daemon. For some versions of SSSD, the **/etc/sss/sss.conf** configuration file is not installed by default and must be manually created. As root, either create or open **/etc/sss/sss.conf** and make the following settings:

```
[sssd]
services = nss, pam
config_file_version = 2
domains = domain-dns-name
[domain/domain-dns-name]
id_provider = ad
access_provider = ad
auth_provider = krb5
krb5_realm = REALM
## Set krb5_renewable_lifetime higher if TGT renew lifetime is longer than
14 days
krb5_renewable_lifetime = 14d
## Set krb5_renew_interval to lower value if TGT ticket lifetime is shorter
than 2 hours
krb5_renew_interval = 1h
krb5_ccachedir = /tmp
krb5_ccname_template = FILE:%d/krb5cc_%U
## This ldap_id_mapping setting is also the default value
ldap_id_mapping = true
override_homedir = /home/%d/%u
default_shell = /bin/bash
ad_gpo_map_remote_interactive = +ctxhdx
```

**Note:**

ldap\_id\_mapping is set to **true** so that SSSD itself takes care of mapping Windows SIDs to Unix UIDs. Otherwise, the Active Directory must be able to provide POSIX extensions. PAM service ctxhdx is added to ad\_gpo\_map\_remote\_interactive.

The **domain-dns-name** parameter in this context is the DNS domain name, such as example.com. The **REALM** is the Kerberos realm name in uppercase, such as EXAMPLE.COM. There is no requirement to configure the NetBIOS domain name.

For information about the configuration settings, see the man pages for sssd.conf and sssd-ad.

The SSSD daemon requires that the configuration file must have owner read permission only:

```
1 sudo chmod 0600 /etc/sss/sss.conf
2 <!--NeedCopy-->
```

### Start SSSD daemon

Run the following commands to start the SSSD daemon now and to enable the daemon to start upon machine startup:

```
1 sudo systemctl start sssd
2
3 sudo systemctl enable sssd
4 <!--NeedCopy-->
```

### PAM configuration

Run the following command and ensure that the **SSS authentication** and **Create home directory on login** options are selected:

```
1 sudo pam-auth-update
2 <!--NeedCopy-->
```

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory.

#### Use adcli to verify domain membership:

Show the domain information by running the following command:

```
1 sudo adcli info domain-dns-name
2 <!--NeedCopy-->
```

#### Use Samba to verify domain membership:

Run the **net ads** command of Samba to verify that the machine is joined to a domain:

```
1 sudo net ads testjoin
2 <!--NeedCopy-->
```

Run the following command to verify extra domain and computer object information:

```
1 sudo net ads info
2 <!--NeedCopy-->
```

### Verify Kerberos configuration

To verify that Kerberos is configured correctly for use with the Linux VDA, verify that the system keytab file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos `kinit` command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\$$@REALM
2 <!--NeedCopy-->
```

The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT for the machine account has been cached using:

```
1 sudo klist
2 <!--NeedCopy-->
```

## Verify user authentication

SSSD does not provide a command-line tool for testing authentication directly with the daemon, and can only be done via PAM.

To verify that the SSSD PAM module is configured correctly, log on to the Linux VDA using a domain user account that has not been used before.

```
1 ssh localhost -l domain\\username
2
3 id -u
4
5 klist
6
7 exit
8 <!--NeedCopy-->
```

Verify that the Kerberos tickets returned by the **klist** command are correct for that user and have not expired.

As a root user, verify that a corresponding ticket cache file was created for the uid returned by the previous **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

A similar test can be performed by logging on to KDE or Gnome Display Manager. Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## PBIS

### Download the required PBIS package

For example:

```
1 sudo wget https://github.com/BeyondTrust/pbis-open/releases/download
   /8.8.0/pbis-open-8.8.0.506.linux.x86_64.deb.sh
2 <!--NeedCopy-->
```

### Make the PBIS installation script executable

For example:

```
1 sudo chmod +x pbis-open-8.8.0.506.linux.x86_64.deb.sh
2 <!--NeedCopy-->
```

### Run the PBIS installation script

For example:

```
1 sudo sh pbis-open-8.8.0.506.linux.x86_64.deb.sh
2 <!--NeedCopy-->
```

### Join Windows domain

Your domain controller must be reachable and you must have an Active Directory user account with permissions to add computers to the domain:

```
1 sudo /opt/pbis/bin/domainjoin-cli join domain-name user
2 <!--NeedCopy-->
```

The **user** is a domain user who has permissions to add computers to the Active Directory domain. The **domain-name** is the DNS name of the domain, for example, example.com.

**Note:** To set Bash as the default shell, run the **sudo /opt/pbis/bin/config LoginShellTemplate/bin/bash** command.

### Verify domain membership

The Delivery Controller requires that all VDA machines (Windows and Linux VDAs) have a computer object in Active Directory. To verify that a PBIS-joined Linux machine is on the domain:

```
1 /opt/pbis/bin/domainjoin-cli query
2 <!--NeedCopy-->
```

If the machine is joined to a domain, this command returns the information about the currently joined AD domain and OU. Otherwise, only the host name appears.

## Verify user authentication

To verify that PBIS can authenticate domain users through PAM, log on to the Linux VDA using a domain user account that has not been used before.

```
1 sudo ssh localhost -l domain\user
2
3 id -u
4 <!--NeedCopy-->
```

Verify that a corresponding Kerberos credential cache file was created for the UID returned by the **id -u** command:

```
1 ls /tmp/krb5cc_uid
2 <!--NeedCopy-->
```

Exit the session.

```
1 exit
2 <!--NeedCopy-->
```

Proceed to [Step 4: Install the Linux VDA](#) after the domain joining verification.

## Step 4: Install the Linux VDA

### Step 4a: Download the Linux VDA package

Go to the [Citrix Virtual Apps and Desktops download page](#). Expand the appropriate version of Citrix Virtual Apps and Desktops and click **Components** to download the Linux VDA package that matches your Linux distribution.

### Step 4b: Install the Linux VDA

Install the Linux VDA software using the Debian package manager:

#### For Ubuntu 20.04:

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu20.04_amd64.deb
2 <!--NeedCopy-->
```



**For Ubuntu 18.04:**

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu18.04_amd64.deb
2 <!--NeedCopy-->
```

**For Ubuntu 16.04:**

```
1 sudo dpkg -i xendesktopvda_20.12.0.20-1.ubuntu16.04_amd64.deb
2 <!--NeedCopy-->
```

Debian dependency list for Ubuntu 20.04:

```
1 postgresql >= 12
2
3 libpostgresql-jdbc-java >= 42.2
4
5 openjdk-8-jdk >= 8u252
6
7 imagemagick >= 8:6.9.10
8
9 ufw >= 0.36
10
11 ubuntu-desktop >= 1.450
12
13 libxrandr2 >= 2:1.5.2
14
15 libxtst6 >= 2:1.2.3
16
17 libxm4 >= 2.3.8
18
19 util-linux >= 2.34
20
21 gtk3-nocsd >= 3
22
23 bash >= 5.0
24
25 findutils >= 4.7.0
26
27 sed >= 4.7
28
29 cups >= 2.3
```

```
30
31 libmspack0 >= 0.10
32
33 libgoogle-perftools4 >= 2.7~
34
35 libpython2.7 >= 2.7~
36 <!--NeedCopy-->
```

Debian dependency list for Ubuntu 18.04:

```
1 postgresql >= 9.5
2
3 libpostgresql-jdbc-java >= 9.2
4
5 openjdk-8-jdk >= 1.8.0
6
7 gtk3-nocsd >=3
8
9 imagemagick >= 8:6.8.9.9
10
11 ufw >= 0.35
12
13 ubuntu-desktop >= 1.361
14
15 libxrandr2 >= 2:1.5.0
16
17 libxtst6 >= 2:1.2.2
18
19 libxm4 >= 2.3.4
20
21 util-linux >= 2.27.1
22
23 bash >= 4.3
24
25 findutils >= 4.6.0
26
27 sed >= 4.2.2
28
29 cups >= 2.1
30
31 libldap-2.4-2 >= 2.4.42
32
33 libsasl2-modules-gssapi-mit >= 2.1.~
```

```
34
35 python-requests >= 2.9.1
36
37 libgoogle-perftools4 >= 2.4~
38
39 xserver-xorg-core >= 2:1.18
40
41 xserver-xorg-core << 2:1.19
42
43 x11vnc>=0.9.13
44
45 python-websockify >= 0.6.1
46 <!--NeedCopy-->
```

Debian dependency list for Ubuntu 16.04:

```
1 postgresql >= 9.5
2
3 libpostgresql-jdbc-java >= 9.2
4
5 default-jdk >= 2:1.8
6
7 imagemagick >= 8:6.8.9.9
8
9 ufw >= 0.35
10
11 ubuntu-desktop >= 1.361
12
13 libxrandr2 >= 2:1.5.0
14
15 libxtst6 >= 2:1.2.2
16
17 libxm4 >= 2.3.4
18
19 util-linux >= 2.27.1
20
21 bash >= 4.3
22
23 findutils >= 4.6.0
24
25 sed >= 4.2.2
26
27 cups >= 2.1
```

```
28
29 libldap-2.4-2 >= 2.4.42
30
31 libsasl2-modules-gssapi-mit >= 2.1.~
32
33 python-requests >= 2.9.1
34
35 libgoogle-perftools4 >= 2.4~
36
37 xserver-xorg-core >= 2:1.18
38
39 xserver-xorg-core << 2:1.19
40
41 x11vnc>=0.9.13
42
43 python-websocketify >= 0.6.1
44 <!--NeedCopy-->
```

**Note:**

For a matrix of the Linux distributions and the Xorg versions that this version of the Linux VDA supports, see [System requirements](#).

**Step 4c: Upgrade the Linux VDA (optional)**

You can upgrade an existing installation from the previous two versions and from an LTSR release.

```
1 sudo dpkg -i <PATH>/<Linux VDA deb>
2 <!--NeedCopy-->
```

**Step 4d: Configure the Linux VDA**

After installing the package, you must configure the Linux VDA by running the `ctxsetup.sh` script. Before making any changes, the script verifies the environment and ensures that all dependencies are installed. If necessary, you can rerun the script at any time to change settings.

You can run the script manually with prompting, or automatically with preconfigured responses. Review Help about the script before proceeding:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh --help
2 <!--NeedCopy-->
```

## Prompted configuration

Run a manual configuration with prompted questions:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsetup.sh
2 <!--NeedCopy-->
```

## Automated configuration

For an automated install, the options required by the setup script can be provided with environment variables. If all required variables are present, the script does not prompt the user for any information, allowing for a scripted installation process.

Supported environment variables include:

- **CTX\_XDL\_SUPPORT\_DDC\_AS\_CNAME=Y | N** – The Linux VDA supports specifying a Delivery Controller name using a DNS CNAME record. Set to N by default.
- **CTX\_XDL\_DDC\_LIST='list-ddc-fqdns'** – The Linux VDA requires a space-separated list of Delivery Controller Fully Qualified Domain Names (FQDNs) to use for registering with a Delivery Controller. At least one FQDN or CNAME alias must be specified.
- **CTX\_XDL\_VDA\_PORT=port-number** – The Linux VDA communicates with Delivery Controllers through a TCP/IP port, which is port 80 by default.
- **CTX\_XDL\_REGISTER\_SERVICE=Y | N** – The Linux Virtual Desktop services are started after machine startup. Set to Y by default.
- **CTX\_XDL\_ADD\_FIREWALL\_RULES=Y | N** – The Linux Virtual Desktop services require incoming network connections to be allowed through the system firewall. You can automatically open the required ports (ports 80 and 1494 by default) in the system firewall for the Linux Virtual Desktop. Set to Y by default.
- **CTX\_XDL\_AD\_INTEGRATION=1 | 2 | 3 | 4 | 5** – The Linux VDA requires Kerberos configuration settings to authenticate with the Delivery Controllers. The Kerberos configuration is determined from the installed and configured Active Directory integration tool on the system. Specify the supported Active Directory integration method to use:
  - 1 – Samba Winbind
  - 2 – Quest Authentication Service
  - 3 – Centrify DirectControl
  - 4 – SSSD
  - 5 – PBIS
- **CTX\_XDL\_HDX\_3D\_PRO=Y | N** – The Linux VDA supports HDX 3D Pro, a set of GPU acceleration technologies designed to optimize the virtualization of rich graphics applications. If HDX 3D Pro is selected, the VDA is configured for VDI desktops (single-session) mode – (that is, CTX\_XDL\_VDI\_MODE=Y).

- **CTX\_XDL\_VDI\_MODE=Y|N** – Whether to configure the machine as a dedicated desktop delivery model (VDI) or hosted shared desktop delivery model. For HDX 3D Pro environments, set this variable to Y. This variable is set to N by default.
- **CTX\_XDL\_SITE\_NAME=dns-name** – The Linux VDA discovers LDAP servers through DNS. To limit the DNS search results to a local site, specify a DNS site name. This variable is set to **<none>** by default.
- **CTX\_XDL\_LDAP\_LIST='list-ldap-servers'** – The Linux VDA queries DNS to discover LDAP servers. If DNS cannot provide LDAP service records, you can provide a space-separated list of LDAP FQDNs with LDAP ports. For example, ad1.mycompany.com:389. This variable is set to **<none>** by default.
- **CTX\_XDL\_SEARCH\_BASE=search-base-set** – The Linux VDA queries LDAP through a search base set to the root of the Active Directory Domain (for example, DC=mycompany,DC=com). However, to improve search performance, you can specify a search base (for example, OU=VDI,DC=mycompany,DC=com). This variable is set to **<none>** by default.
- **CTX\_XDL\_FAS\_LIST='list-fas-servers'** – The Federated Authentication Service (FAS) servers are configured through AD Group Policy. The Linux VDA does not support AD Group Policy, but you can provide a semicolon-separated list of FAS servers instead. The sequence must be the same as configured in AD Group Policy. If any server address is removed, fill its blank with the **<none>** text string and do not modify the order of server addresses.
- **CTX\_XDL\_DOTNET\_RUNTIME\_PATH=path-to-install-dotnet-runtime** – The path to install .NET Core Runtime 3.1 for supporting the new broker agent service (`ctxvda`). The default path is `/usr/bin`.
- **CTX\_XDL\_START\_SERVICE=Y|N** – Whether or not the Linux VDA services are started when the Linux VDA configuration is complete. Set to Y by default.
- **CTX\_XDL\_TELEMETRY\_SOCKET\_PORT** – The socket port for listening for Citrix Scout. The default port is 7503.
- **CTX\_XDL\_TELEMETRY\_PORT** – The port for communicating with Citrix Scout. The default port is 7502.

Set the environment variable and run the configure script:

```
1 export CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N
2
3 export CTX_XDL_DDC_LIST= 'list-ddc-fqdns'
4
5 export CTX_XDL_VDA_PORT=port-number
6
7 export CTX_XDL_REGISTER_SERVICE=Y|N
8
9 export CTX_XDL_ADD_FIREWALL_RULES=Y|N
```

```
10
11 export CTX_XDL_AD_INTEGRATION=1|2|3|4|5
12
13 export CTX_XDL_HDX_3D_PRO=Y|N
14
15 export CTX_XDL_VDI_MODE=Y|N
16
17 export CTX_XDL_SITE_NAME=dns-site-name | '<none>'
18
19 export CTX_XDL_LDAP_LIST= 'list-ldap-servers' | '<none>'
20
21 export CTX_XDL_SEARCH_BASE=search-base-set | '<none>'
22
23 export CTX_XDL_FAS_LIST= 'list-fas-servers' | '<none>'
24
25 export CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime
26
27 export CTX_XDL_TELEMETRY_SOCKET_PORT=port-number
28
29 export CTX_XDL_TELEMETRY_PORT=port-number
30
31 export CTX_XDL_START_SERVICE=Y|N
32
33 sudo -E /opt/Citrix/VDA/sbin/ctxsetup.sh
34 <!--NeedCopy-->
```

When running the sudo command, type the **-E** option to pass the existing environment variables to the new shell it creates. We recommend that you create a shell script file from the preceding commands with **#!/bin/bash** as the first line.

Alternatively, you can specify all parameters by using a single command:

```
1 sudo CTX_XDL_SUPPORT_DDC_AS_CNAME=Y|N \
2
3 CTX_XDL_DDC_LIST= 'list-ddc-fqdns' \
4
5 CTX_XDL_VDA_PORT=port-number \
6
7 CTX_XDL_REGISTER_SERVICE=Y|N \
8
9 CTX_XDL_ADD_FIREWALL_RULES=Y|N \
10
11 CTX_XDL_AD_INTEGRATION=1|2|3|4|5 \
12
```

```
13 CTX_XDL_HDX_3D_PRO=Y|N \  
14 \  
15 CTX_XDL_VDI_MODE=Y|N \  
16 \  
17 CTX_XDL_SITE_NAME=dns-name \  
18 \  
19 CTX_XDL_LDAP_LIST= 'list-ldap-servers' \  
20 \  
21 CTX_XDL_SEARCH_BASE=search-base-set \  
22 \  
23 CTX_XDL_FAS_LIST= 'list-fas-servers' \  
24 \  
25 CTX_XDL_DOTNET_RUNTIME_PATH=path-to-install-dotnet-runtime \  
26 \  
27 CTX_XDL_TELEMETRY_SOCKET_PORT=port-number \  
28 \  
29 CTX_XDL_TELEMETRY_PORT=port-number \  
30 \  
31 CTX_XDL_START_SERVICE=Y|N \  
32 \  
33 /opt/Citrix/VDA/sbin/ctxsetup.sh  
34 <!--NeedCopy-->
```

### Remove configuration changes

In some scenarios, you might have to remove the configuration changes made by the **ctxsetup.sh** script without uninstalling the Linux VDA package.

Review Help about this script before proceeding:

```
1 sudo /opt/Citrix/VDA/sbin/ctxcleanup.sh --help  
2 <!--NeedCopy-->
```

To remove configuration changes:

```
1 sudo /opt/Citrix/VDA/sbin/ctxcleanup.sh  
2 <!--NeedCopy-->
```

#### **Important:**

This script deletes all configuration data from the database and renders the Linux VDA inopera-



ble.

### Configuration logs

The **ctxsetup.sh** and **ctxcleanup.sh** scripts display errors on the console, with additional information written to the configuration log file **/tmp/xdl.configure.log**.

Restart the Linux VDA services to have the changes take effect.

### Uninstall the Linux VDA software

To check whether the Linux VDA is installed and to view the version of the installed package:

```
1 dpkg -l xendesktopvda
2 <!--NeedCopy-->
```

To view more detailed information:

```
1 apt-cache show xendesktopvda
2 <!--NeedCopy-->
```

To uninstall the Linux VDA software:

```
1 dpkg -r xendesktopvda
2 <!--NeedCopy-->
```

#### Note:

Uninstalling the Linux VDA software deletes the associated PostgreSQL and other configuration data. However, the PostgreSQL package and other dependent packages that were set up before the installation of the Linux VDA are not deleted.

#### Tip:

The information in this section does not cover the removal of dependent packages including PostgreSQL.

### Step 5: Run the Linux VDA

Once you have configured the Linux VDA using the **ctxsetup.sh** script, you use the following commands to control the Linux VDA.

### Start the Linux VDA:

To start the Linux VDA services:

```
1 sudo systemctl start ctxhdx
2
3 sudo systemctl start ctxvda
4 <!--NeedCopy-->
```

### Stop the Linux VDA:

To stop the Linux VDA services:

```
1 sudo systemctl stop ctxvda
2
3 sudo systemctl stop ctxhdx
4 <!--NeedCopy-->
```

#### Note:

Before you stop the `ctxvda` and `ctxhdx` services, run the `service ctxmonitorservice stop` command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

### Restart the Linux VDA:

To restart the Linux VDA services:

```
1 sudo systemctl stop ctxvda
2
3 sudo systemctl restart ctxhdx
4
5 sudo systemctl restart ctxvda
6 <!--NeedCopy-->
```

### Check the Linux VDA status:

To check the running status of the Linux VDA services:

```
1 sudo systemctl status ctxvda
2
3 sudo systemctl status ctxhdx
```

## Step 6: Create the machine catalog in Citrix Virtual Apps or Citrix Virtual Desktops

The process for creating machine catalogs and adding Linux VDA machines is similar to the traditional Windows VDA approach. For a more detailed description of how to complete these tasks, see [Create machine catalogs](#) and [Manage machine catalogs](#).

For creating machine catalogs that contain Linux VDA machines, there are a few restrictions that differentiate the process from creating machine catalogs for Windows VDA machines:

- For the operating system, select:
  - The **Multi-session OS** option for a hosted shared desktops delivery model.
  - The **Single-session OS** option for a VDI dedicated desktop delivery model.
- Do not mix Linux and Windows VDA machines in the same machine catalog.

### Note:

Early versions of Citrix Studio did not support the notion of a “Linux OS.” However, selecting the **Windows Server OS** or **Server OS** option implies an equivalent hosted shared desktops delivery model. Selecting the **Windows Desktop OS** or **Desktop OS** option implies a single user per machine delivery model.

### Tip:

If you remove and rejoin a machine to the Active Directory domain, you must remove and add the machine to the machine catalog again.

## Step 7: Create the delivery group in Citrix Virtual Apps or Citrix Virtual Desktops

The process for creating a delivery group and adding machine catalogs containing Linux VDA machines is almost identical to Windows VDA machines. For a more detailed description of how to complete these tasks, see [Create Delivery Groups](#).

For creating delivery groups that contain Linux VDA machine catalogs, the following restrictions apply:

- Ensure that the AD users and groups you select have been properly configured to log on to the Linux VDA machines.
- Do not allow logon of unauthenticated (anonymous) users.
- Do not mix the delivery group with machine catalogs that contain Windows machines.

For information about how to create machine catalogs and delivery groups, see [Citrix Virtual Apps and Desktops 7 2012](#).

## Configure the Linux VDA

April 8, 2021

This section details the features of the Linux VDA, including feature description, configuration, and troubleshooting.

### Tip:

The `xdlcollect` Bash script used to collect logs is integrated into the Linux VDA software and located under `/opt/Citrix/VDA/bin`. After you install the Linux VDA, you can run the `bash /opt/Citrix/VDA/bin/xdlcollect.sh` command to collect logs.

After log collection completes, a compressed log file is generated in the same folder as the script. `xdlcollect` can ask you whether or not to upload the compressed log file to Citrix Insight Services (CIS). If you agree, `xdlcollect` returns an `upload_ID` after the upload completes. The upload does not remove the compressed log file from your local machine. Other users can use the `upload_ID` to access the log file in CIS.

## Integrate NIS with Active Directory

March 10, 2021

This article describes how to integrate NIS with Windows Active Directory (AD) on the Linux VDA by using SSSD. The Linux VDA is considered a component of Citrix Virtual Apps and Desktops. As a result, it fits tightly into the Windows AD environment.

Using NIS as a UID and GID provider instead of using AD requires that the account information (user name and password combinations) is the same in both AD and NIS.

### Note:

Authentication is still performed by the AD server. NIS+ is not supported. If you use NIS as the UID and GID provider, the POSIX attributes from the Windows server are no longer used.

### Tip:

This method represents a deprecated way to deploy the Linux VDA, which is used only for special use cases. For an RHEL/CentOS distribution, follow the instructions in [Install Linux Virtual Delivery Agent for RHEL/CentOS](#). For an Ubuntu distribution, follow the instructions in [Install Linux Virtual Delivery Agent for Ubuntu](#).

What is SSSD?

SSSD is a system daemon. Its primary function is to provide access to identify and authenticate remote resources through a common framework that can provide caching and offline support for the system. It provides both PAM and NSS modules, and in the future can support D-BUS based interfaces for extended user information. It also provides a better database to store local user accounts and extended user data.

## Integrate NIS with AD

To integrate NIS with AD, do the following:

1. [Add the Linux VDA as a NIS client](#)
2. [Join the domain and create a host keytab using Samba](#)
3. [Set up SSSD](#)
4. [Configure NSS/PAM](#)
5. [Verify the Kerberos configuration](#)
6. [Verify user authentication](#)

### Add the Linux VDA as a NIS client

Configure the NIS client:

```
1 yum -y install ypbind rpcbind oddjob-mkhomedir
2 <!--NeedCopy-->
```

Set the NIS domain:

```
1 ypdomainname nis.domain
2 echo "NISDOMAIN=nis.domain" >> /etc/sysconfig/network
3 <!--NeedCopy-->
```

Add the IP address for the NIS server and client in **/etc/hosts**:

```
{ NIS server IP address }    server.nis.domain nis.domain
```

Configure NIS by `authconfig`:

```
1 sudo authconfig --enablenis --nisdomain=nis.domain --nisserver=server.
  nis.domain --enablemkhomedir --update
2 <!--NeedCopy-->
```

The **nis.domain** represents the domain name of the NIS server. The **server.nis.domain** is the host name of the NIS server, which can also be the IP address of the NIS server.

Configure the NIS services:

```
1 sudo systemctl start rpcbind ybind
2
3 sudo systemctl enable rpcbind ybind
4 <!--NeedCopy-->
```

Ensure that the NIS configuration is correct:

```
1 ypwhich
2 <!--NeedCopy-->
```

Validate that the account information is available from the NIS server:

```
1 getent passwd nisaccount
2 <!--NeedCopy-->
```

**Note:**

The **nisaccount** represents the real NIS account on the NIS server. Ensure that the UID, GID, home directory, and login shell are configured correctly.

### Join the domain and create a host keytab using Samba

SSSD does not provide AD client functions for joining the domain and managing the system keytab file. There are a few methods for achieving the functions, including:

- `adcli`
- `realmd`
- `Winbind`
- `Samba`

The information in this section describes the Samba approach only. For `realmd`, see the RHEL or CentOS vendor's documentation. These steps must be followed before configuring SSSD.

### Join the domain and create host keytab using Samba:

On the Linux client with properly configured files:

- /etc/krb5.conf
- /etc/samba/smb.conf:

Configure the machine for Samba and Kerberos authentication:

```
1 sudo authconfig --smbsecurity=ads --smbworkgroup=domain --smbrealm=
   REALM --krb5realm=REALM --krb5kdc=fqdn-of-domain-controller --update
2 <!--NeedCopy-->
```

Where **REALM** is the Kerberos realm name in uppercase and **domain** is the NetBIOS name of the domain.

If DNS-based lookup of the KDC server and realm name is required, add the following two options to the preceding command:

```
--enablekrb5kdcdns --enablekrb5realmdns
```

Open **/etc/samba/smb.conf** and add the following entries under the **[Global]** section, but after the section generated by the **authconfig** tool:

```
kerberos method = secrets and keytab
winbind offline logon = no
```

Joining the Windows domain requires that your domain controller is reachable and you have an AD user account with permissions to add computers to the domain:

```
1 sudo net ads join REALM -U user
2 <!--NeedCopy-->
```

**REALM** is the Kerberos realm name in uppercase and **user** is a domain user who has permissions to add computers to the domain.

## Set up SSSD

Setting up SSSD consists of the following steps:

- Install the **sssd-ad** and **sssd-proxy** packages on the Linux client machine.
- Make configuration changes to various files (for example, **sssd.conf**).
- Start the **sssd service**.

### **/etc/sss/sss.conf**

An example **sssd.conf** configuration (more options can be added as needed):

```
1 [sssd]
2 config_file_version = 2
3 domains = EXAMPLE
4 services = nss, pam
5
6 [domain/EXAMPLE]
7 # Uncomment if you need offline logins
8 # cache_credentials = true
9 re_expression = (((?P<domain>[^\w]+)\w(?P<name>.+))|((?P<name>[^\w]+)@
    (?P<domain>.+))|(^(?P<name>[^\w]+)$))
10 id_provider = proxy
11 proxy_lib_name = nis
12 auth_provider = ad
13 access_provider = ad
14
15 # Should be specified as the long version of the Active Directory
    domain.
16 ad_domain = EXAMPLE.COM
17
18 # Kerberos settings
19 krb5_ccachedir = /tmp
20 krb5_ccname_template = FILE:%d/krb5cc_%U
21
22 # Uncomment if service discovery is not working
23 # ad_server = server.ad.example.com
24
25 # Comment out if the users have the shell and home dir set on the AD
    side
26 default_shell = /bin/bash
27 fallback_homedir = /home/%d/%u
28
29 # Uncomment and adjust if the default principal SHORTNAME$@REALM is not
    available
30 # ldap_sasl_authid = host/client.ad.example.com@AD.EXAMPLE.COM
31 <!--NeedCopy-->
```

Replace **ad.domain.com**, **server.ad.example.com** with the corresponding value. For more details, see the [sssd-ad\(5\) - Linux man page](#).

Set the file ownership and permissions on **sssd.conf**:

```
chown root:root /etc/sssds/sssds.conf
chmod 0600 /etc/sssds/sssds.conf
restorecon /etc/sssds/sssds.conf
```



## Configure NSS/PAM

### RHEL/CentOS:

Use **authconfig** to enable SSSD. Install **oddjob-mkhomedir** to ensure that the home directory creation is compatible with SELinux:

```
1 authconfig --enablesssd --enablesssdauth --enablemkhomedir --update
2
3 sudo systemctl start sssd
4
5 sudo systemctl enable sssd
6 <!--NeedCopy-->
```

#### Tip:

When configuring Linux VDA settings, consider that for SSSD, there has no special settings for the Linux VDA client. For extra solutions in the **ctxsetup.sh** script, use the default value.

## Verify the Kerberos configuration

To ensure that Kerberos is configured correctly for use with the Linux VDA, check that the system **keytab** file has been created and contains valid keys:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

This command displays the list of keys available for the various combinations of principal names and cipher suites. Run the Kerberos **kinit** command to authenticate the machine with the domain controller using these keys:

```
1 sudo kinit -k MACHINE\@$@REALM
2 <!--NeedCopy-->
```

The machine and realm names must be specified in uppercase. The dollar sign (\$) must be escaped with a backslash (\) to prevent shell substitution. In some environments, the DNS domain name is different from the Kerberos realm name. Ensure that the realm name is used. If this command is successful, no output is displayed.

Verify that the TGT ticket for the machine account has been cached using:

```
1 sudo klist -ke
2 <!--NeedCopy-->
```

### Verify user authentication

Use the **getent** command to verify that the logon format is supported and whether the NSS works:

```
1 sudo getent passwd DOMAIN\\username
2 <!--NeedCopy-->
```

The **DOMAIN** parameter indicates the short version domain name. If another logon format is needed, verify by using the **getent** command first.

The supported logon formats are:

- Down-level logon name: `DOMAIN\username`
- UPN: `username@domain.com`
- NetBIOS Suffix format: `username@DOMAIN`

To verify that the SSSD PAM module is configured correctly, use a domain user account to log on to the Linux VDA. The domain user account has not been used before.

```
1 sudo ssh localhost -l DOMAIN\\username
2
3 id -u
4 <!--NeedCopy-->
```

Check that a corresponding Kerberos credential cache file was created for the **uid** returned by the command:

```
1 ls /tmp/krb5cc_{
2 uid }
3
4 <!--NeedCopy-->
```

Check that the tickets in the user's Kerberos credential cache are valid and not expired:

```
1 klist
2 <!--NeedCopy-->
```

## Publish applications

June 22, 2022

With Linux VDA Version 7.13, Citrix added the seamless applications feature to all the supported Linux platforms. No specific installation procedures are required to use this feature.

### Tip:

With Linux VDA version 1.4, Citrix added support for non-seamless published applications and session sharing.

## Publish applications using Citrix Studio

You can publish applications installed on a Linux VDA when you create a delivery group or add applications to an existing delivery group. The process is similar to publishing applications installed on a Windows VDA. For more information, see the [Citrix Virtual Apps and Desktops documentation](#) (based on the version of Citrix Virtual Apps and Desktops being used).

### Tip:

When configuring delivery groups, ensure that the delivery type is set to **Desktop and applications** or **Applications**.

### Important:

Publishing applications is supported with Linux VDA Version 1.4 and later. However, the Linux VDA does not support the delivery of desktops and apps to the same machine. To address this issue, we recommend that you create separate delivery groups for app and desktop deliveries.

### Note:

To use seamless applications, do not disable the seamless mode on StoreFront. The seamless mode is enabled by default. If you have already disabled it by setting “TWIMode=Off,” remove this setting instead of changing it to “TWIMode=On.” Otherwise you might not be able to launch a published desktop.

## Limitation

The Linux VDA does not support the launch of multiple concurrent instances of the same application by a single user.

## Known issues

The following known issues are identified during publishing applications:

- Non-rectangular windows are not supported. The corners of a window might show the server-side background.
- Preview of the content of a window from a published application is not supported.
- Currently, the seamless mode supports the following Window Managers: Mutter, Metacity, and Compiz (Ubuntu 16.04). Kwin and other window managers are not supported. Ensure that your window manager is set a supported one.
- When you run multiple LibreOffice applications, only the one launched first shows on Citrix Studio because these applications share the process.
- Published Qt5-based applications like “Dolphin” might not show icons. To resolve the issue, see the article at <https://wiki.archlinux.org/title/Qt>.
- All the taskbar buttons of published applications running in the same ICA session are combined in the same group. To resolve this issue, set the taskbar property not to combine taskbar buttons.

## Remote PC Access

March 10, 2021

### Overview

Remote PC Access is an extension of Citrix Virtual Apps and Desktops. It enables organizations to easily allow employees to access their physical office PCs remotely in a secure manner. If users can access their office PCs, they can access all the applications, data, and resources they need to do their work.

Remote PC Access uses the same Citrix Virtual Apps and Desktops components that deliver virtual desktops and applications. The requirements and process of deploying and configuring Remote PC Access are the same as the requirements and process required for deploying Citrix Virtual Apps and Desktops for the delivery of virtual resources. This uniformity provides a consistent and unified administrative experience. Users receive the best user experience by using Citrix HDX to deliver their remote office PC sessions.

For more information, see [Remote PC Access](#) in the Citrix Virtual Apps and Desktops documentation.

## Considerations

These considerations are specific to the Linux VDA:

- On physical machines, use the Linux VDA only in non-3D mode. Due to limitations on NVIDIA's driver, the local screen of the PC cannot be blacked out and displays the activities of the session when HDX 3D mode is enabled. Showing this screen is a potential security risk.
- Use machine catalogs of type single-session OS for physical Linux machines.
- Automatic user assignment is not available for Linux machines. With automatic user assignment, users are automatically assigned to their machines when they log on locally to the PCs. This logon occurs without administrator intervention. The Citrix Workspace app running on the client device gives users access to the applications and data on the office PC within the Remote PC Access desktop session.
- If users are already logged on to their PCs locally, attempts to launch the PCs from StoreFront fail.
- Power saving options are not available for Linux machines.

## Configuration

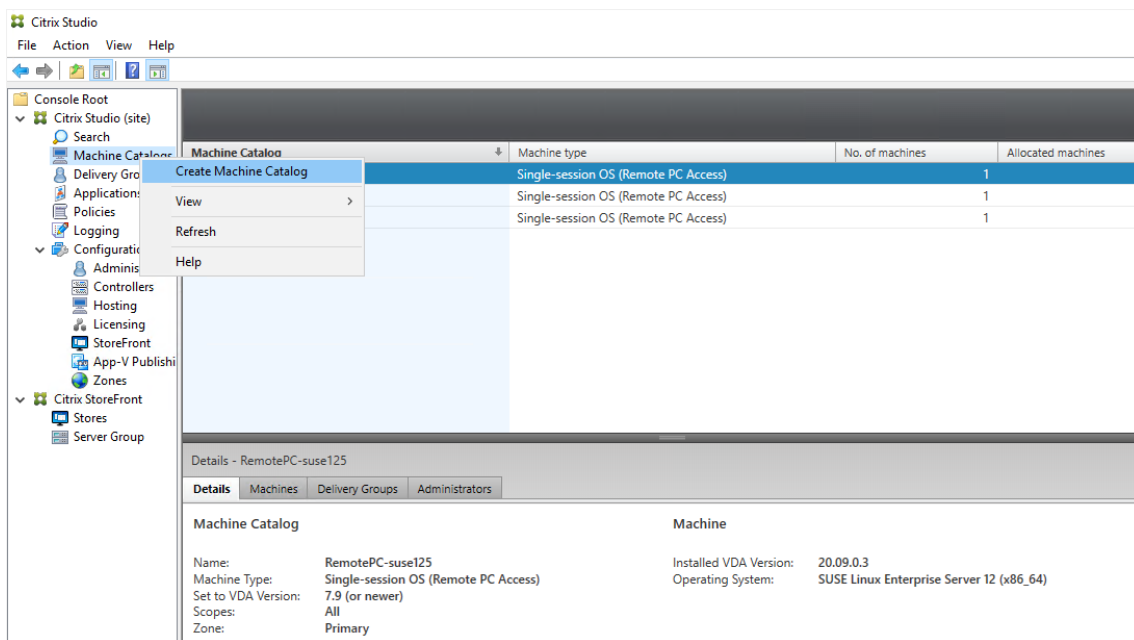
To deliver Linux PC sessions, install the Linux VDA on target PCs, create a machine catalog of the **Remote PC Access** type, and create a Delivery Group to make the PCs in the machine catalog available for users who request access. The following section details the procedure:

### Step 1 - Install the Linux VDA on target PCs

We recommend you use [easy install](#) to install the Linux VDA. During the installation, set the value of the `CTX_XDL_VDI_MODE` variable to `Y`.

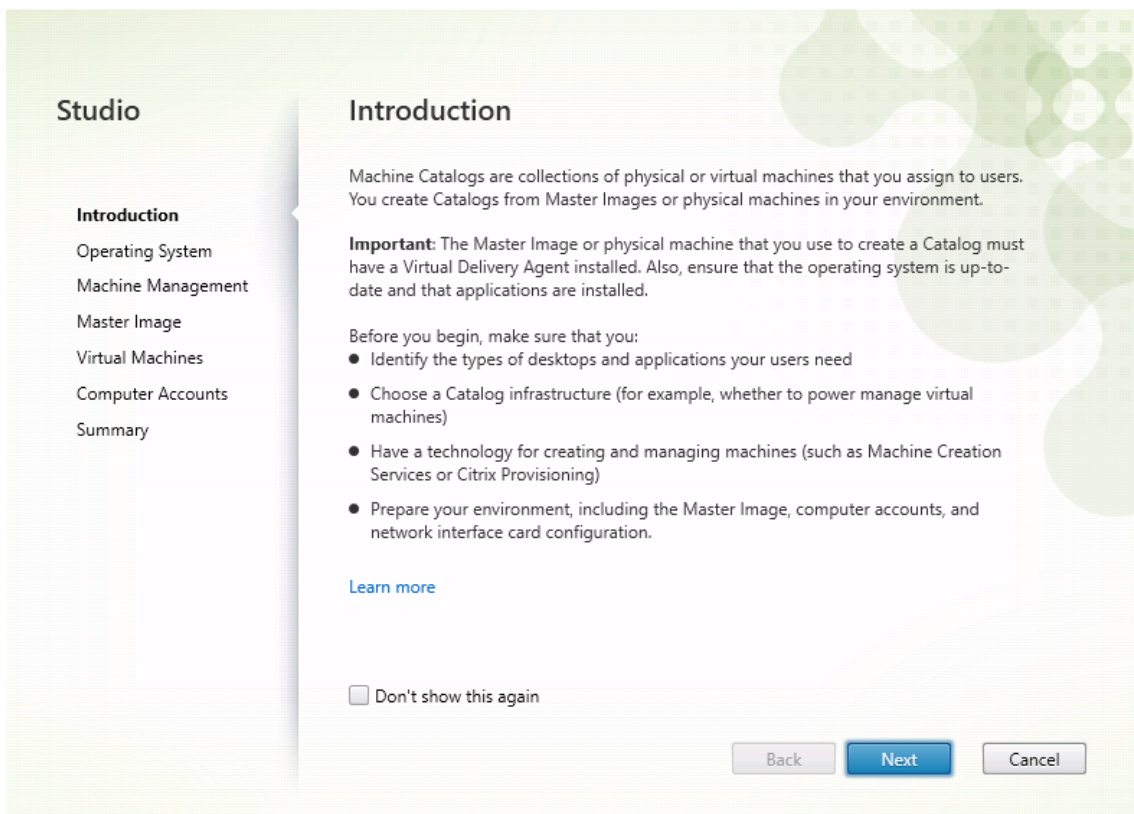
### Step 2 - Create a machine catalog of the Remote PC Access type

1. In Citrix Studio, right-click **Machine Catalogs** and select **Create Machine Catalog** from the shortcut menu.

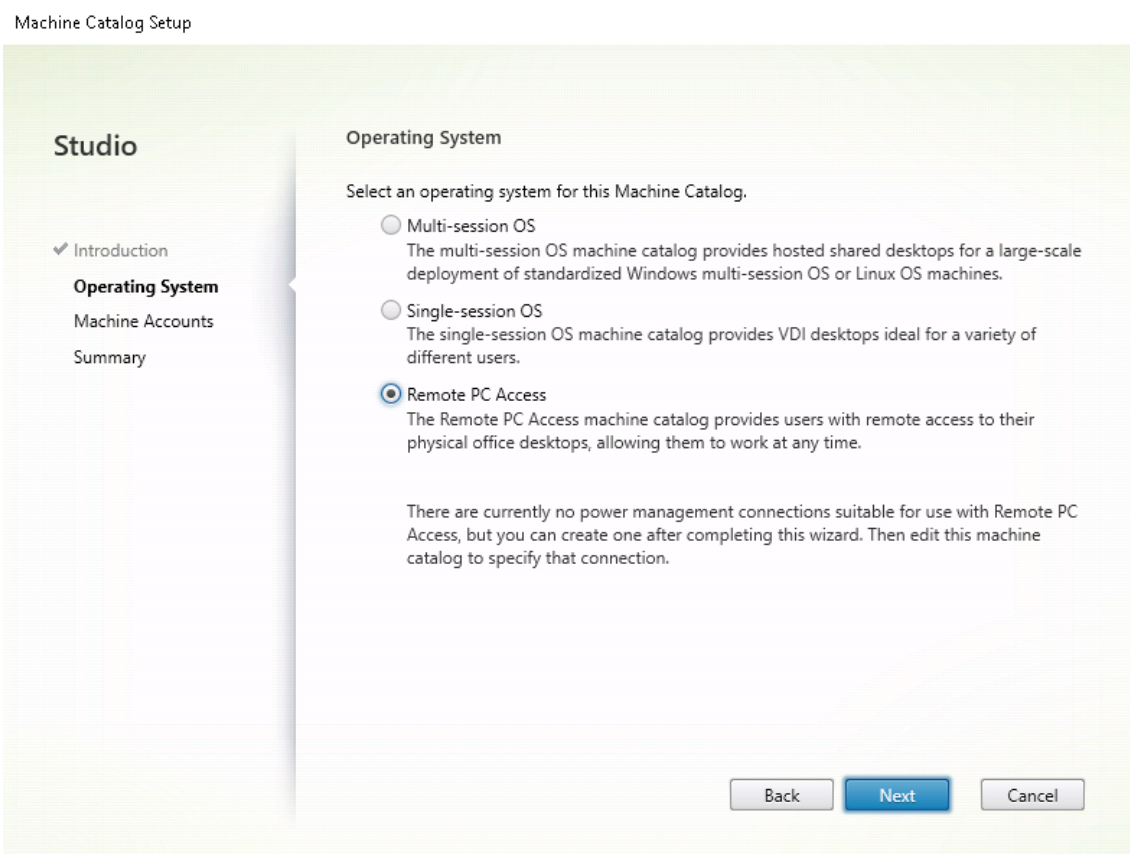


2. Click **Next** on the **Introduction** page.

Machine Catalog Setup

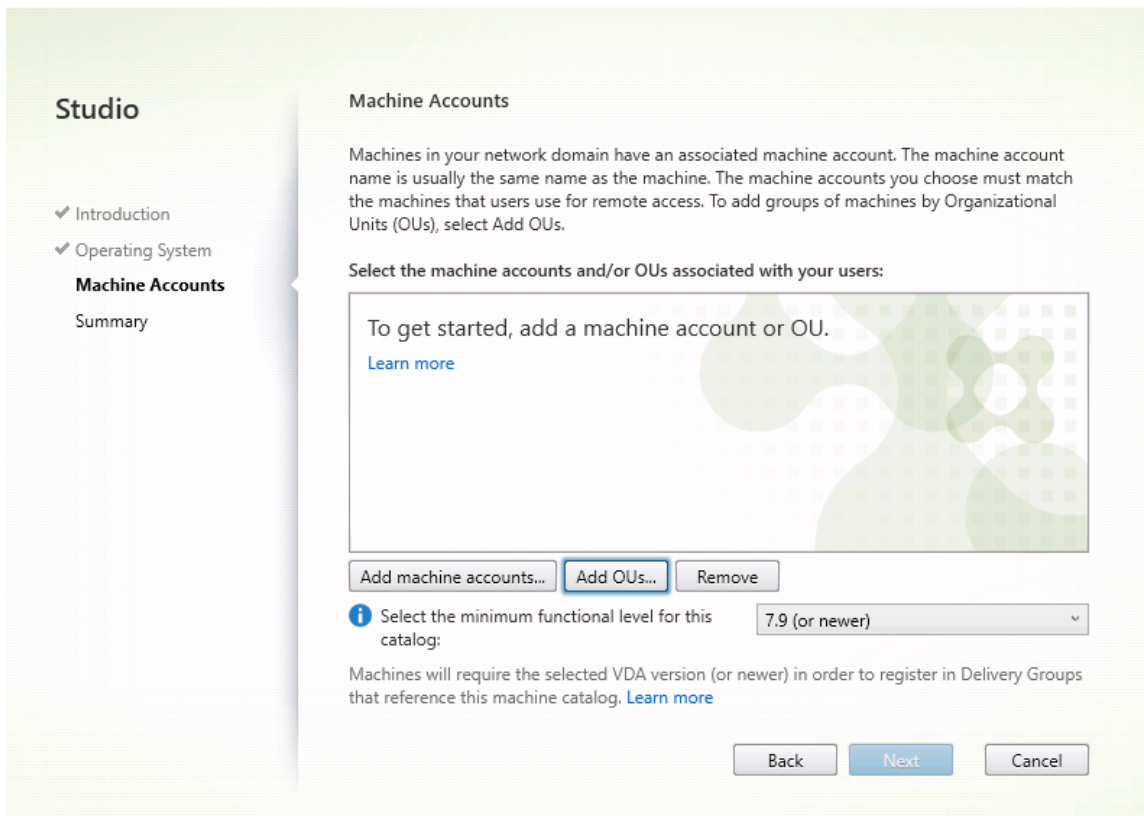


3. Select **Remote PC Access** on the **Operating System** page.



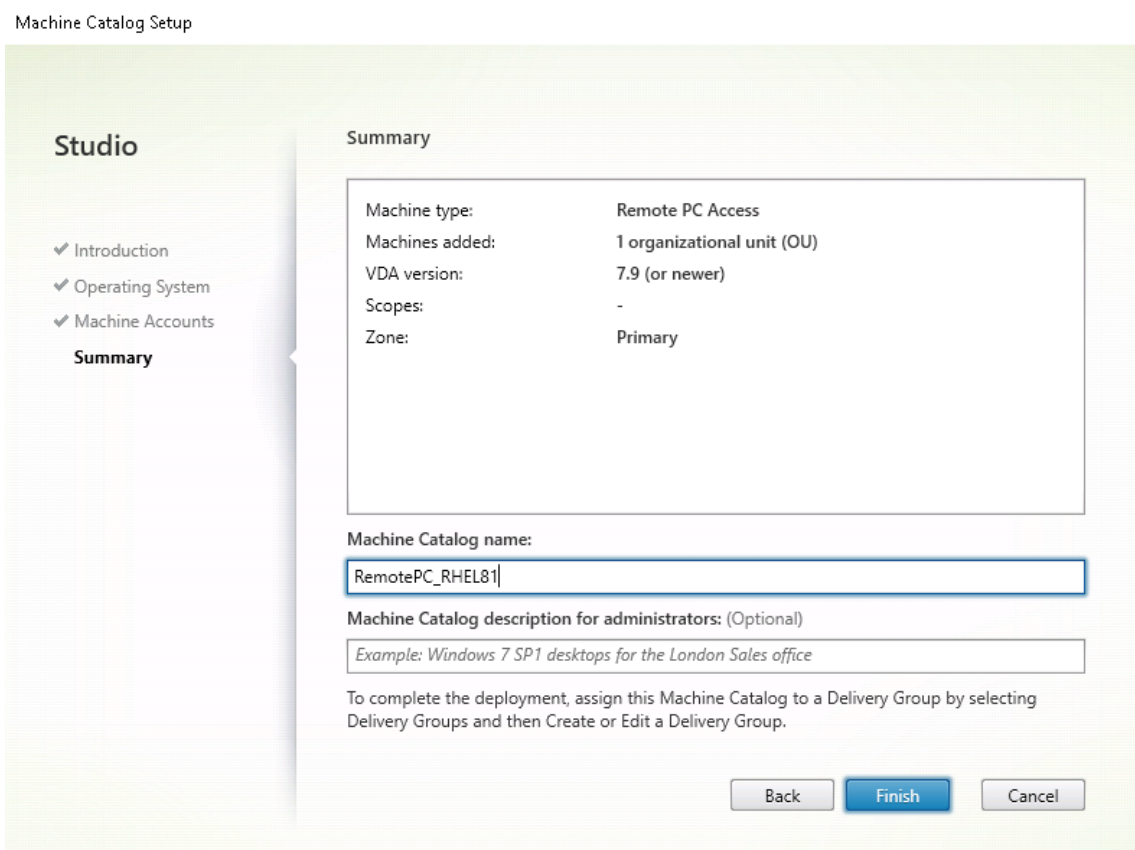
4. Click **Add OUs** to select OUs that contain the target PCs, or click **Add machine accounts** to add individual machines to the machine catalog.

Machine Catalog Setup

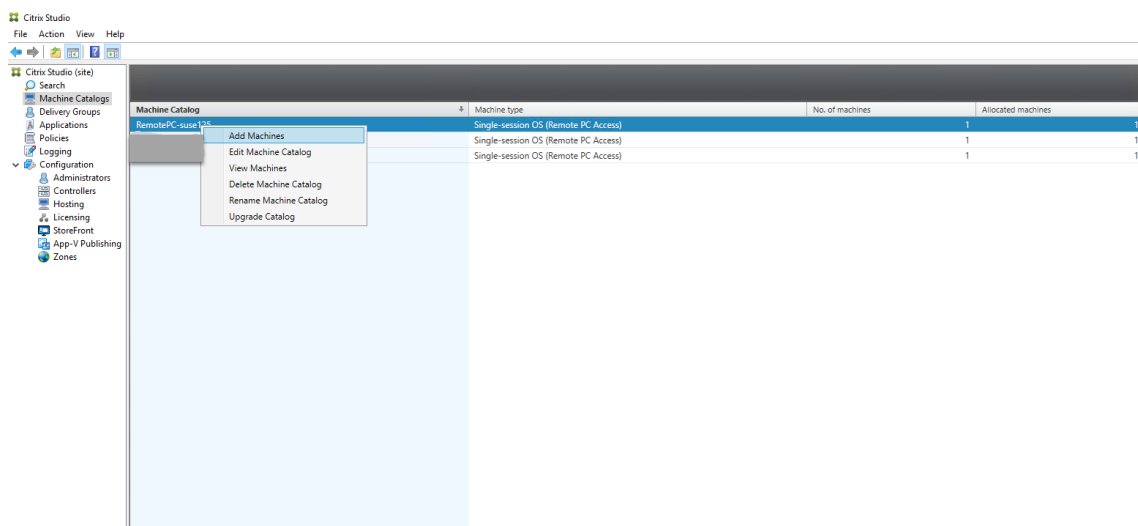


5. Name the machine catalog.



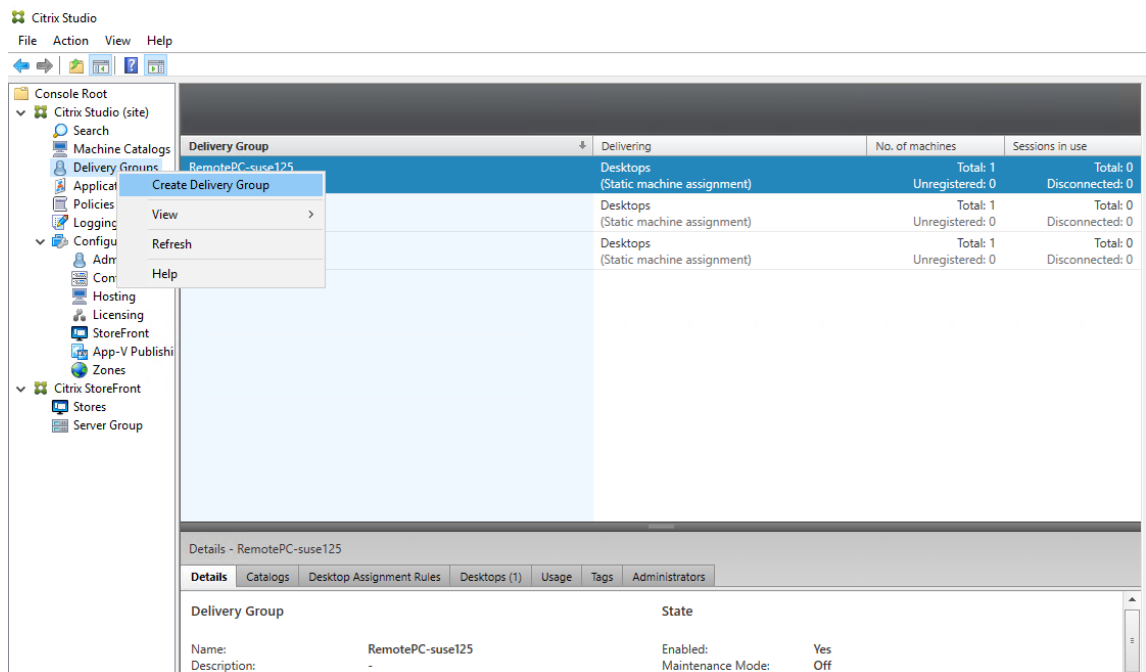


6. (Optional) Right-click the machine catalog to perform relevant operations.

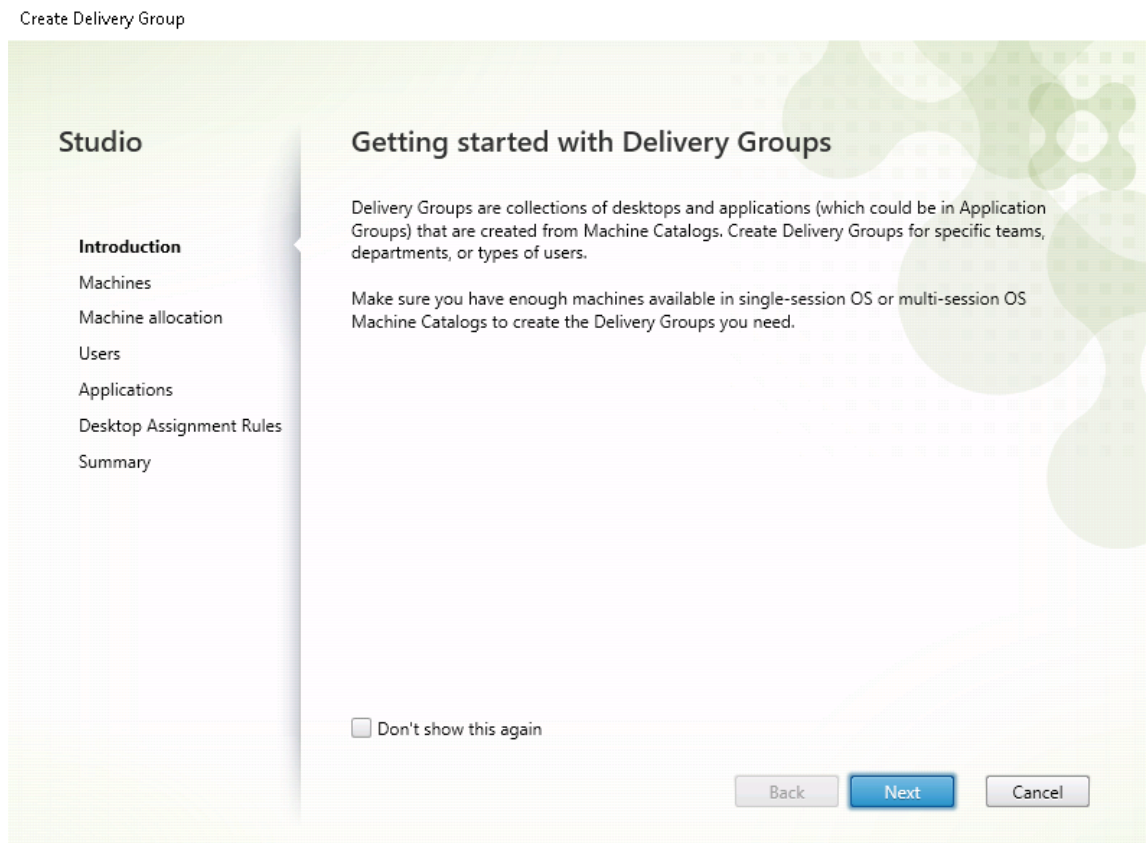


**Step 3 - Create a Delivery Group to make the PCs in the machine catalog available for users who request access**

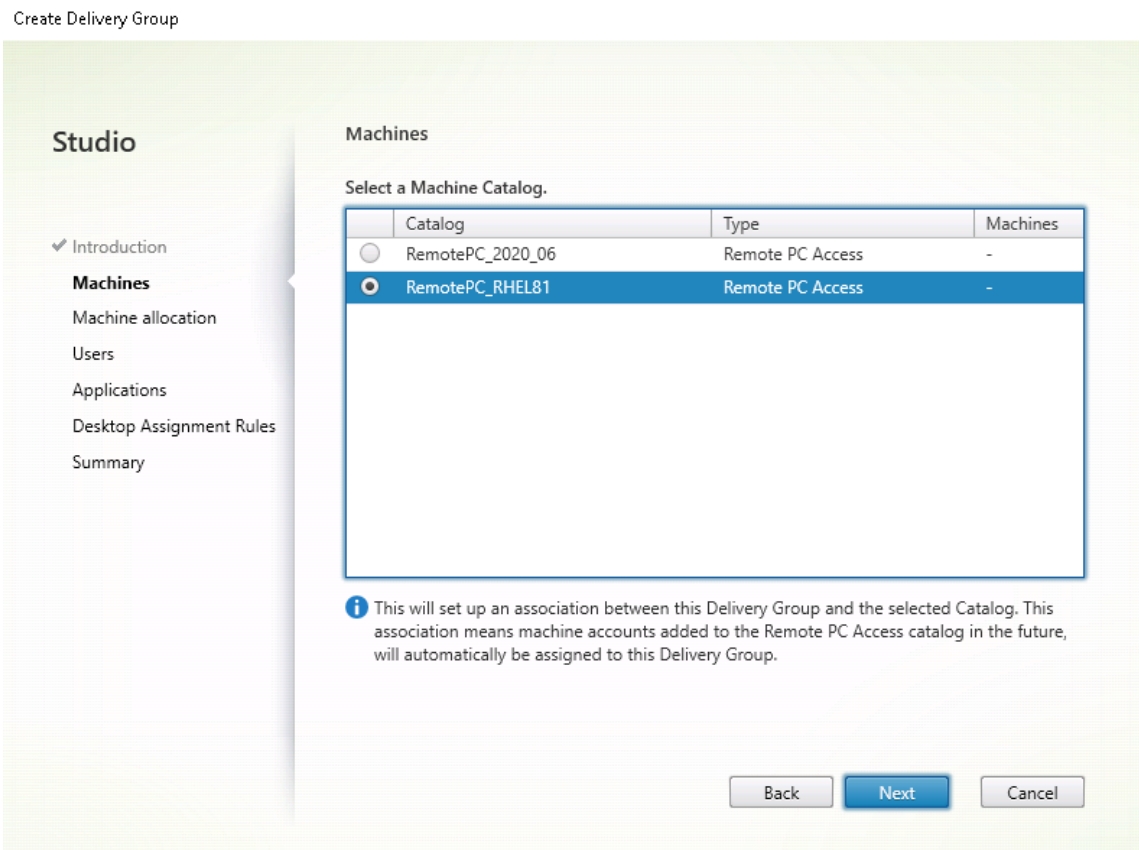
1. In Citrix Studio, right-click **Delivery Groups** and select **Create Delivery Group** from the shortcut menu.



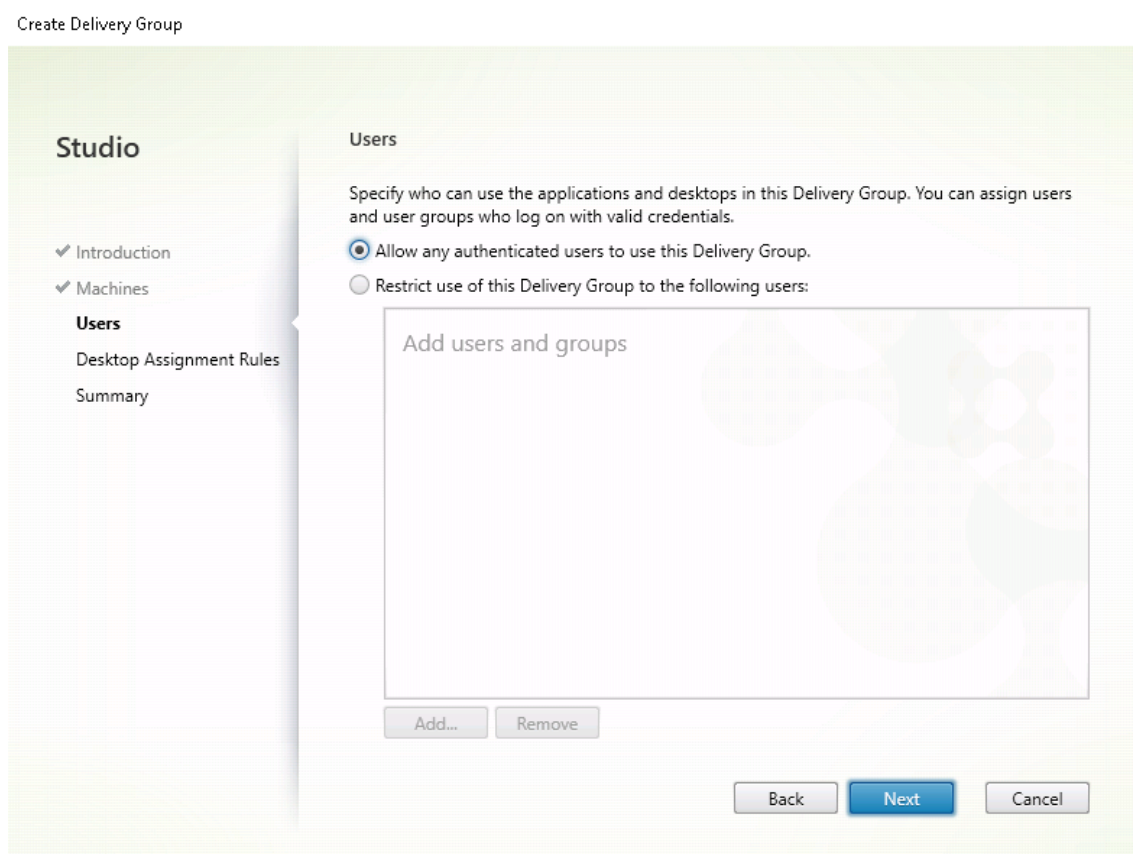
2. Click **Next** on the **Getting started with Delivery Groups** page.



3. Select the machine catalog created in Step 2 to associate it with the Delivery Group.



4. Add users who can access the PCs in the machine catalog. The users you add can use Citrix Workspace app on a client device to access the PCs remotely.



## Wake on LAN

Remote PC Access supports Wake on LAN, which gives users the ability to turn on physical PCs remotely. This feature enables users to keep their office PCs turned off when not in use to save energy costs. It also enables remote access when a machine has been turned off inadvertently.

With the Wake on LAN feature, the magic packets are sent directly from the VDA running on the PC to the subnet in which the PC resides when instructed by the delivery controller. This allows the feature to work without dependencies on extra infrastructure components or third-party solutions for delivery of magic packets.

The Wake on LAN feature differs from the legacy SCCM-based Wake on LAN feature. For information on the SCCM-based Wake on LAN, see [Wake on LAN – SCCM-integrated](#).

## System requirements

The following are the system requirements for using the Wake on LAN feature:

- Control plane:
  - Citrix Virtual Apps and Desktops Service
  - Citrix Virtual Apps and Desktops 2012 or later

- Physical PCs:
  - VDA version 2012 or later
  - Wake on LAN enabled in BIOS and on the NIC

### Configure Wake on LAN

Currently, the configuration of integrated Wake on LAN is only supported using PowerShell.

To configure Wake on LAN:

1. Create the Remote PC Access machine catalog if you do not have one already.
2. Create the Wake on LAN host connection if you do not have one already.

**Note:**

To use the Wake on LAN feature, if you have a host connection of the “Microsoft Configuration Manager Wake on LAN” type, create a host connection.

3. Retrieve the Wake on LAN host connection’s unique identifier.
4. Associate the Wake on LAN host connection with a machine catalog.

To create the Wake on LAN host connection:

```
1 # Load Citrix SnapIns
2 Add-PSSnapIn -Name "*citrix*"
3
4 # Provide the name of the Wake on LAN host connection
5 [string]$connectionName = "Remote PC Access Wake on LAN"
6
7 # Create the hypervisor connection
8 $hypHc = New-Item -Path xdhyp:\Connections `
9             -Name $connectionName `
10            -HypervisorAddress "N/A" `
11            -UserName "woluser" `
12            -Password "wolpwd" `
13            -ConnectionType Custom `
14            -PluginId VdaWOLMachineManagerFactory `
15            -CustomProperties "<CustomProperties></
16                               CustomProperties>" `
17            -Persist
18 $bhc = New-BrokerHypervisorConnection -HypHypervisorConnectionUid
19             $hypHc.HypervisorConnectionUid
```

```
20 # Wait for the connection to be ready before trying to use it
21 while (-not $bhc.IsReady)
22 {
23
24     Start-Sleep -s 5
25     $bhc = Get-BrokerHypervisorConnection -
           HypHypervisorConnectionUid $hypHc.HypervisorConnectionUid
26 }
27
28 <!--NeedCopy-->
```

When the host connection is ready, run the following commands to retrieve the host connection's unique identifier:

```
1 $bhc = Get-BrokerHypervisorConnection -Name "<WoL Connection Name>"
2 $hypUid = $bhc.Uid
3 <!--NeedCopy-->
```

After you retrieve the connection's unique identifier, run the following commands to associate the connection with the Remote PC Access machine catalog:

```
1 Get-BrokerCatalog -Name "<Catalog Name>" | Set-BrokerCatalog -
   RemotePCHypervisorConnectionUid $hypUid
2 <!--NeedCopy-->
```

5. Enable Wake on LAN in BIOS and on the NIC on each VM in the machine catalog.

**Note:** The method for enabling Wake on LAN varies with different machine configurations.

- To enable Wake on LAN in BIOS:
  - a) Enter BIOS and enable the Wake on LAN feature.  
The method for accessing BIOS depends on the manufacturer of your motherboard and the BIOS vendor the manufacturer has selected.
  - b) Save your settings and restart the machine.
- To enable Wake on LAN on the NIC:
  - a) Run the `sudo ethtool <NIC>` command to check whether your NIC supports magic packets.  
<NIC> is the device name of your NIC, for example, `eth0`. The `sudo ethtool <NIC>` command provides output about the capabilities of your NIC:

- If the output contains a line similar to `Supports Wake-on: <letters>` where `<letters>` contains the letter `g`, your NIC supports the Wake on LAN magic packet method.
  - If the output contains a line similar to `Wake-on: <letters>` where `<letters>` contains the letter `g` and does not contain the letter `d`, the Wake on LAN magic packet method is enabled. However, if `<letters>` contains the letter `d`, it indicates that the Wake on LAN feature is disabled. In this case, enable Wake on LAN by running the `sudo ethtool -s <NIC> wol g` command.
- b) On most distributions, the `sudo ethtool -s <NIC> wol g` command is required after each startup. To persistently set this option, complete the following steps based on your distributions:

**Ubuntu:**

Add the `up ethtool -s <NIC> wol g` line to the interface configuration file `/etc/network/interfaces`. For example:

```
1 # ifupdown has been replaced by netplan(5) on this system.
   See
2 # /etc/netplan for current configuration.
3 # To re-enable ifupdown on this system, you can run:
4 # sudo apt install ifupdown
5 auto eth0
6 iface eth0 inet static
7     address 10.0.0.1
8     netmask 255.255.240.0
9     gateway 10.0.0.1
10    up ethtool -s eth0 wol g
11 <!--NeedCopy-->
```

**RHEL/SUSE:**

Add the following `ETHTOOL_OPTS` parameter to the interface configuration file `/etc/sysconfig/network-scripts/ifcfg-<NIC>`:

```
1 ETHTOOL_OPTS="-s ${
2   DEVICE }
3   wol g"
4 <!--NeedCopy-->
```

**Design considerations**

When you are planning to use Wake on LAN with Remote PC Access, consider the following:

- Multiple machine catalogs can use the same Wake on LAN host connection.
- For a PC to wake up another PC, both PCs must be in the same subnet and use the same Wake on LAN host connection. It does not matter if the PCs are in the same or different machine catalogs.
- Host connections are assigned to specific zones. If your deployment contains more than one zone, you need a Wake on LAN host connection in each zone. The same applies to machine catalogs.
- Magic packets are broadcasted using the global broadcast address 255.255.255.255. Ensure that the address is not blocked.
- There must be at least one PC turned on in the subnet - for every Wake on LAN connection - to be able to wake up machines in that subnet.

### Operational considerations

The following are considerations for using the Wake on LAN feature:

- The VDA must register at least once before the PC can be woken up using the integrated Wake on LAN feature.
- Wake on LAN can only be used to wake up PCs. It does not support other power actions, such as restart or shut down.
- After the Wake on LAN connection is created, it is visible in Studio. However, editing its properties within Studio is not supported.
- Magic packets are sent in one of the two ways:
  - When a user tries to launch a session to their PC and the VDA is unregistered
  - When an administrator manually sends a power on command from Studio or PowerShell
- Because the delivery controller is unaware of a PC's power state, Studio displays **Not Supported** under power state. The delivery controller uses the VDA registration state to determine whether a PC is on or off.

### More resources

The following are other resources for Remote PC Access:

- Solution design guidance: [Remote PC Access Design Decisions](#).
- Examples of Remote PC Access architectures: [Reference Architecture for Citrix Remote PC Access Solution](#).

## Print

March 10, 2021



This article provides information about printing best practices.

## Installation

The Linux VDA requires both **cups** and **foomatic** filters. The filters are installed when you install the VDA. You can also install the filters manually based on the distribution. For example:

### On RHEL 7:

```
1 sudo yum -y install cups
2
3 sudo yum -y install foomatic-filters
4 <!--NeedCopy-->
```

### On RHEL 6:

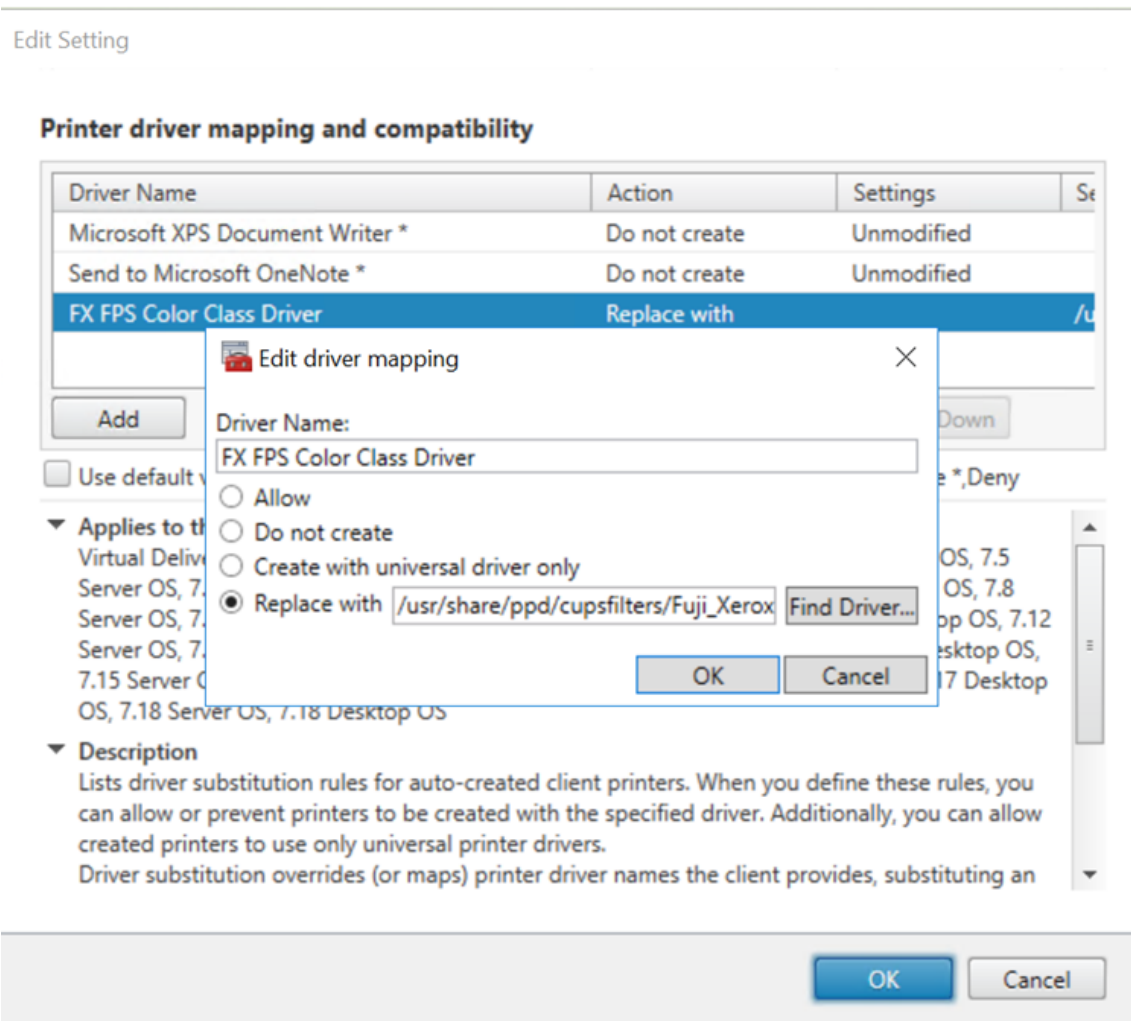
```
1 sudo yum -y install cups
2
3 sudo yum -y install foomatic
4 <!--NeedCopy-->
```

## Configuration

There are three types of Universal Printer Driver supplied by Citrix (postscript, pcl5, and pcl6). However, the Universal Printer Driver might not be compatible with your client printer. In this case, your only option in earlier releases was to edit the `~/.CtxlpProfile$CLIENT_NAME` configuration file. Starting with Version 1906, you can choose to configure the **Printer driver mapping and compatibility** policy in Citrix Studio instead.

To configure the **Printer driver mapping and compatibility** policy in Citrix Studio:

1. Select the **Printer driver mapping and compatibility** policy.
2. Click **Add**.
3. Fill in **Driver name** with the driver name of the client printer. If you are using Citrix Workspace app for Linux, fill in the printer name instead.
4. Choose **Replace with** and type in the absolute path of the driver file on the VDA.



**Note:**

- Only PPD driver files are supported.
- Other options of the **Printer driver mapping and compatibility** policy are not supported. Only **Replace with** takes effect.

**Usage**

You can print from both published desktops and published applications. Only the client-side default printer is mapped into a Linux VDA session. The printer names are different for desktops and applications:

- For published desktops:  
CitrixUniversalPrinter:\$CLIENT\_NAME:dsk\$SESSION\_ID
- For published applications:  
CitrixUniversalPrinter:\$CLIENT\_NAME:app\$SESSION\_ID

**Note:**

If the same user opens both a published desktop and a published application, both printers are available to the session. Printing on a desktop printer in a published application session, or printing on an application printer in a published desktop fails.

## Troubleshooting

### Unable to print

When printing is not working correctly, check the print daemon, **ctxlpmngt**, and the CUPS framework.

The print daemon, **ctxlpmngt**, is a per-session process and must be running for the length of the session. Run the following command to verify that the printing daemon is running. If **ctxlpmngt** is not running, manually start **ctxlpmngt** from a command line.

```
1 ps -ef | grep ctxlpmngt
2 <!--NeedCopy-->
```

If printing is still not working, check the CUPS framework. The **ctxcups** service is used for printer management and communicates with the Linux CUPS framework. It is a single process per machine and can be checked by running the following command:

```
1 service ctxcups status
2 <!--NeedCopy-->
```

### Extra steps for collecting CUPS logs

To collect CUPS logs, run the following commands to configure the CUPS service file. Otherwise, CUPS logs cannot be recorded in **hdx.log**:

```
1 sudo service cups stop
2
3 sudo vi /etc/systemd/system/printer.target.wants/cups.service
4
5 PrivateTmp=false
6
7 sudo service cups start
8
```

```
9 sudo systemctl daemon-reload
10 <!--NeedCopy-->
```

**Note:**

This configuration is made only for collecting the full printing log when an issue arises. Under normal circumstances, this configuration is not recommended because it breaks CUPS security.

**Print output is garbled**

An incompatible printer driver can cause garbled output. A per-user driver configuration is available and can be configured by editing the `~/.CtXlpProfile$CLIENT_NAME` configuration file:

```
1 [DEFAULT_PRINTER]
2
3 printername=
4
5 model=
6
7 ppdpath=
8
9 drivertype=
10 <!--NeedCopy-->
```

**Important:**

The **printername** is a field containing the name of the current client-side default printer. It is a read-only value. Do not edit it.

The fields **ppdpath**, **model**, and **drivertype** cannot be set at the same time because only one takes effect for the mapped printer.

- If the Universal Printer driver is not compatible with the client printer, configure the model of the native printer driver using the **model=** option. You can find the current model name of the printer by using the **lpinfo** command:

```
1 lpinfo -m
2
3 ...
4
5 xerox/ph3115.ppd.gz Xerox Phaser 3115, SpliX V. 2.0.0
6
```

```
7 xerox/ph3115fr.ppd.gz Xerox Phaser 3115, SpliX V. 2.0.0
8 xerox/ph3115pt.ppd.gz Xerox Phaser 3115, SpliX V. 2.0.0
9
10 <!--NeedCopy-->
```

You can then set the model to match the printer:

```
1 model=xerox/ph3115.ppd.gz
2 <!--NeedCopy-->
```

- If the Universal Printer driver is not compatible with the client printer, configure the PPD file path of the native printer driver. The value of **ppdpath** is the absolute path of the native printer driver file.

For example, there is a **ppd driver** under `/home/tester/NATIVE_PRINTER_DRIVER.ppd`:

```
1 ppdpath=/home/tester/NATIVE_PRINTER_DRIVER.ppd
2 <!--NeedCopy-->
```

- There are three types of Universal Printer Driver supplied by Citrix (postscript, pcl5, and pcl6). You can configure the driver type based on your printer properties.

For example, if the client default printer driver type is PCL5, set **drivertype** to:

```
1 drivertype=pcl5
2 <!--NeedCopy-->
```

### Output size is zero

Try different types of printers. And try a virtual printer like CutePDF and PDFCreator to find out whether this issue is related to the printer driver.

The print job depends on the printer driver of the client default printer. It's important to identify the type of the current active driver type. If the client printer is using a PCL5 driver but the Linux VDA chooses a Postscript driver, an issue can occur.

If the printer driver type is correct, you can identify the problem by performing the following steps:

1. Log on to a published desktop session.
2. Run the **vi ~/.CtxlpProfile\$CLIENT\_NAME** command.

3. Add the following field to save the spool file on the Linux VDA:

```
1 deletespoolfile=no
2 <!--NeedCopy-->
```

4. Log off and back on to load the configuration changes.
5. Print the document to reproduce the issue. After printing, a spool file is saved under **/var/spool/cups-ctx/\$logon\_user/\$spool\_file**.
6. Check whether the spool is empty. If the spool file is zero, it represents an issue. Contact Citrix Support (and provide the printing log) for more guidance.
7. If the spool size is not zero, copy the file to the client. The spool file content depends on the printer driver type of the client default printer. If the mapped printer (native) driver is postscript, the spool file can be opened in the Linux OS directly. Check whether the content is correct.  
  
If the spool file is PCL, or if the client OS is Windows, copy the spool file to the client and print it on the client-side printer by using a different printer driver.
8. Change the mapped printer to use a different printer driver. The following example uses the postscript client printer as an example:
  - a) Log on to an active session and open a browser on the client desktop.
  - b) Open the printing management portal:

```
1 localhost:631
2 <!--NeedCopy-->
```

- c) Choose the mapped printer **CitrixUniversalPrinter:\$ClientName:app/dsk\$SESSION\_ID** and **Modify Printer**. This operation requires administrator privileges.
- d) Retain the cups-ctx connection, then click Continue to change the printer driver.
- e) In the **Make** and **Model** fields, choose a different printer driver from the Citrix UPD driver. For example, if the CUPS-PDF virtual printer is installed, select the Generic CUPS-PDF Printer driver. Save the change.
- f) If this process succeeds, configure the PPD file path of the driver in **.CtxlpProfile\$CLIENT\_NAME** to allow the mapped printer to use the newly selected driver.

## Known issues

The following issues have been identified during printing on the Linux VDA:

### CTXPS driver is not compatible with some PLC printers

If you encounter printing output corruption, set the printer driver to the native one provided by the manufacturer.

### Slow printing performance for large documents

When you print a large document on a local client printer, the document is transferred over the server connection. On slow connections, the transfer can take a long time.

### Printer and print job notifications seen from other sessions

Linux does not have the same session concept as the Windows operating system. Therefore, all users get system-wide notifications. You can disable these notifications by changing the CUPS configuration file: **/etc/cups/cupsd.conf**.

Locate the current policy name configured in the file:

```
DefaultPolicy default
```

If the policy name is *default*, add the following lines to the default policy XML block:

```
1 <Policy default>
2
3     # Job/subscription privacy...
4
5     JobPrivateAccess default
6
7     JobPrivateValues default
8
9     SubscriptionPrivateAccess default
10
11    SubscriptionPrivateValues default
12
13    ... ..
14
15    <Limit Create-Printer-Subscription>
16
17        Require user @OWNER
18
19        Order deny,allow
20
21    </Limit>
22
```

```
23     <Limit All>
24
25         Order deny,allow
26
27     </Limit>
28
29 </Policy>
30 <!--NeedCopy-->
```

## File copy and paste

March 10, 2021

Using Citrix Virtual Apps and Desktops 2006 and Citrix Workspace app 1903 or later for Windows, users can now copy and paste files between a session and a local client. Copy and paste functions by using the right-click menu or keyboard shortcuts.

To successfully copy and paste files, ensure that:

- The maximum number of files does not exceed 20.
- The maximum file size does not exceed 200 MB.

### Supported platforms

The file copy and paste feature is available for:

- RHEL 7.8
- SLES 12.5
- Ubuntu 16.04
- Ubuntu 18.04

### Relevant policies

The following clipboard policies are relevant to configuring the feature. For more information about the clipboard policies, see [Policy support list](#).

- Client clipboard redirection
- Clipboard selection update mode
- Primary selection update mode



## Limitations

- Cut is not supported. Requests to cut a file are treated as copy.
- Drag and drop is not supported.
- Copying directories is not supported.

## File transfer

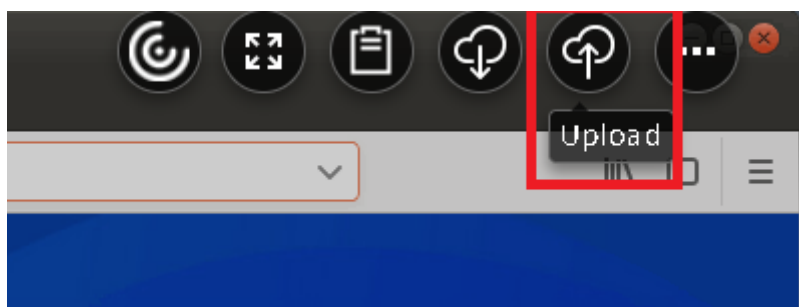
March 10, 2021

File transfer is supported between the Linux VDA and the client device. This feature is available when the client device runs a web browser that supports the HTML5 sandbox attribute. The HTML5 sandbox attribute allows users to access virtual desktops and apps using Citrix Workspace app for HTML5 and for Chrome.

### Note:

File transfer is available for Citrix Workspace app for HTML5 and for Chrome.

Within published app and desktop sessions, file transfer allows file uploads and downloads between the Linux VDA and the client device. To upload files from the client device to the Linux VDA, click the **Upload** icon on the toolbar of Citrix Workspace app and select the file you want from the file dialogs. See the following screen capture. To download files from the Linux VDA to the client device, click the **Download** icon.



### Note:

To upload and download files between the Linux VDA and the client device, ensure that the toolbar of Citrix Workspace app is enabled.

Auto-download is an enhancement for file transfer. Files you download or move to the **Save to My Device** directory on the VDA are automatically transferred to the client device.

### Note:

Auto-download requires the **Allow file transfer between desktop and client** and **Download file**

from desktop policies to be set to **Allowed**.

Here are some use cases for auto-download:

- Download files to **Save to My Device**

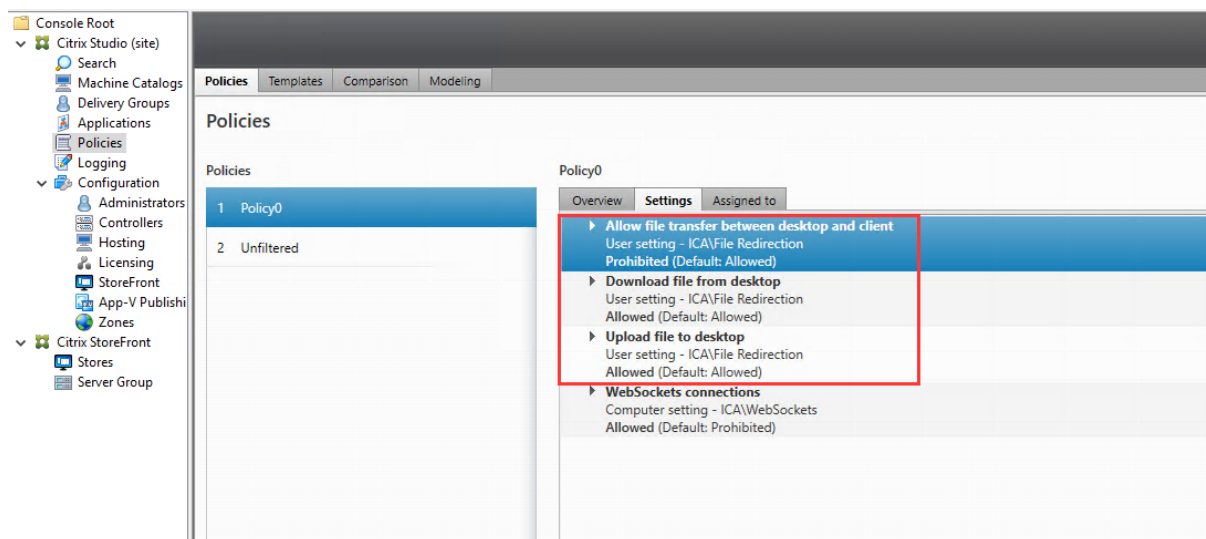
Within published desktop and web browser app sessions, files you download from websites can be saved to the **Save to My Device** directory on the VDA for automatic transfer to the client device. To achieve auto-download, set the default download directory of the in-session web browser to **Save to My Device** and set a local download directory in the web browser that runs your Citrix Workspace app for HTML5 or for Chrome.

- Move or copy files to **Save to My Device**

Within published desktop sessions, choose the target files and move or copy them to the **Save to My Device** directory for availability on the client device.

## File transfer policies

You can use Citrix Studio to set the file transfer policies. By default, file transfer is enabled.



Policy descriptions:

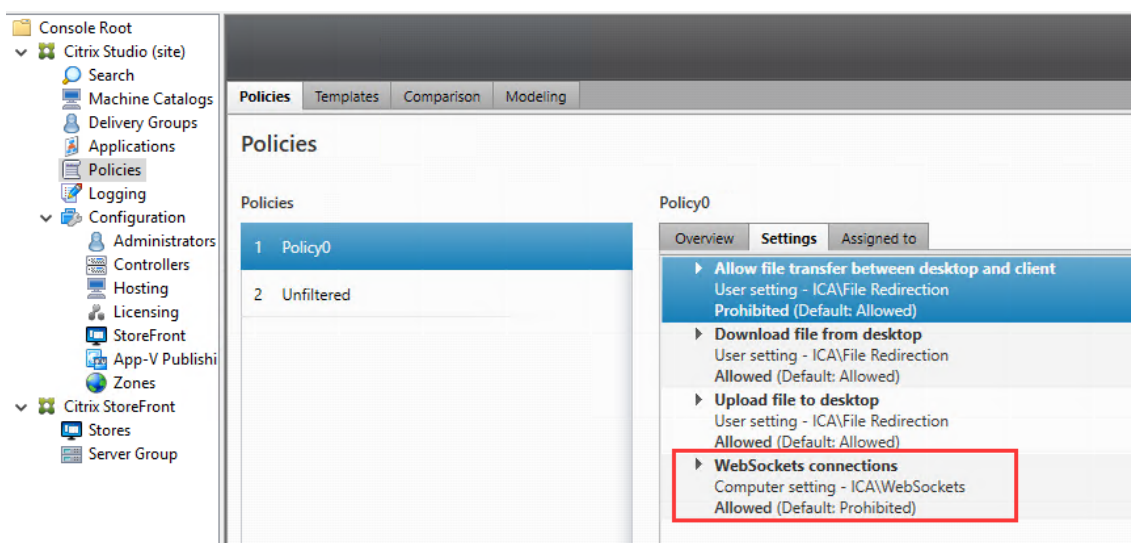
- **Allow file transfer between desktop and client.** Allows or prevents users from transferring files between a Citrix Virtual Apps and Desktops session and their devices.
- **Download file from desktop.** Allows or prevents users from downloading files from a Citrix Virtual Apps and Desktops session to their device.
- **Upload file to desktop.** Allows or prevents users from uploading files from their device to a Citrix Virtual Apps and Desktops session.

**Note:**

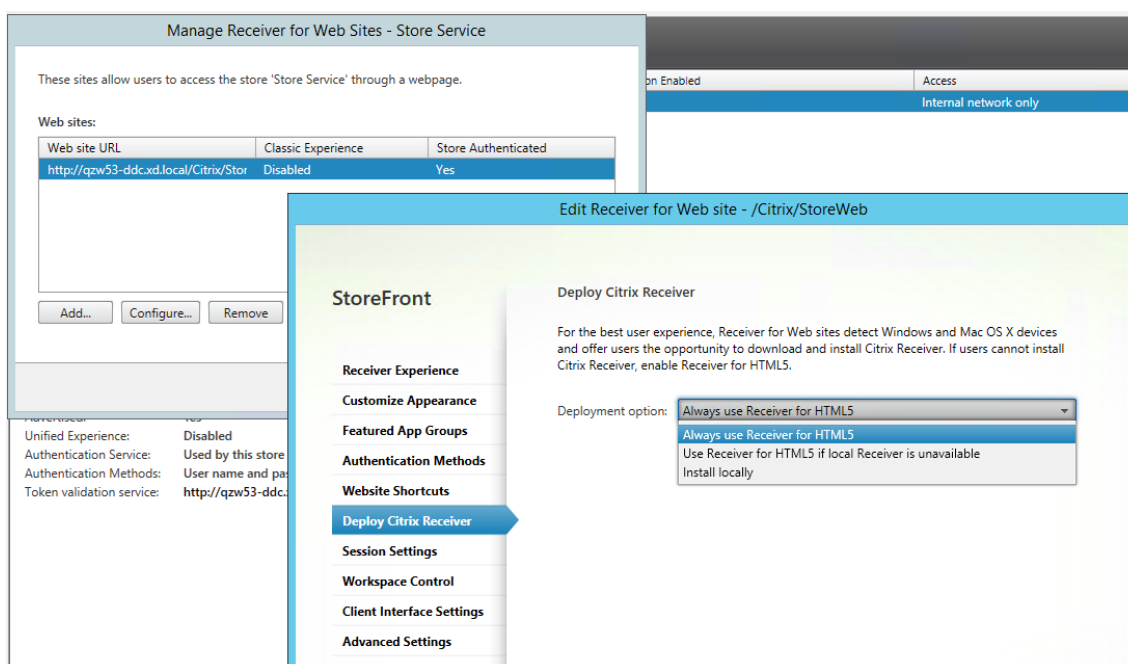
To ensure that the **Download file from desktop** and **Upload file to desktop** policies take effect, set the **Allow file transfer between desktop and client** policy to **Allowed**.

**Usage****To use the file transfer feature through Citrix Workspace app for HTML5:**

1. In Citrix Studio, set the **WebSockets connections** policy to **Allowed**.



2. In Citrix Studio, enable file transfer through the file transfer policies described earlier.
3. In the Citrix StoreFront management console, click **Stores**, select the **Manage Receiver for Web Sites** node, and enable Citrix Receiver for HTML5 by selecting the **Always use Receiver for HTML5** option.



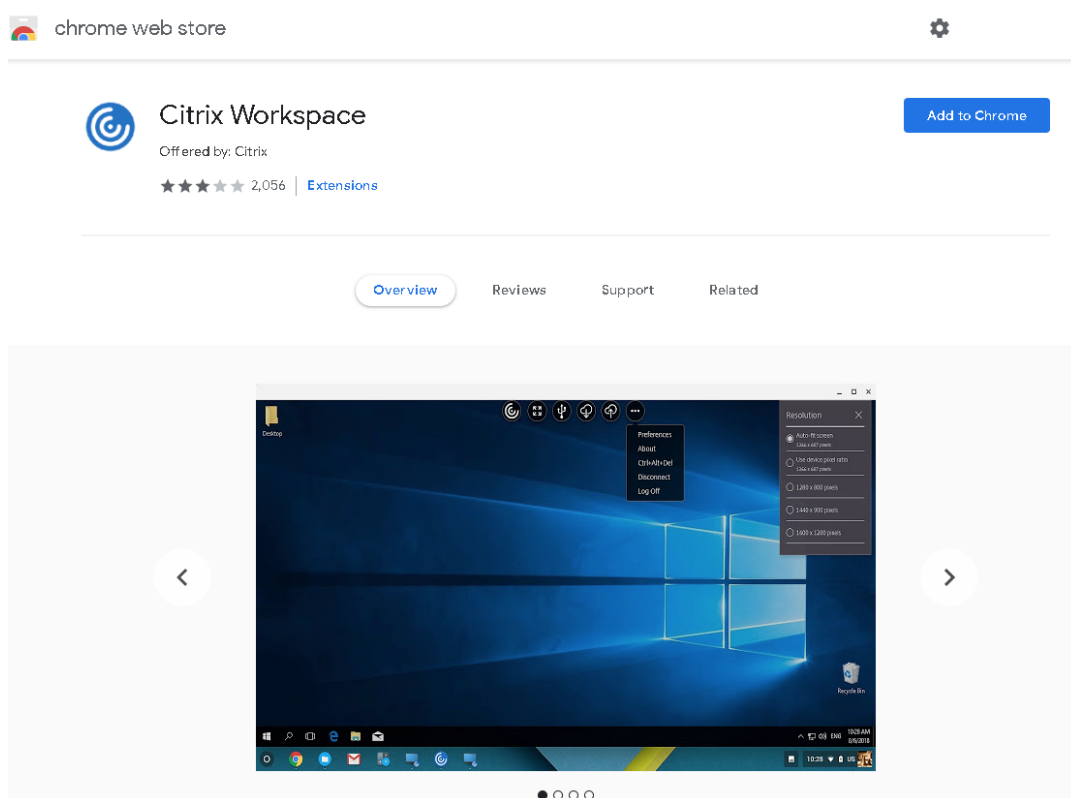
4. Launch a virtual desktop or web browser app session. Perform one or more file transfers between the Linux VDA and your client device.

**To use the file transfer feature through Citrix Workspace app for Chrome:**

1. Enable file transfer through the file transfer policies described earlier.
2. Obtain Citrix Workspace app from the Chrome Web Store.

Skip this step if you already added Citrix Workspace app for Chrome to the Chrome Apps page.

- a) Type **Citrix Workspace for Chrome** in the search box of Google Chrome. Click the search icon.
- b) Among the search results, click the URL to the Chrome Web Store where Citrix Workspace app is available.



- c) Click **Add to Chrome** to add Citrix Workspace app to Google Chrome.
3. Click Citrix Workspace app for Chrome on the Chrome Apps page.
4. Type the URL of your StoreFront store to connect.  
Skip this step if you typed the URL before.
5. Launch a virtual desktop or app session. Perform one or more file transfers between the Linux VDA and your client device.

## PDF printing

March 10, 2021

Using a version of Citrix Workspace app that supports PDF printing, you can print PDFs converted from within the Linux VDA sessions. Session print jobs are sent to the local machine where Citrix Workspace app is installed. On the local machine, you can open PDFs using your PDF viewer of choice and print them on your printer of choice.

The Linux VDA supports PDF printing on the following versions of Citrix Workspace app:

- Citrix Receiver for HTML5 Versions 2.4 through 2.6.9, Citrix Workspace app 1808 for HTML5 and later

- Citrix Receiver for Chrome Versions 2.4 through 2.6.9, Citrix Workspace app 1808 for Chrome and later
- Citrix Workspace app 1905 for Windows and later

## Configuration

Apart from using a version of Citrix Workspace app that supports PDF printing, enable the following policies in Citrix Studio:

- **Client Printer Redirection** (enabled by default)
- **Auto-create PDF Universal Printer** (disabled by default)

With these policies enabled, a print preview appears on the local machine for you to select a printer when you click **Print** within your launched session. See the [Citrix Workspace app documentation](#) for information about setting default printers.

## Configure graphics

March 10, 2021

This article provides guidance for the Linux VDA graphics configuration and fine-tuning.

For more information, see [System requirements](#) and the [Installation overview](#) section.

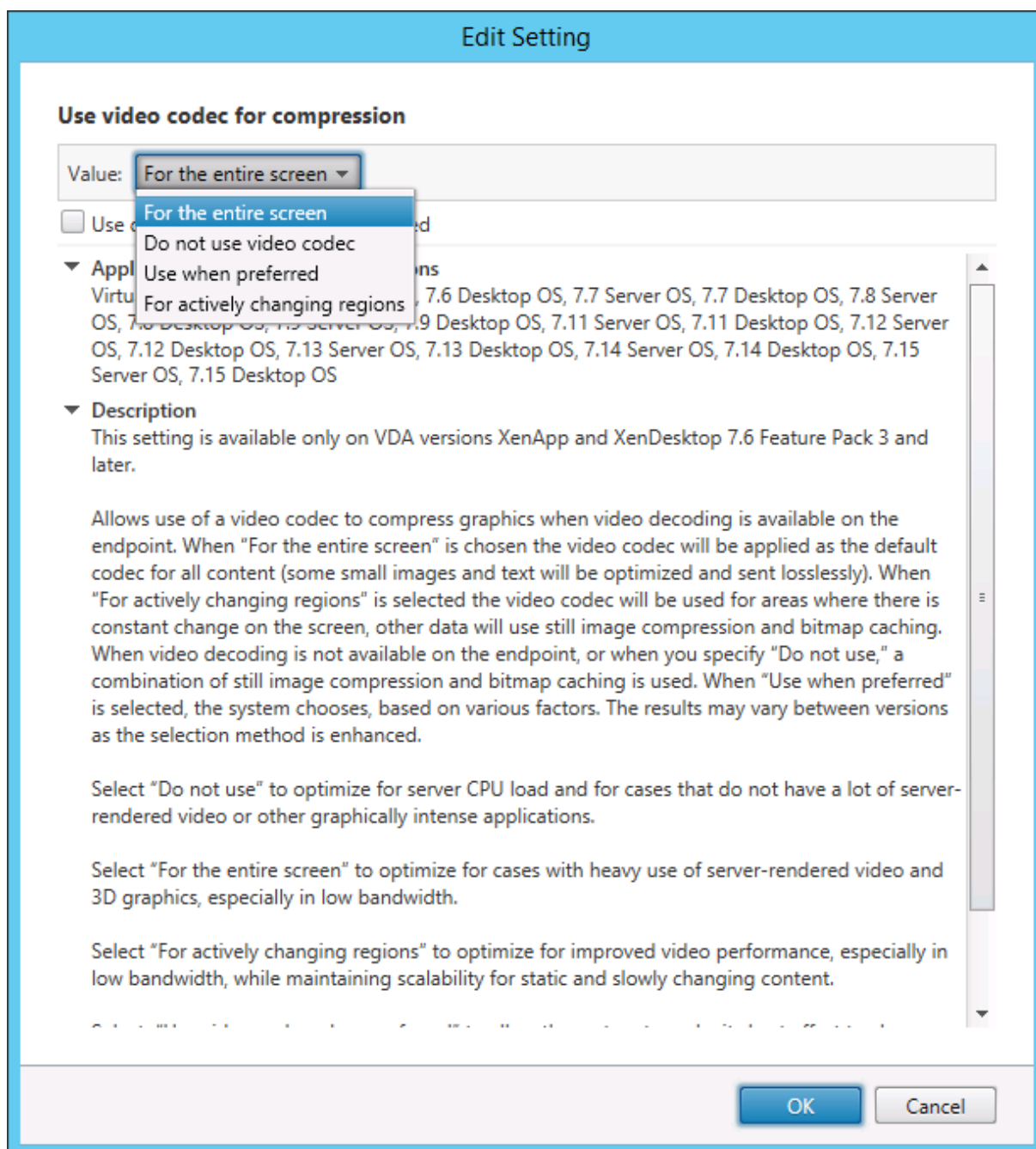
## Configuration

Thinwire is the display remoting technology used in the Linux VDA. The technology allows graphics generated on one machine to be transmitted, typically across a network, to another machine for display.

The [Use video codec for compression](#) graphics policy sets the default graphics mode and provides the following options for different use cases:

- **Use when preferred.** This setting is the default. No additional configuration is required. Keeping this setting ensures that Thinwire is selected for all Citrix connections, and optimized for scalability, bandwidth, and superior image quality for typical desktop workloads.
- **For the entire screen.** Delivers Thinwire with full-screen H.264 or H.265 to optimize for improved user experience and bandwidth, especially in cases with heavy use of 3D graphics.
- **For actively changing regions.** The adaptive display technology in Thinwire identifies moving images (video, 3D in motion), and uses H.264 only in the part of the screen where the image is moving. The *selective use of the H.264 video codec* enables HDX Thinwire to detect and encode parts of the screen that are frequently updated using the H.264 video codec, for example, video

content. Still image compression (JPEG, RLE) and bitmap caching continue to be used for the rest of the screen, including text and photographic imagery. Users get the benefit of lower bandwidth and better quality for video content combined with lossless text or high quality imagery elsewhere. To enable this feature, change the policy setting **Use video codec for compression** to **Use when preferred** (default) or **For actively changing regions**. For more information, see [Graphics policy settings](#).



Some other policy settings, including the following visual display policy settings can be used to fine-tune the performance of display remoting:

- [Preferred color depth for simple graphics](#)
- [Target frame rate](#)
- [Visual quality](#)

### **Use H.264 for Build to Lossless in Thinwire**

By default, the **Build to Lossless** preference of the **Visual quality** policy setting is now H.264 instead of JPEG for moving images.

H.264 encoding offers superior image quality. The **Use video codec for compression** policy controls that preference, with the default being **Use when preferred**. To force **Build to Lossless** to use JPEG, set the **Use video codec for compression** policy to **Do not use video codec**. If your client does not support Selective H.264, **Build to Lossless** falls back to JPEG regardless of the policy settings. Citrix Receiver for Windows 4.9 through 4.12, Citrix Receiver for Linux 13.5 through 13.10, Citrix Workspace app 1808 for Windows and later, and Citrix Workspace app 1808 for Linux and later support Selective H.264. For more information about the **Visual quality** and **Use video codec for compression** policy settings, see [Visual display policy settings](#) and [Graphics policy settings](#).

### **Support for H.265 video codec**

Starting with the 7.18 release, the Linux VDA supports the H.265 video codec for hardware acceleration of remote graphics and videos. You can use this feature on Citrix Receiver for Windows 4.10 through 4.12 and on Citrix Workspace app 1808 for Windows and later. To benefit from this feature, enable it on both the Linux VDA and on your client. If the GPU of your client does not support H.265 decoding using the DXVA interface, the H.265 Decoding for graphics policy setting is ignored and the session falls back to using the H.264 video codec. For more information, see [H.265 video encoding](#).

To enable H.265 hardware encoding on the VDA:

1. Enable the **Use hardware encoding for video codec** policy.
2. Enable the **Optimize for 3D graphics workload** policy
3. Ensure that the **Use video codec for compression** policy is default or set to **For the entire screen**.
4. Ensure that the **Visual quality** policy is **NOT** set to **Build to Lossless** or **Always Lossless**.

To enable H.265 hardware encoding on your client, see [H.265 video encoding](#).

### **Support for YUV444 software encoding**

The Linux VDA supports YUV444 software encoding. The YUV encoding scheme assigns both brightness and color values to each pixel. In YUV, ‘Y’ represents the brightness, or ‘luma’ value, and ‘UV’ represents the color, or ‘chroma’ values. You can use this feature of the Linux VDA on Citrix Receiver for Windows 4.10 through 4.12 and on Citrix Workspace app 1808 for Windows and later.



Each unique Y, U, and V value comprises 8 bits, or one byte, of data. The YUV444 data format transmits 24 bits per pixel. The YUV422 data format shares U and V values between two pixels, which results in an average transmission rate of 16 bits per pixel. The following table shows an intuitive comparison between YUV444 and YUV420.

YUV444				YUV420			
	A	B	C		A	B	C
1	Citrix	Citrix	Citrix	1	Citrix	Citrix	Citrix
2	Citrix	Citrix	Citrix	2	Citrix	Citrix	Citrix
3	Citrix	Citrix	Citrix	3	Citrix	Citrix	Citrix
4	Citrix	Citrix	Citrix	4	Citrix	Citrix	Citrix
5	Citrix	Citrix	Citrix	5	Citrix	Citrix	Citrix
6	Citrix	Citrix	Citrix	6	Citrix	Citrix	Citrix

To enable YUV444 software encoding on the VDA:

1. Enable the **Allow visually lossless compression** policy.
2. Ensure that the **Use video codec for compression** policy is set to **For the entire screen**.
3. Ensure that the **Visual quality** policy is set to **Always Lossless** or **Build to Lossless**.

### Adjust average bit rates based on bandwidth estimates

Citrix enhances HDX 3D Pro hardware encoding by adjusting average bit rates based on bandwidth estimates.

When the HDX 3D Pro hardware encoding is in use, the VDA can intermittently estimate the bandwidth of the network and adjust the bit rates of encoded frames based on the bandwidth estimates. This new feature provides a mechanism to balance between sharpness and fluency.

This feature is enabled by default. To disable it, run the following command:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SYSTEM\
   CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "
   DisableReconfigureEncoder" -d "0x00000001" --force
2 <!--NeedCopy-->
```

In addition to using this feature, you can also run the following commands to adjust between sharpness and fluency. The **AverageBitRatePercent** and **MaxBitRatePercent** parameters set the percentage of bandwidth usage. The higher values you set, the sharper graphics and lower fluency you get. The recommended setting range is 50–100.

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SYSTEM\
  CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "
  AverageBitRatePercent" -d "90" --force
2
3 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SYSTEM\
  CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "
  MaxBitRatePercent" -d "100" --force
4 <!--NeedCopy-->
```

In the average bit rate adjustment, when your screen holds still, the most recent frame stays in a low-quality state because no new frames are sent. Sharpening support can address this issue by reconfiguring and immediately sending the most recent frame at the highest quality.

For a full list of the policies supported by the Linux VDA Thinwire, see [Policy support list](#).

For information on the configuration of multi-monitor support on the Linux VDA, see [CTX220128](#).

## Troubleshooting

### Check which graphics mode is in use

Run the following command to check which graphics mode is in use (**0** means TW+; **1** means full-screen video codec):

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep GraphicsMode
2 <!--NeedCopy-->
```

The result resembles:

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
GraphicsMode"-d "0x00000000"--force
```

### Check whether H.264 is in use

Run the following command to check whether H.264 is in use (**0** means not in use; **1** means in use):

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep H264
2 <!--NeedCopy-->
```

The result resembles:

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
H264"-d "0x00000000"--force
```

### Check whether H.265 is in use

Run the following command to check whether full-screen H.265 is in use (**0** means not in use; **1** means in use):

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep H265
2 <!--NeedCopy-->
```

The result resembles:

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
H265"-d "0x00000000"--force
```

### Check which YUV encoding scheme is in use

Run the following command to check which YUV encoding scheme is in use (**0** means YUV420. **1** means YUV422. **2** means YUV444):

**Note:** The value of YUVFormat is meaningful only when a video codec is in use.

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep YUVFormat
2 <!--NeedCopy-->
```

The result resembles:

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
YUVFormat"-d "0x00000000"--force
```

### Check whether YUV444 software encoding is in use

Run the following command to check whether YUV444 software encoding is in use:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep Graphics
2 <!--NeedCopy-->
```

When YUV444 is in use, the result resembles:

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
GraphicsMode"-d "0x00000001"--force
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
H264"-d "0x00000001"--force
```

```
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
HardwareEncoding"-d "0x00000000"--force
create -k "HKLM\Software\Citrix\Ica\Session\4\Graphics"-t "REG_DWORD"-v "
YUVFormat"-d "0x00000002"--force
```

### Check whether hardware encoding is in use for 3D Pro

Run the following command (**0** means not in use; **1** means in use):

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep HardwareEncoding
2 <!--NeedCopy-->
```

The results resemble:

```
create -k "HKLM\Software\Citrix\Ica\Session\1\Graphics"-t "REG_DWORD"-v "
HardwareEncoding"-d "0x00000001"--force
```

Another way is to use the **nvidia-smi** command. The outputs resemble the following if hardware encoding is in use:

```
1 Tue Apr 12 10:42:03 2016
2 +-----+
3 | NVIDIA-SMI 361.28      Driver Version: 361.28      |
4 |-----+-----+-----+-----+-----+-----+
5 | GPU   Name           Persistence-M| Bus-Id        Disp.A | Volatile
   |   Uncorr. ECC |
6 | Fan  Temp  Perf    Pwr:Usage/Cap|      Memory-Usage | GPU-Util
   |   Compute M. |
7 |====+-----+-----+-----+-----+=====+
8 |    0  GRID K1                Off   | 0000:00:05.0    Off   |
   |                  N/A |
9 | N/A   42C    P0     14W / 31W |  207MiB / 4095MiB |      8%
   |   Default |
10 +-----+-----+-----+-----+-----+-----+
11
12 +-----+-----+-----+-----+-----+-----+
13 | Processes:                                     GPU
   |   Memory |
```

```

14 | GPU          PID  Type  Process name
    | Usage          |
15 | =====
16 |    0         2164 C+G   /usr/local/bin/ctxgfx
    | 106MiB |
17 |    0         2187  G    Xorg
    | 85MiB  |
18 +-----+
19 <!--NeedCopy-->

```

**Verify that the NVIDIA GRID graphics driver is installed correctly**

To verify that the NVIDIA GRID graphics driver is installed correctly, run **nvidia-smi**. The results resemble:

```

1  +-----+
2  | NVIDIA-SMI 352.70      Driver Version: 352.70      |
3  |-----+-----+-----+
4  | GPU  Name          Persistence-M| Bus-Id        Disp.A | Volatile
    | Uncorr. ECC |
5  | Fan  Temp  Perf  Pwr:Usage/Cap|      Memory-Usage | GPU-Util
    | Compute M. |
6  |=====+=====+=====+
7  |   0  Tesla M60           Off | 0000:00:05.0   Off |
    |           Off |
8  | N/A   20C    P0     37W / 150W |    19MiB /  8191MiB |    0%
    | Default |
9  +-----+-----+-----+
10
11 +-----+
12 | Processes:                                     GPU
    | Memory |
13 | GPU          PID  Type  Process name
    | Usage          |
14 |=====

```

```
15 | No running processes found
```

```
16
```

```
17 <!--NeedCopy-->
```

Set the correct configuration for the card:

```
etc/X11/ctx-nvidia.sh
```

### **HDX 3D Pro multi-monitor redraw issues**

If you are seeing redraw issues on screens other than the primary monitor, check that the NVIDIA GRID license is available.

### **Check Xorg error logs**

The log file of Xorg is named similar to **Xorg.{DISPLAY}.log** in the `/var/log/` folder.

### **Known issues and limitations**

#### **For vGPU, the Citrix Hypervisor local console shows the ICA desktop session screen**

**Workaround:** Disable the VM’s local VGA console by running the following command:

```
1 xe vm-param-set uuid=<vm-uuid> platform:vgpu_extra_args="disable_vnc=1"  
2 <!--NeedCopy-->
```

#### **NVIDIA K2 graphics cards do not support YUV444 hardware encoding in pass-through mode**

With **Build to Lossless** enabled through the policy setting, a black or gray screen appears when users are launching an app/desktop session with an NVIDIA K2 graphics card. The issue occurs because NVIDIA K2 graphics cards do not support YUV444 hardware encoding in pass-through mode. For more information, see [Video Encode and Decode GPU Support Matrix](#).

#### **Gnome 3 desktop popups slow when logging on**

It is a limitation of Gnome 3 desktop session startup.

## Some OpenGL/WebGL applications do not render well upon resizing the Citrix Workspace app window

Resizing the window of Citrix Workspace app changes the screen resolution. The NVIDIA proprietary driver changes some internal states and might require applications to respond accordingly. For example, the WebGL library element **lightgl.js** might spawn an error saying that `'Rendering to this texture is not supported (incomplete frame buffer)'`.

## Thinwire progressive display

March 10, 2021

Session interactivity can degrade on low bandwidth or high latency connections. For example, on connections with less than 2 Mbps bandwidth or latency of more than 200 ms, scrolling on a webpage can become slow, unresponsive, or choppy. Keyboard and mouse operations can lag behind graphics updates.

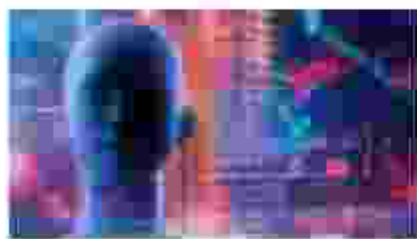
Through version 7.17, you were able to use policy settings to reduce bandwidth consumption by configuring the session to **Low** visual quality, or setting a lower color depth (16-bit or 8-bit graphics). However, you had to know that a user was on a weak connection. HDX Thinwire did not dynamically adjust static image quality based on network conditions.

Starting with Version 7.18, HDX Thinwire, by default, switches to a progressive update mode when available bandwidth falls below 2 Mbps, or network latency exceeds 200 ms. In this mode:

- All static images are heavily compressed.
- Text quality is reduced.

For example, in the following graphic where progressive update mode is active, the letters **F** and **e** have blue artifacts, and the image is heavily compressed. This approach significantly reduces bandwidth consumption, which allows images and text to be received more quickly, and session interactivity improves.

### Features



When you stop interacting with the session, the degraded images and text are progressively sharpened to lossless. For example, in the following graphic, the letters no longer contain blue artifacts, and the image appears at source quality.

## Features



For images, sharpening uses a random block-like method. For text, individual letters or parts of words are sharpened. The sharpening process occurs over several frames. This approach avoids introducing a delay with a single large sharpening frame.

Transient imagery (video) is still managed with adaptive display or Selective H.264.

### How progressive mode is used

By default, progressive mode is on standby for the **Visual quality** policy settings: **High**, **Medium** (default), and **Low**.

Progressive mode is forced off (not used) when:

- **Visual quality = Always Lossless** or **Build to Lossless**
- **Preferred color depth for simple graphics = 8-bit**
- **Use video codec for compression = For the entire screen** (when full-screen H.264 is desired)

When progressive mode is on standby, by default it is enabled when either of the following conditions occurs:

- Available bandwidth drops below 2 Mbps
- Network latency increases above 200 ms

After a mode switch occurs, a minimum of 10 s is spent in that mode, even if the adverse network conditions are momentary.

### Change progressive mode behavior

You can change the progressive mode behavior by running the following command:



```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SOFTWARE\  
CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "  
ProgressiveDisplay" -d "<value>" --force  
2 <!--NeedCopy-->
```

where <value>:

0 = Always off (do not use under any circumstances)

1 = Automatic (toggle based on network conditions, default value)

2 = Always on

When in automatic mode (1), you can run either of the following commands to change the thresholds at which progressive mode is toggled:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SYSTEM\  
CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "  
ProgressiveDisplayBandwidthThreshold" -d "<value>" --force  
2 <!--NeedCopy-->
```

where <value> is <threshold in Kbps> (default = 2,048)

Example: 4096 = toggle progressive mode on if bandwidth falls below 4 Mbps

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SOFTWARE\  
\CurrentControlSet\Control\Citrix\Thinwire" -t "REG_DWORD" -v "  
ProgressiveDisplayLatencyThreshold" -d "<value>" --force  
2 <!--NeedCopy-->
```

where <value> is <threshold in ms> (default = 200)

Example: 100 = toggle progressive mode on if network latency drops below 100 ms.

## Non-GRID 3D graphics

June 10, 2022

### Overview

With this feature enhancement, the Linux VDA supports not only NVIDIA GRID 3D cards but also non-GRID 3D cards.

## Installation

To use the non-GRID 3D graphics feature, you must:

- Install XDamage as a prerequisite. Typically, XDamage exists as an extension of XServer.
- Set `CTX_XDL_HDX_3D_PRO` to `Y` when installing the Linux VDA. For information about environment variables, see [Step 3: Set up the runtime environment to complete the installation](#).

## Configuration

### Xorg configuration files

If your 3D card driver is NVIDIA, the configuration files are installed and set automatically.

### Other types of 3D cards

If your 3D card driver is NOT NVIDIA, you must modify the four template configuration files installed under `/etc/X11/`:

- `ctx-driver_name-1.conf`
- `ctx-driver_name-2.conf`
- `ctx-driver_name-3.conf`
- `ctx-driver_name-4.conf`

Using **`ctx-driver_name-1.conf`** as an example, do the following to modify the template configuration files:

1. Replace **`driver_name`** with your actual driver name.

For example, if your driver name is `intel`, you can change the configuration file name to `ctx-intel-1.conf`.

2. Add the video driver information.

Each template configuration file contains a section named “Device,” which is commented out. This section describes the video driver information. Enable this section before adding your video driver information. To enable this section:

- a) See the 3D card guide provided by the manufacturer for configuration information. A native configuration file can be generated. Verify that your 3D card can work in a local environment with the native configuration file when you are not using a Linux VDA ICA session.
  - b) Copy the “Device” section of the native configuration file to **`ctx-driver_name-1.conf`**.
3. Run the following command to set the registry key so that the Linux VDA can recognize the configuration file name set in Step 1.

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\System\
  CurrentControlSet\Control\Citrix\XDamage" -t "REG_SZ" -v "
  DriverName" -d "intel" --force
2 <!--NeedCopy-->
```

### Enable the non-GRID 3D graphics feature

The non-GRID 3D graphics feature is disabled by default. You can run the following command to enable it by setting XDamageEnabled to 1.

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\System\
  CurrentControlSet\Control\Citrix\XDamage" -t "REG_DWORD" -v "
  XDamageEnabled" -d "0x00000001" --force
2 <!--NeedCopy-->
```

## Troubleshooting

### No or garbled graphic output

If you can run 3D applications locally and all configurations are correct, missing or garbled graphic output is the result of a bug. Use `/opt/Citrix/VDA/bin/setlog` and set `GFX_X11` to verbose to collect the trace information for debugging.

### Hardware encoding does not work

This feature supports only software encoding.

## Configure policies

March 10, 2021

### Installation

Follow the installation articles to prepare the Linux VDA.

## Dependencies

Ensure that you install these dependencies before installing the Linux VDA package.

### RHEL/CentOS:

```
1 sudo yum -y install openldap
2
3 sudo yum -y install libxml2
4
5 sudo yum -y install cyrus-sasl
6
7 sudo yum -y install cyrus-sasl-gssapi
8 <!--NeedCopy-->
```

### SLES/SELD:

```
1 sudo zypper install openldap2
2
3 sudo zypper install libxml2
4
5 sudo zypper install cyrus-sasl
6
7 sudo zypper install cyrus-sasl-gssapi
8 <!--NeedCopy-->
```

### Ubuntu:

```
1 sudo apt-get install -y libldap-2.4-2
2
3 sudo apt-get install -y libsasl2-2
4
5 sudo apt-get install -y libsasl2-modules-gssapi-mit
6 <!--NeedCopy-->
```

## Configuration

### Policy settings in Citrix Studio

To set policies in Citrix Studio, do the following:

1. Open **Citrix Studio**.
2. Select the **Policies** panel.
3. Click **Create Policy**.
4. Set the policy according to the [Policy support list](#).

### LDAP server setting on the VDA

The LDAP server setting on Linux VDA is optional for single domain environments but mandatory for multiple domain and multiple forest environments. The setting is necessary for the policy service to perform an LDAP search in these environments.

After installing the Linux VDA package, run the command:

```
1 /opt/Citrix/VDA/sbin/ctxsetup.sh
2 <!--NeedCopy-->
```

Type all the LDAP servers in the suggested format: space-separated list of LDAP Fully Qualified Domain Names (FQDNs) with the LDAP port (for example, ad1.mycompany.com:389 ad2.mycompany.com:389).

```
Checking CTX_XDL_LDAP_LIST... value not set.
The Virtual Delivery Agent by default queries DNS to discover LDAP servers, however if DNS is unable to provide
LDAP service records, you may provide a space-separated list of LDAP Fully Qualified Domain Names (FQDNs) with
LDAP port (e.g. ad1.mycompany.com:389).
If required, please provide the FQDN:port of at least one LDAP server. [<none>]: █
```

You can also run the **ctxreg** command to write this setting to the registry directly:

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\
  VirtualDesktopAgent" -t "REG_SZ" -v "ListOfLDAPServers" -d "ad1.
  mycompany.com:389 ad2.mycompany.com:389" --force
2 <!--NeedCopy-->
```

## Policy support list

March 10, 2021

### Linux VDA policy support list

Studio Policy	Key Name	Type	Module	Default Value
Use local time of client	UseLocalTimeOfClient	User	ICA\Time Zone Control	Use server time zone
ICA round trip calculation	IcaRoundTripCheckEnabled	Computer	ICA\End User Monitoring	Enabled (1)
ICA round trip calculation interval	IcaRoundTripCheckInterval	Computer	ICA\End User Monitoring	15
ICA round trip calculations for idle connections	IcaRoundTripCheckOnIdle	Computer	ICA\End User Monitoring	Disabled (0)
Overall session bandwidth limit	LimitOverallBw	User	ICA\Bandwidth	0
Audio redirection bandwidth limit	LimitAudioBw	User	ICA\Bandwidth	0
Audio redirection bandwidth limit percent	LimitAudioBwPercent	User	ICA\Bandwidth	0
Client USB device redirection bandwidth limit	LimitUSBBw	User	ICA\Bandwidth	0
Client USB device redirection bandwidth percent	LimitUSBBwPercent	User	ICA\Bandwidth	0
Clipboard redirection bandwidth limit	LimitClipbdBW	User	ICA\Bandwidth	0
Clipboard redirection bandwidth limit percent	LimitClipbdBWPercent	User	ICA\Bandwidth	0

Studio Policy	Key Name	Type	Module	Default Value
File redirection bandwidth limit	LimitCdmBw	User	ICA\Bandwidth	0
File redirection bandwidth limit percent	LimitCdmBwPerce	User	ICA\Bandwidth	0
Printer redirection bandwidth limit	LimitPrinterBw	User	ICA\Bandwidth	0
Printer redirection bandwidth limit percent	LimitPrinterBwPer	User	ICA\Bandwidth	0
WebSockets connections	AcceptWebSocketsConnections	Computer	ICA\WebSockets	Prohibited
WebSockets port number	WebSocketsPort	Computer	ICA\WebSockets	8008
WebSockets trusted origin server list	WSTrustedOriginServerList	Computer	ICA\WebSockets	*
ICA keep alives	SendICAKeepAlive	Computer	ICA keep alive	Do not send ICA keep alive messages (0)
ICA keep alive timeout	ICAKeepAliveTimeout	Computer	ICA keep alive	60 seconds
ICA listener port number	IcaListenerPortNum	Computer	ICA	1494
HDX adaptive transport	HDXoverUDP	Computer	ICA	Preferred(2)
Session reliability connections	AcceptSessionReliability	Computer	ICA\Session Reliability	Allowed(1)
Reconnection UI transparency level	ReconnectionUITransparencyLevel	Computer	ICA\Auto Client Reconnect	80%

Studio Policy	Key Name	Type	Module	Default Value
Session reliability port number	SessionReliabilityPort	Computer	ICA\Session Reliability	2598
Session reliability timeout	SessionReliabilityTimeout	Computer	ICA\Session Reliability	180 s
Auto Client Reconnect	AllowAutoClientReconnect	User	ICA\Auto Client Reconnect	Allowed (1)
Client audio redirection	AllowAudioRedirection	User	Audio	Allowed (1)
Client printer redirection	AllowPrinterRedirection	User	Printing	Allowed (1)
Auto-create PDF Universal Printer	AutoCreatePDFPrinter	User	Printing	Disabled (0)
Printer driver mapping and compatibility	DriverMappingList	User	Printing	"Microsoft XPS Document Writer *, Deny;Send to Microsoft OneNote *, Deny"
Client clipboard redirection	AllowClipboardRedirection	User	Clipboard	Allowed (1)
Client USB device redirection	AllowUSBRedirection	User	USB	Prohibited (0)
Client USB device redirection rules	USBDeviceRules	User	USB	"\0"
Moving image compression	MovingImageCompression	User	Thinwire	Enabled (1)
Extra color compression	ExtraColorCompression	User	Thinwire	Disabled (0)
Target minimum frame rate	TargetedMinimumFrameRate	User	Thinwire	10 fps



Studio Policy	Key Name	Type	Module	Default Value
Target frame rate	FramesPerSecond	User	Thinwire	30 fps
Visual quality	VisualQuality	User	Thinwire	Medium (3)
Use video codec for compression	VideoCodec	User	Thinwire	Use when preferred (3)
Use hardware encoding for video codec	UseHardwareEnco	User	Thinwire	Enabled (1)
Allow visually lossless compression	AllowVisuallyLosslessCompression	User	Thinwire	Disabled (0)
Optimize for 3D graphics workload	OptimizeFor3dWo	User	Thinwire	Disabled (0)
Preferred color depth for simple graphics	PreferredColorDepth	User	Thinwire	24 bits per pixel(1)
Audio quality	SoundQuality	User	Audio	High – high definition audio (2)
Client microphone redirection	AllowMicrophoneRedir	User	Audio	Allowed (1)
Maximum number of sessions	MaximumNumber	Computer	Load Management	250
Concurrent logons tolerance	ConcurrentLogonsTol	Computer	Load Management	2
Enable auto update of Controllers	EnableAutoUpdate	Computer	Virtual Delivery Agent Settings	Allowed (1)
Clipboard selection update mode	ClipboardSelectionMode	User	Clipboard	3

Studio Policy	Key Name	Type	Module	Default Value
Primary selection update mode	PrimarySelectionL	User	Clipboard	3
Max speex quality	MaxSpeexQuality	User	Audio	5
Auto connect client drives	AutoConnectDrive	User	File redirection/CDM	Enabled (1)
Client optical drives	AllowCdromDrives	User	File redirection/CDM	Allowed (1)
Client fixed drives	AllowFixedDrives	User	File redirection/CDM	Allowed (1)
Client floppy drives	AllowFloppyDrives	User	File redirection/CDM	Allowed (1)
Client network drives	AllowNetworkDriv	User	File redirection/CDM	Allowed (1)
Client drive redirection	AllowDriveRedir	User	File redirection/CDM	Allowed (1)
Read-only client drive access	ReadOnlyMappedI	User	File redirection/CDM	Disabled (0)
Automatic keyboard display	AllowAutoKeyboard	User	MRVC	Disabled (0)
Allow file transfer between desktop and client	AllowFileTransfer	User	File Transfer	Allowed
Download file from desktop	AllowFileDownload	User	File Transfer	Allowed
Upload file to desktop	AllowFileUpload	User	File Transfer	Allowed

**Note:**

Only the Windows Virtual Delivery Agent (VDA) supports audio over User Datagram Protocol (UDP). The Linux VDA does not. For more information, see [Audio over User Datagram Protocol](#)

### (UDP) Real-time Transport.

The following policies can be configured in Citrix Studio Version 7.12 and later.

- MaxSpeexQuality

**Value (integer):** [0–10]

**Default value:** 5

**Details:**

Audio redirection encodes audio data with the Speex codec when audio quality is medium or low (see the policy Audio quality). Speex is a lossy codec, which means that it achieves compression at the expense of fidelity of the input speech signal. Unlike some other speech codecs, it is possible to control the tradeoff made between quality and bit rate. The Speex encoding process is controlled most of the time by a quality parameter that ranges from 0 to 10. The higher the quality is, the higher the bit rate.

The max Speex quality chooses the best Speex quality to encode audio data according to audio quality and bandwidth limit (see the policy Audio redirection bandwidth limit). If the audio quality is medium, the encoder is in wide band mode, which means a higher sampling rate. If the audio quality is low, the encoder is in narrow band mode, which means a lower sampling rate. The same Speex quality has different bit rates in different modes. The best Speex quality is when the largest value meets the following conditions:

- It is equal to or less than the max Speex quality.
- Its bit rate is equal to or less than the bandwidth limit.

**Related Settings:** Audio quality, Audio redirection bandwidth limit

- PrimarySelectionUpdateMode

**Value (enum):** [0, 1, 2, 3]

**Default value:** 3

**Details:**

Primary selection is used when you select data and paste it by pressing the middle mouse button.

This policy controls whether primary selection changes on the Linux VDA and client can update the clipboard on each other. There are four value options:

### Primary selection update mode

Value: Selection changes are not updated on neither client nor host

Use Selection changes are not updated on neither client nor host

Host selection changes are not updated to client

Client selection changes are not updated to host

Selection changes are updated on both client and host

OS, 7.1 Desktop OS, 7.5 Server OS, 7.1 Desktop OS, 7.8 Server OS, 7.8 Desktop OS, 7.9 Server OS, 7.9 Desktop OS, 7.11 Server OS, 7.11 Desktop OS, 7.12 Server OS, 7.12 Desktop OS, 7.13 Server OS, 7.13 Desktop OS, 7.14 Server OS, 7.14 Desktop OS, 7.15 Server OS, 7.15 Desktop OS, 7.16 Server OS, 7.16 Desktop OS, 7.17 Server OS, 7.17 Desktop OS, 7.18 Server OS, 7.18 Desktop OS, 7.19 Server OS, 7.19 Desktop OS

▼ Description

This setting is supported only by Linux VDA version 1.4 onwards.

PRIMARY selection is used for explicit copy/paste actions such as mouse selection and middle mouse button paste. This setting controls whether PRIMARY selection changes on the Linux VDA can be updated on the client's clipboard (and vice versa). It can include one of the following selection changes:

Selection changes are not updated on the client or the host. PRIMARY selection changes do not update a client's clipboard. Client clipboard changes do not update PRIMARY selection.

Host selection changes are not updated on the client. PRIMARY selection changes do not update a client's clipboard. Client clipboard changes update the PRIMARY selection.

Client selection changes are not updated on the host. PRIMARY selection changes update the client's clipboard. Client clipboard changes do not update the PRIMARY selection.

Selection changes are updated on both the client and host. PRIMARY selection change updates the client's clipboard. Client clipboard changes update the PRIMARY selection.

▼ Related settings

Clipboard selection update mode

- **Selection changes are not updated on neither client nor host**  
Primary selection changes on the Linux VDA do not update the clipboard on the client. Primary selection changes on the client do not update the clipboard on the Linux VDA.
- **Host selection changes are not updated to client**  
Primary selection changes on the Linux VDA do not update the clipboard on the client. Primary selection changes on the client update the clipboard on the Linux VDA.
- **Client selection changes are not updated to host**  
Primary selection changes on the Linux VDA update the clipboard on the client. Primary selection changes on the client do not update the clipboard on the Linux VDA.
- **Selection changes are updated on both client and host**  
Primary selection changes on the Linux VDA update the clipboard on the client. Primary selection changes on the client update the clipboard on the Linux VDA. This option is the

default value.

**Related Setting:** Clipboard selection update mode

- ClipboardSelectionUpdateMode

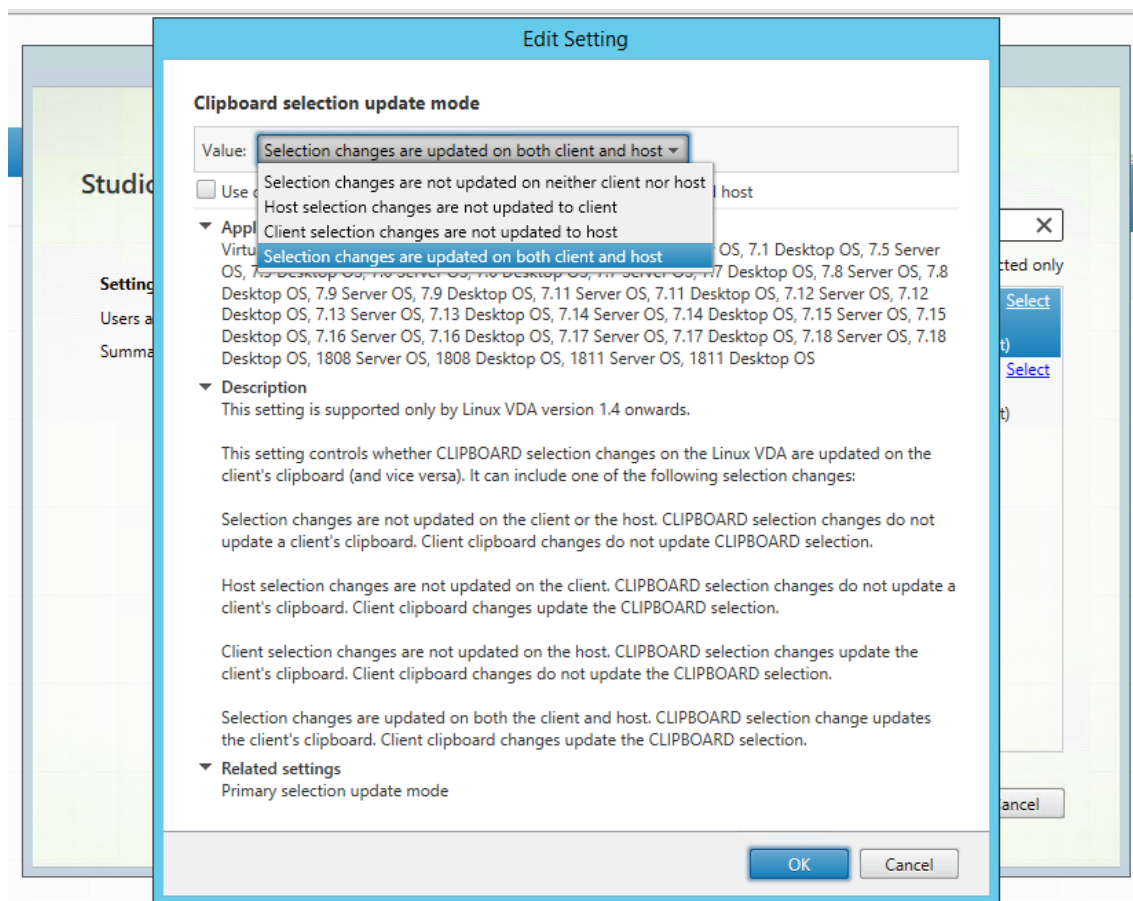
**Value (enum):** [0, 1, 2, 3]

**Default value:** 3

**Details:**

Clipboard selection is used when you select some data and explicitly request it to be “copied” to the clipboard, such as by selecting “Copy” from the shortcut menu. Clipboard selection is primarily used in connection with Microsoft Windows clipboard operations while primary selection is unique to Linux.

This policy controls whether clipboard selection changes on the Linux VDA and client can update the clipboard on each other. There are four value options:



– **Selection changes are not updated on neither client nor host**

Clipboard selection changes on the Linux VDA do not update the clipboard on the client. Clipboard selection changes on the client do not update the clipboard on the Linux VDA.

- **Host selection changes are not updated to client**  
Clipboard selection changes on the Linux VDA do not update the clipboard on the client. Clipboard selection changes on the client update the clipboard on the Linux VDA.
- **Client selection changes are not updated to host**  
Clipboard selection changes on the Linux VDA update the clipboard on the client. Clipboard selection changes on the client do not update the clipboard on the Linux VDA.
- **Selection changes are updated on both client and host**  
Clipboard selection changes on the Linux VDA update the clipboard on the client. Clipboard selection changes on the client update the clipboard on the Linux VDA. This option is the default value.

**Related Setting:** Primary selection update mode

**Note:**

The Linux VDA supports both clipboard selection and primary selection. To control the copy and paste behaviors between the Linux VDA and the client, we recommend that you set both clipboard selection update mode and primary selection update mode to the same value.

## Configure IPv6

March 10, 2021

The Linux VDA supports IPv6 to align with Citrix Virtual Apps and Desktops. When using this feature, consider the following:

- For dual stack environments, IPv4 is used unless IPv6 is explicitly enabled.
- If IPv6 is enabled in an IPv4 environment, the Linux VDA fails to function.

**Important:**

- The whole network environment must be IPv6, not only for the Linux VDA.
- Centrify does not support pure IPv6.

No special setup tasks are required for IPv6 when you install the Linux VDA.

### Configure IPv6 for the Linux VDA

Before changing the configuration for the Linux VDA, ensure that your Linux virtual machine has previously worked in an IPv6 network. There are two registry keys related to IPv6 configuration:

```
1 "HKLM\Software\Policies\Citrix\VirtualDesktopAgent" -t "REG_DWORD"
  -v "OnlyUseIPv6ControllerRegistration"
2 "HKLM\Software\Policies\Citrix\VirtualDesktopAgent" -t "REG_DWORD"
  -v "ControllerRegistrationIPv6Netmask"
3 <!--NeedCopy-->
```

**OnlyUseIPv6ControllerRegistration** must be set to 1 to enable IPv6 on the Linux VDA:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Policies\
  Citrix\VirtualDesktopAgent" -t "REG_DWORD" -v "
  OnlyUseIPv6ControllerRegistration" -d "0x00000001" --force
2 <!--NeedCopy-->
```

If the Linux VDA has more than one network interfaces, **ControllerRegistrationIPv6Netmask** can be used to specify which one is used for the Linux VDA registration:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Policies\
  Citrix\VirtualDesktopAgent" -t "REG_SZ" -v "
  ControllerRegistrationIPv6Netmask " -d "{
2   IPv6 netmask }
3   " --force
4 <!--NeedCopy-->
```

Replace **{IPv6 netmask}** with the real netmask (for example, 2000::/64).

For more information about IPv6 deployment in Citrix Virtual Apps and Desktops, see [IPv4/IPv6 support](#).

## Troubleshooting

Check the basic IPv6 network environment and use ping6 to check whether AD and Delivery Controller are reachable.

## Configure Citrix Customer Experience Improvement Program (CEIP)

March 10, 2021

When you participate in the CEIP, anonymous statistics and usage information are sent to Citrix to help improve the quality and performance of Citrix products. In addition, a copy of the anonymous data is sent to Google Analytics (GA) for fast and efficient analysis.

## Registry settings

By default, you automatically participate in the CEIP when you install the Linux VDA. The first upload of data occurs approximately seven days after you install the Linux VDA. You can change this default setting in the registry.

- **CEIPSwitch**

Registry setting that enables or disables the CEIP (default = 0):

Location: HKEY\_LOCAL\_MACHINE\SOFTWARE\Citrix\CEIP

Name: CEIPSwitch

Value: 1 = disabled, 0 = enabled

When unspecified, the CEIP is enabled.

You can run the following command on a client to disable the CEIP:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SOFTWARE\  
Citrix\CEIP" -v "CEIPSwitch" -d "1"  
2 <!--NeedCopy-->
```

- **GASwitch**

Registry setting that enables or disables GA (default = 0):

Location: HKEY\_LOCAL\_MACHINE\SOFTWARE\Citrix\CEIP

Name: GASwitch

Value: 1 = disabled, 0 = enabled

When unspecified, GA is enabled.

You can run the following command on a client to disable GA:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SOFTWARE\  
Citrix\CEIP" -v "GASwitch" -d "1"  
2 <!--NeedCopy-->
```

- **DataPersistPath**



Registry setting that controls the data persisting path (default = /var/xdl/ceip):

Location: HKEY\_LOCAL\_MACHINE\SOFTWARE\Citrix\CEIP

Name: DataPersistPath

Value: String

You can run the following command to set this path:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SOFTWARE\
   Citrix\CEIP" -v "DataPersistPath" -d "your_path"
2 <!--NeedCopy-->
```

If the configured path does not exist or cannot be accessed, data is saved in the default path.

### CEIP data collected from the Linux VDA

The following table gives an example of the types of anonymous information collected. The data does not contain any details that identify you as a customer.

Data Point	Key Name	Description
Machine GUID	machine_guid	Identifying the machine where the data originates
AD solution	ad_solution	Text string denoting the machine's domain joining method
Linux kernel version	kernel_version	Text string denoting the machine's kernel version
LVDA version	vda_version	Text string denoting the installed version of the Linux VDA.
LVDA update or fresh install	update_or_fresh_install	Text string denoting the current Linux VDA package is being freshly installed or updated
LVDA installed method	install_method	Text string denoting that the current Linux VDA package is installed by using MCS, PVS, easy install, or manual installation.

Data Point	Key Name	Description
HDX 3D pro enabled or not	hdx_3d_pro	Text string denoting whether HDX 3D Pro is enabled on the machine
VDI mode enabled or not	vdi_mode	Text string denoting whether VDI mode is enabled
System Locale	system_locale	Text string denoting the locale of this machine
LVDA key services last restart time	ctxhdx ctxvda	The last restart time of the <a href="#">ctxhdx</a> and <a href="#">ctxvda</a> services, in the format of dd-hh:mm:ss, for example, 10-17:22:19
GPU type	gpu_type	Denoting the GPU type of the machine
CPU cores	cpu_cores	Integer denoting the number of CPU cores of the machine
CPU frequency	cpu_frequency	Float denoting the CPU frequency in MHz
Physical memory size	memory_size	Integer denoting the physical memory size in KB
Launched session number	session_launch	Integer denoting the number of sessions launched (logged on or reconnected) on the machine at the time we collect this data point
Linux OS name and version	os_name_version	Text string denoting the Linux OS name and version of the machine
Session key	session_key	Identifying the session where the data originates
Resource type	resource_type	Text string denoting the resource type of the launched session: desktop or <a href="#">&lt;appname&gt;</a>

Data Point	Key Name	Description
Active session time	active_session_time	Used to save the session's active times. One session can have multiple active times because the session can disconnect/reconnect
Session duration time	session_duration_time	Used to save the session's duration from logon to logoff
Receiver client type	receiver_type	Integer denoting the type of Citrix Workspace app used to launch the session
Receiver client version	receiver_version	Text string denoting the version of Citrix Workspace app used to launch the session
Printing count	printing_count	Integer denoting the number of times the session uses the printing function
USB redirection count	usb_redirecting_count	Integer denoting the number of times the session uses a USB device
Gfx Provider type	gfx_provider_type	Text string denoting the graphics provider type of the session
Shadowing count	shadow_count	Integer denoting the number of times the session has been shadowed
User selected Language	ctxism_select	Composed long string that contains all languages that users have selected
Smartcard redirecting count	scard_redirecting_count	Integer denoting the number of times smart card redirection is used for session logons and user authentication for in-session apps

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## Configure USB redirection

March 10, 2021

USB devices are shared between Citrix Workspace app and the Linux VDA desktop. When a USB device is redirected to the desktop, the user can use the USB device as if it were locally connected.

### Tip:

We recommend using USB redirection when the network latency is lower than 100 milliseconds. Do not use USB redirection when the network latency is higher than 200 milliseconds.

USB redirection includes three main areas of functionality:

- Open-source project implementation (VHCI)
- VHCI service
- USB service

### Open-source VHCI:

This portion of the USB redirection feature develops a general USB device sharing system over an IP network. It consists of a Linux kernel driver and some user mode libraries that allow you to communicate with the kernel driver to get all the USB data. In the Linux VDA implementation, Citrix reuses the kernel driver of VHCI. However, all the USB data transfers between the Linux VDA and Citrix Workspace app are encapsulated in the Citrix ICA protocol package.

### VHCI service:

The VHCI service is an open-source service provided by Citrix to communicate with the VHCI kernel module. This service works as a gateway between VHCI and the Citrix USB service.

### USB service:

The USB service represents a Citrix module that manages all the virtualization and data transfers on the USB device.

### How USB redirection works

Typically, if a USB device is redirected successfully to the Linux VDA, one or more device nodes are created in the system `/dev` path. Sometimes, however, the redirected device is not usable for an active Linux VDA session. USB devices rely on drivers to function properly and some devices require special drivers. If drivers are not provided, the redirected USB devices are inaccessible to the active Linux VDA session. To ensure USB device connectivity, install the drivers and configure the system properly.

The Linux VDA supports a list of USB devices that are successfully redirected to and from the client. In addition, the device is properly mounted, especially the USB disk, allowing the user to access the disk without any additional configuration.

## Supported USB devices

The following devices have been verified to support this version of the Linux VDA. Other devices might be freely used, with unexpected results:

**Note:**

The Linux VDA supports only USB 2.0 protocols.

---

USB mass storage device	VID:PID	File system
Netac Technology Co., Ltd	0dd8:173c	FAT32
Kingston Datatraveler 101 II	0951:1625	FAT32
Kingston Datatraveler GT101 G2	1567:8902	FAT32
SanDisk SDCZ80 flash drive	0781:5580	FAT32
WD HDD	1058:10B8	FAT32

---

---

USB 3D mouse	VID:PID
3DConnexion SpaceMouse Pro	046d: c62b

---

---

USB scanner	VID:PID
Epson Perfection V330 photo	04B8: 0142

---

## Configure USB redirection

A Citrix policy controls whether USB device redirection is enabled or disabled. In addition, the type of device can also be specified using a Delivery Controller policy. When configuring USB redirection for the Linux VDA, configure the following policy and rules:

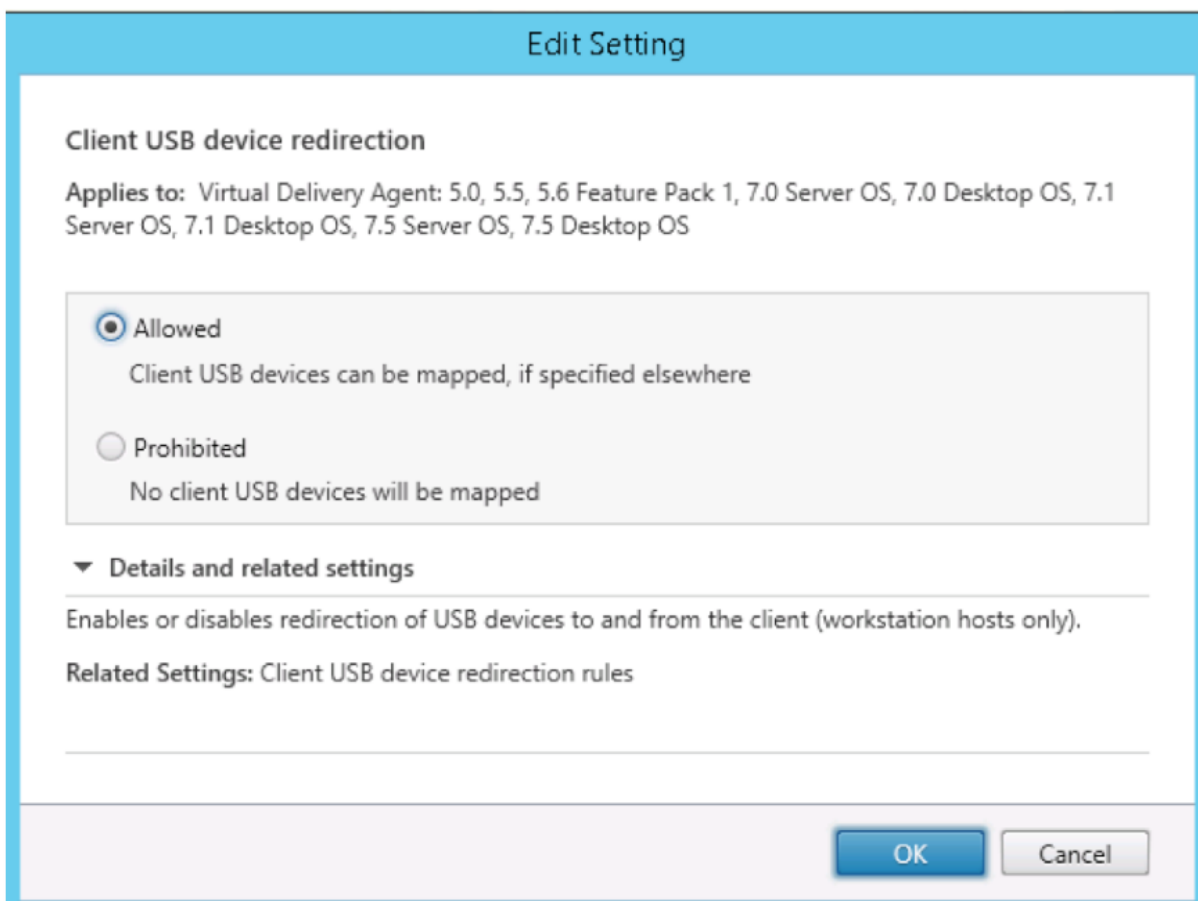
- Client USB device redirection policy
- Client USB device redirection rules

## Enable USB redirection policy

In Citrix Studio, enable (or disable) USB device redirection to and from the client (for workstation hosts only).

In the **Edit Setting** dialog:

1. Select **Allowed**.
2. Click **OK**.



### Set USB redirection rules

After enabling the USB redirection policy, set the redirection rules using Citrix Studio by specifying which devices are allowed (or denied) on the Linux VDA.

In the Client USB device redirection rules dialog:

1. Click **New** to add a redirection rule, or click **Edit** to review an existing rule.
2. After creating (or editing) a rule, click **OK**.

**Edit Setting**

**Client USB device redirection rules**

**Applies to:** Virtual Delivery Agent: 5.0, 5.5, 5.6 Feature Pack 1, 7.0 Server OS, 7.0 Desktop OS, 7.1 Server OS, 7.1 Desktop OS, 7.5 Server OS, 7.5 Desktop OS

Values:

Allow: #all ok
----------------

Use default value:

▼ **Details and related settings**

Lists redirection rules for USB devices.

For more information about configuring generic USB redirection, see [Citrix Generic USB Redirection Configuration Guide](#).

### Build the VHCI kernel module

USB redirection depends on the VHCI kernel modules (`usb-vhci-hcd.ko` and `usb-vhci-iocif.ko`). These modules are part of the Linux VDA distribution (as part of the RPM package). They are compiled based on the official Linux distribution kernels and are noted in the following table:

Supported Linux distribution	Kernel version
RHEL 8.3	4.18.0-240
RHEL 8.2	4.18.0-240
RHEL 8.1	4.18.0-240
RHEL 7.9	3.10.0-1160.6.1
RHEL 7.8	3.10.0-1160.6.1
SUSE 12.5	4.18.0-240

Supported Linux distribution	Kernel version
Ubuntu 20.04	5.4.0-54
Ubuntu 18.04	4.15.0-124
Ubuntu 16.04	4.4.0-194

**Important:**

If the kernel of your machine is not compatible with the driver built for the Linux VDA, the USB service might fail to start. In this case, you can use the USB redirection feature only if you build your own VHCI kernel modules.

**Verify whether your kernel is consistent with the modules built by Citrix**

On the command line, run the following command to verify whether the kernel is consistent:

```
1 insmod /opt/Citrix/VDA/lib64/usb-vhci-hcd.ko
2 <!--NeedCopy-->
```

If the command runs successfully, the kernel module has loaded successfully and the version is consistent with the one installed by Citrix.

If the command runs with errors, the kernel is inconsistent with the Citrix module and must be rebuilt.

**Rebuild the VHCI kernel module**

If your kernel module is inconsistent with the Citrix version, do the following:

1. Download the LVDA source code from the [Citrix download site](#). Select the file contained in the section “**Linux Virtual Delivery Agent (sources)**.”
2. Unzip the **citrix-linux-vda-sources.zip** file. Navigate to **linux-vda-souces/vhci-hcd-1.15.tar.bz2** and unzip the VHCI source files by using **tar xvf vhci-hcd-1.15.tar.bz2**.
3. Build the kernel module based on the header files and the **Module.symvers** file. Use the following steps to install the kernel header files and create **Module.symvers** based on the appropriate Linux distribution:

**RHEL/CentOS:**



```
1 yum install kernel-devel
2 <!--NeedCopy-->
```

### SUSE 12:

```
1 zypper install kernel-devel
2
3 zypper install kernel-source
4 <!--NeedCopy-->
```

### Ubuntu:

```
1 apt-get install linux-headers
2 <!--NeedCopy-->
```

#### Tip:

If the installation is successful, there is a kernel folder resembling:

```
/usr/src/kernels/3.10.0-327.10.1.el7.x86_64
```

4. In the `/usr/src/kernels/3.10.0-327.10.1.el7.x86_64` folder, verify that the **Module.symvers** file is present. If this file is not in the folder, build the kernel (by running the following commands in sequence: `make oldconfig`; `make prepare`; `make modules`; `make`) to get this file or copy it from `/usr/src/kernels/3.10.0-327.10.1.el7.x86_64-obj/x86_64/defaults/module.*`
5. Run the following commands to install the development tools.

### RHEL 8, CentOS 8:

```
1 yum groupinstall 'Development Tools'
2
3 yum install elfutils-libelf-devel
4 <!--NeedCopy-->
```

### RHEL 7, CentOS 7:

```
1 yum groupinstall 'Development Tools'
2 <!--NeedCopy-->
```

### Ubuntu 20.04, Ubuntu 18.04:

```
1 apt install build-essential flex bison libelf-dev
2 <!--NeedCopy-->
```

### Ubuntu 16.04:

```
1 apt install build-essential flex bison
2
3 <!--NeedCopy-->
```

6. In the `vhci-hcd-1.15/Makefile` file, change the Makefile of VCHI and set KDIR to the kernel directory:

```
1 #KDIR = $(BUILD_PREFIX)/lib/modules/$(KVERSION)/build
2
3 KDIR = /usr/src/kernels/3.10.0-327.10.1.el7.x86_64
4 <!--NeedCopy-->
```

7. In the `vhci-hcd-1.15/` folder, run `make` to build the VHCI kernel.

#### Note:

If the build was successful, `usb-vhci-hcd.ko` and `usb-vhci-iocifc.ko` are created in the `vhci-hcd-1.15/` folder.

8. Replace the kernel module with the newly built one: **`cp -f usb-vhci-*.ko /opt/Citrix/VDA/lib64/`**
9. Restart the USB service:

```
1 service ctxusbsd restart
2 <!--NeedCopy-->
```

10. Log off and back on to the session again. Check whether USB redirection is functioning.

### Troubleshoot kernel building issues

The following errors might occur when you build the VHCI module with specific kernels:

- The `implicit declaration of function 'copy_to_user'` error might occur, see the following screen capture:

```
usb-vhci-iocifc.c:216:5: error: implicit declaration of function 'copy_to_user'
```

The error occurs due to header file changes in the kernels. As a workaround, add the **#include <linux/uaccess.h>** line to the `vhci-hcd-1.15/usb-vhci-iocifc.c` file.

```
#include <linux/fs.h>
#include <linux/uaccess.h>
#include "usb-vhci-hcd.h"
```

- The `'driver\\_attr\\_debug_output'` undeclared error might occur, see the following screen capture:

```
error: 'driver_attr_debug_output' undeclared (first use in this function)
```

The error occurs when symbols are missing on the kernel. As a workaround, disable the macro definition for `DEBUG` in the `vhci-hcd-1.15/usb-vhci-iocifc.c` and `vhci-hcd-1.15/usb-vhci-hcd.c` files.

```
22
23 // #define DEBUG
24
25 #include <linux/module.h>
```

- The `'make[3]: *** No rule to make target 'arch/x86/tools/relocs_32.c', needed by 'arch/x86/tools/relocs_32.o'.` Stop. error might occur, see the following screen capture:

```
scripts/kconfig/conf --syncconfig Kconfig
make[3]: *** No rule to make target 'arch/x86/tools/relocs_32.c', needed by 'arch/x86/tools/relocs_32.o'. Stop.
arch/x86/Makefile:232: recipe for target 'archscripts' failed
make[2]: *** [archscripts] Error 2
make[2]: Leaving directory '/usr/src/linux-headers-5.4.0-1031-azure'
Makefile:102: recipe for target 'testcc' failed
make[1]: *** [testcc] Error 2
make[1]: Leaving directory '/home/administrator1/linuxvda-vhci'
Makefile:97: recipe for target 'conf/usb-vhci.config.h' failed
make: *** [conf/usb-vhci.config.h] Error 2
```

As a workaround, replace `SUBDIRS=$(PWD)` with `M=$(shell pwd)` by using the following commands under the `vhci-hcd-1.15/` path:

```
1 sed -i 's/SUBDIRS=$(PWD)/M=$(shell pwd)/g' Makefile
2
3 sed -i 's/SUBDIRS=$(PWD)/M=$(shell pwd)/g' test/Makefile
4 <!--NeedCopy-->
```

- The `./include/uapi/linux/stat.h:30:17: error: expected '(' before numeric constant`  
`##define S_IRUSR 00400` error might occur, see the following screen capture:

```
In file included from ./include/linux/stat.h:7:0,
                 from ./include/linux/module.h:10,
                 from /home/administrator1/vhci-hcd-1.15/usb-vhci-hcd.c:24:
./include/uapi/linux/stat.h:30:17: error: expected ')' before numeric constant
#define S_IRUSR 00400
                 ^
/home/administrator1/vhci-hcd-1.15/usb-vhci-hcd.c:1312:34: note: in expansion of macro 'S_IRUSR'
static DRIVER_ATTR(debug_output, S_IRUSR | S_IWUSR, show_debug_output, store_debug_output);
                                 ^~~~~~
```

Run the following commands to work around the issue:

```
1 sed -i 's/show_debug_output/debug_output_show/g' usb-vhci-iocifc.c usb-vhci-hcd.c
2
3 sed -i 's/store_debug_output/debug_output_store/g' usb-vhci-iocifc.c usb-vhci-hcd.c
4
5 sed -i 's/static DRIVER_ATTR(debug_output, S_IRUSR | S_IWUSR, debug_output_show, debug_output_store);/static DRIVER_ATTR_RW(debug_output);/g' usb-vhci-iocifc.c usb-vhci-hcd.c
6 <!--NeedCopy-->
```

- The `./arch/x86/include/asm/uaccess.h:433:29: error: invalid initializer __typeof__(ptr) __pu_ptr = (ptr); \` error might occur, see the following screen capture:

```
/home/administrator1/vhci-hcd-1.15/usb-vhci-iocifc.c: In function 'ioc_register':
./arch/x86/include/asm/uaccess.h:433:29: error: invalid initializer
__typeof__(ptr) __pu_ptr = (ptr); \
                               ^
./arch/x86/include/asm/uaccess.h:553:2: note: in expansion of macro '__put_user_nocheck'
__put_user_nocheck((__typeof__(*(ptr)))(x), (ptr), sizeof(*(ptr)))
^~~~~~
/home/administrator1/vhci-hcd-1.15/usb-vhci-iocifc.c:219:3: note: in expansion of macro '__put_user'
__put_user('\0', arg->bus_id);
^~~~~~
```

As a workaround, change the 219 line of the `usb-vhci-iocifc.c` file from `__put_user('\0', arg->bus_id);` to `__put_user('\0', arg->bus_id + 0);`.

- The error: `'access_ok' undeclared (first use in this function) if(unlikely((_IOC_DIR(cmd) & _IOC_READ) && !access_ok(VERIFY_WRITE, arg, _IOC_SIZE(cmd))))` error might occur, see the following screen capture:

```
/root/linuxvda-vhci/usb-vhci-iocifc.c:963:46: error: 'access_ok' undeclared (first use in this function)
if(unlikely((_IOC_DIR(cmd) & _IOC_READ) && !access_ok(VERIFY_WRITE, arg, _IOC_SIZE(cmd))))
                                             ^~~~~~
./include/linux/compiler.h:77:42: note: in definition of macro 'unlikely'
#define unlikely(x) __builtin_expect(!(x), 0)
                                         ^
```

Run the following commands to work around the issue:

```
1 sed -i 's/VERIFY_READ, //g' usb-vhci-iocifc.c
```

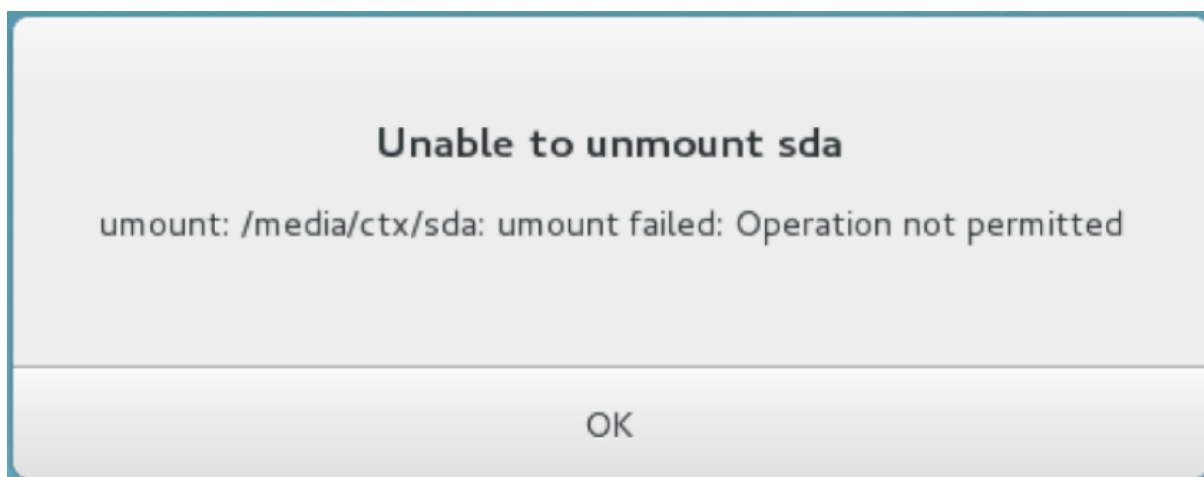
```
2 sed -i 's/VERIFY_WRITE, //g' usb-vhci-iocifc.c
3 <!--NeedCopy-->
```

## Troubleshoot USB redirection issues

Use the information in this section to troubleshoot various issues that you might encounter when using the Linux VDA.

### Unable to unmount the redirected USB disk

For the access control of all USB disks redirected from Citrix Workspace app, the Linux VDA manages all these devices under administrative privilege to ensure that only the owner can access the redirected device. As a result, the user cannot unmount the device without the administrative privilege.



### File lost when you stop redirecting a USB disk

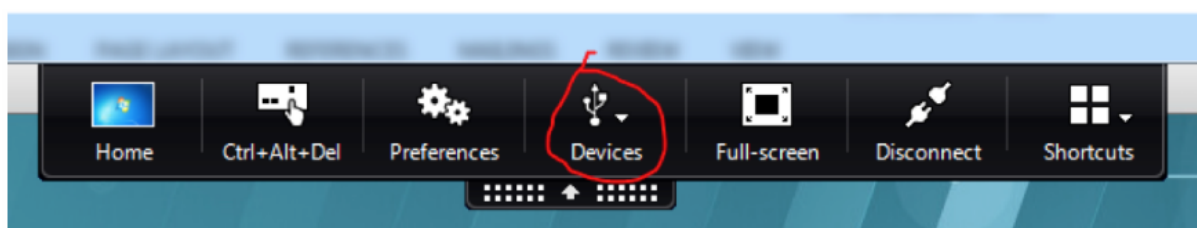
If you redirect a USB disk to a session and try to modify it (for example, create some files on the disk), then stop redirecting it immediately using the toolbar of Citrix Workspace app, the file you modified or created can be lost. This issue occurs because when you write data to a file system, the system mounts the memory cache in the file system. The data is not written to the disk itself. If you stop redirecting using the toolbar of Citrix Workspace app, there is no time remaining for the data being flushed to the disk, which results in lost data. To resolve this issue, use the sync command in a terminal to flush data to the disk before stopping USB redirection.

```
user1@rhel74work:~  
File Edit View Search Terminal Help  
[user1@rhel74work ~]$  
[user1@rhel74work ~]$ sync  
[user1@rhel74work ~]$
```

### No devices in the toolbar of Citrix Workspace app

Sometimes, you might not be able to see devices listed in the toolbar of Citrix Workspace app, which indicates that no USB redirection is taking place. If you encounter the issue, verify the following:

- The policy is configured to allow USB redirection
- The Kernel module is compatible with your kernel



**Note:**

The **Devices** tab is not available in Citrix Workspace app for Linux.

### Failed redirection when USB devices can be seen in the toolbar of Citrix Workspace app, but are labeled *policy restricted*

When the issue occurs, do the following:

- Configure the Linux VDA policy to enable redirection.
- Check whether any additional policy restrictions are configured in the registry of Citrix Workspace app. Check **DeviceRules** in the registry path to ensure that the device is not denied access by this setting:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Citrix\ICA Client\GenericUSB
```

For more information, see the Knowledge Center article [How to Configure Automatic Redirection of USB Devices](#).

## A USB device is redirected successfully, but I cannot use it in my session

Typically, only [supported USB devices](#) can be redirected. Other devices might be redirected to an active Linux VDA session too. For every redirected device, a node owned by the user is created in the system `/dev` path. However, it is the drivers and the configuration that determine whether the user can use the device successfully. If you find a device owned (plugged in) but inaccessible, add the device to an unrestricted policy.

### Note:

In the case of USB drives, the Linux VDA configures and mounts the disk. The user (and only the owner who installed it) can access the disk without any additional configuration. This might not be the case for devices that are not in the supported device list.

## Configure session reliability

March 10, 2021

Citrix introduces the session reliability feature to all supported Linux platforms. Session reliability is enabled by default.

Session reliability reconnects ICA sessions seamlessly across network interruptions. For more information about session reliability, see [Auto client reconnect and session reliability](#).

**Note:** Data transmitted through a session reliability connection is in plain text by default. For security purposes, We recommend that you enable TLS encryption. For more information about TLS encryption, see [Secure user sessions using TLS](#).

## Configuration

### Policy settings in Citrix Studio

You can set the following policies for session reliability in Citrix Studio:

- Session reliability connections
- Session reliability timeout
- Session reliability port number
- Reconnection UI transparency level

For more information, see [Session reliability policy settings](#) and [Auto client reconnect policy settings](#).

**Note:** After setting the **Session reliability connections** or **Session reliability port number** policy, restart the VDA service and the HDX service, in this order, for your settings to take effect.

## Settings on the Linux VDA

- **Enable/disable the session reliability TCP listener**

By default, the session reliability TCP listener is enabled and listening on port 2598. To disable the listener, run the following command.

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SYSTEM\
   CurrentControlSet\Control\Citrix\WinStations\cgp" -v "
   fEnableWinStation" -d "0x00000000"
2 <!--NeedCopy-->
```

**Note:** Restart the HDX service for your settings to take effect. Disabling the TCP listener does not disable session reliability. Session reliability is still available through other listeners (for example, SSL) if the feature is enabled through the **Session reliability connections** policy.

- **Session reliability port number**

You can also set the session reliability port number by using the following command (using port number 2599 as an example).

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SYSTEM\
   CurrentControlSet\Control\Citrix\WinStations\cgp" -v "PortNumber"
   -d "2599"
2 <!--NeedCopy-->
```

**Note:** Restart the HDX service for your setting to take effect. If the port number has been set through the policy setting in Citrix Studio, your setting on the Linux VDA is ignored. Ensure that the firewall on the VDA is configured not to prohibit network traffic through the set port.

- **Server-to-client keep-alive interval**

Session reliability keep-alive messages are sent between the Linux VDA and the ICA client when there is no activity in the session (for example, no mouse movement, no screen update). The keep-alive messages are used to detect whether the client is still responsive. If there is no response from the client, the session is suspended until the client reconnects. This setting specifies the number of seconds between successive keep-alive messages. By default, this setting is not configured. To configure it, run the following command (using 10 seconds as an example).

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SOFTWARE\
   Citrix\XTEConfig" -t "REG_DWORD" -v "CgpServerToClientKeepAlive"
   -d "10" --force
```



- **Client-to-server keep-alive interval**

This setting specifies the number of seconds between successive keep-alive messages sent from the ICA client to the Linux VDA. By default, this setting is not configured. To configure it, run the following command (using 10 seconds as an example).

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKEY_LOCAL_MACHINE\SOFTWARE\  
Citrix\XTEConfig" -t "REG_DWORD" -v "CgpClientToServerKeepAlive"  
-d "10" --force  
2 <!--NeedCopy-->
```

## Troubleshooting

### Unable to launch sessions after enabling session reliability through the policy setting.

To work around this issue, do the following:

1. Ensure that the VDA service and HDX service are restarted, in this order, after you enable session reliability through the policy setting in Citrix Studio.
2. On the VDA, run the following command to verify that the session reliability TCP listener is running (using port 2598 as an example).

```
1 netstat -an | grep 2598  
2 <!--NeedCopy-->
```

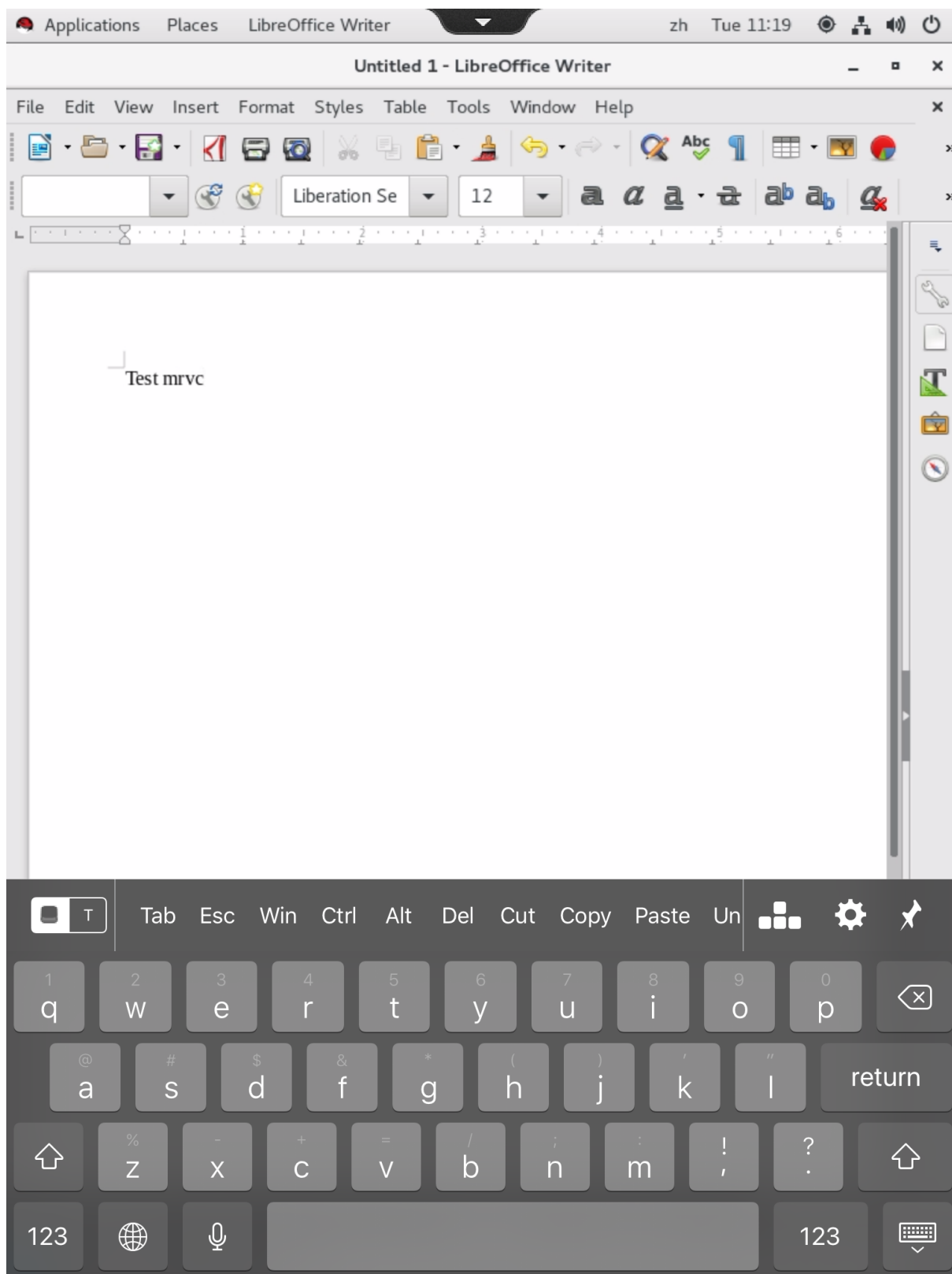
If there is no TCP listener on the session reliability port, enable the listener by running the following command.

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\SYSTEM\  
CurrentControlSet\Control\Citrix\WinStations\cgp" -v "  
fEnableWinStation" -d "0x00000001"  
2 <!--NeedCopy-->
```

## Soft keyboard

March 10, 2021

The soft keyboard feature is available in a Linux virtual desktop or application session. The soft keyboard shows or hides automatically when you enter or leave an input field.



**Note:**

The feature is available for RHEL 7.8, RHEL 7.9, RHEL 8.1, RHEL 8.2, RHEL 8.3, SUSE 12.5, Ubuntu 16.04, and Ubuntu 18.04. It is supported on Citrix Workspace app for iOS and for Android.

## Enable and disable the feature

The feature is disabled by default. Use the **ctxreg** utility to enable or disable the feature. The feature configuration on a given Linux VDA applies to all sessions on that VDA.

To enable the feature:

1. Run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\
  CurrentControlSet\Control\Citrix\VirtualChannels\MrVc" -v "
  Enabled" -d "0x00000001"
2 <!--NeedCopy-->
```

2. In Citrix Studio, set the **Automatic keyboard display** policy to **Allowed**.
3. (Optional) For RHEL 7 and CentOS 7, run the following command to configure Intelligent Input Bus (IBus) as the default IM service:

```
1 echo "GTK_IM_MODULE=ibus" >>/etc/bashrc
2 <!--NeedCopy-->
```

To disable the feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\CurrentControlSet\
  Control\Citrix\VirtualChannels\MrVc" -v "Enabled" -d "0x00000000"
2 <!--NeedCopy-->
```

**Note:**

The preceding settings take effect when you log on to a new session or log off and back on to the current session.

## Limitations

- The feature might not work as expected with Google Chrome, LibreOffice, and other apps.

- To display the soft keyboard again after manually hiding it, click a non-input field and then the current input field again.
- The soft keyboard might not appear when you click from one input field to another in a web browser. To work around this issue, click a non-input field and then the target input field.
- The feature does not support Unicode characters and double-byte characters (such as Chinese, Japanese, and Korean characters).
- The soft keyboard is not available for password input fields.
- The soft keyboard might overlap the current input field. In this case, move the app window or scroll up your screen to move the input field to an accessible position.
- Due to compatibility issues between Citrix Workspace app and Huawei tablets, the soft keyboard appears on Huawei tablets even with a physical keyboard connected.

## Client Input Method Editor (IME)

March 10, 2021

### Overview

Double-byte characters such as Chinese, Japanese, and Korean characters must be typed through an IME. Type such characters with any IME that is compatible with Citrix Workspace app on the client side, such as the Windows native CJK IME.

### Installation

This feature is installed automatically when you install the Linux VDA.

### Usage

Open a Citrix Virtual Apps or Citrix Virtual Desktops session as per usual.

Change your input method as required on the client side to start using the client IME feature.

### Known issues

- Double-clicking a cell in a Google spreadsheet is a must before you can use the client IME feature to type characters in the cell.
- The client IME feature is not automatically disabled in Password fields.
- The IME user interface does not follow the cursor in the input area.

## Support for multiple language inputs

March 10, 2021

As of the Linux VDA Version 1.4, Citrix has added support for published applications. Users can access a desired Linux application without the Linux desktop environment.

However, the native language bar on the Linux VDA was unavailable to the published application because the language bar is highly integrated with the Linux desktop environment. As a result, users were unable to input text in a language that requires IME such as Chinese, Japanese, or Korean. It was also not possible for users to switch between keyboard layouts during an application session.

To address those issues, this feature provides a language bar for published applications that accept text input. The language bar enables users to select a server-side IME and to switch between keyboard layouts during an application session.

### Configuration

You can use the **ctxreg** utility to enable or disable this feature (disabled by default). The feature configuration on a given Linux VDA server applies to all applications published on that VDA.

The configuration key is “HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Control\Citrix\LanguageBar” and the type is DWORD.

To enable this feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE \SYSTEM\  
   CurrentControlSet\Control\Citrix\LanguageBar" -v "Enabled" -d "0  
   x00000001"  
2 <!--NeedCopy-->
```

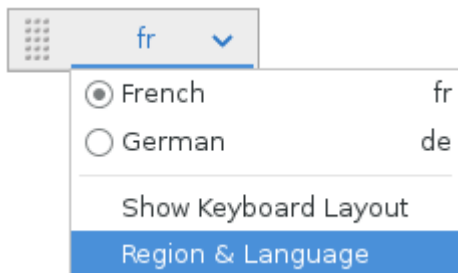
To disable this feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE \SYSTEM\  
   CurrentControlSet\Control\Citrix\LanguageBar" -v "Enabled" -d "0  
   x00000000"  
2 <!--NeedCopy-->
```

### Usage

The usage is straightforward.

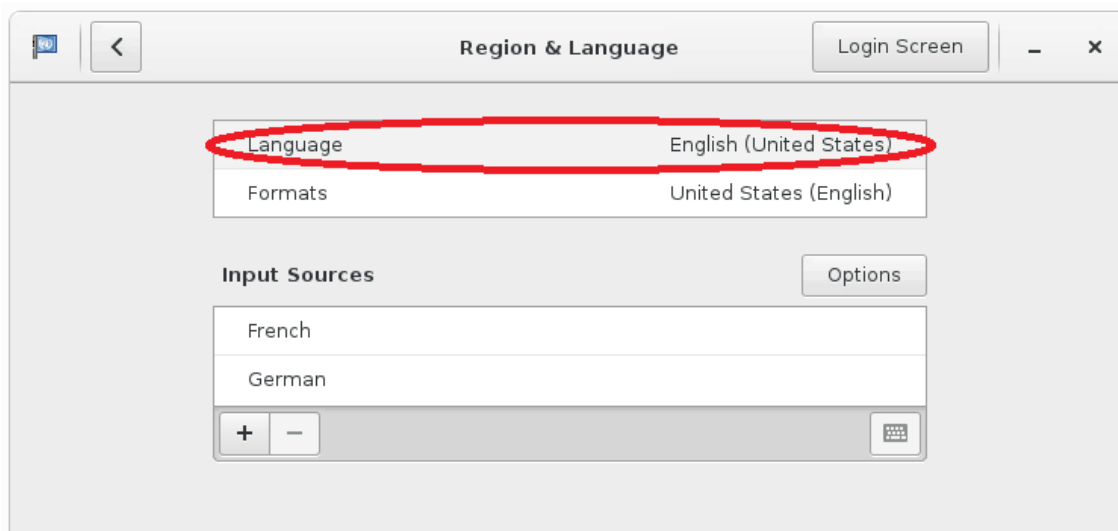
1. Enable the feature.
2. Access a published application that can accept text input. A language bar appears in the session, alongside the application.
3. From the drop-down menu, select **Region & Language** to add the desired language (input source).



4. Select the IME or keyboard layout from the drop-down menu.
5. Type a language using the selected IME or keyboard layout.

**Note:**

- When you change a keyboard layout on the VDA-side language bar, ensure that the same keyboard layout is used on the client side (running Citrix Workspace app).
- The **accountsservice** package must be upgraded to Version 0.6.37 or later before you can perform settings in the **Region & Language** dialog box.



## Dynamic keyboard layout synchronization

March 10, 2021

Previously, the keyboard layouts on the Linux VDA and on the client device had to be the same. For example, when the keyboard layout changed from English to French on the client device but not on the VDA, key mapping issues might occur and persist until the VDA changed to French too.

Citrix addresses the issue by automatically synchronizing the keyboard layout of the VDA with the keyboard layout of the client device. Anytime the keyboard layout on the client device changes, the layout on the VDA follows suit.

**Note:**

Citrix Workspace app for HTML5 does not support the dynamic keyboard layout synchronization feature.

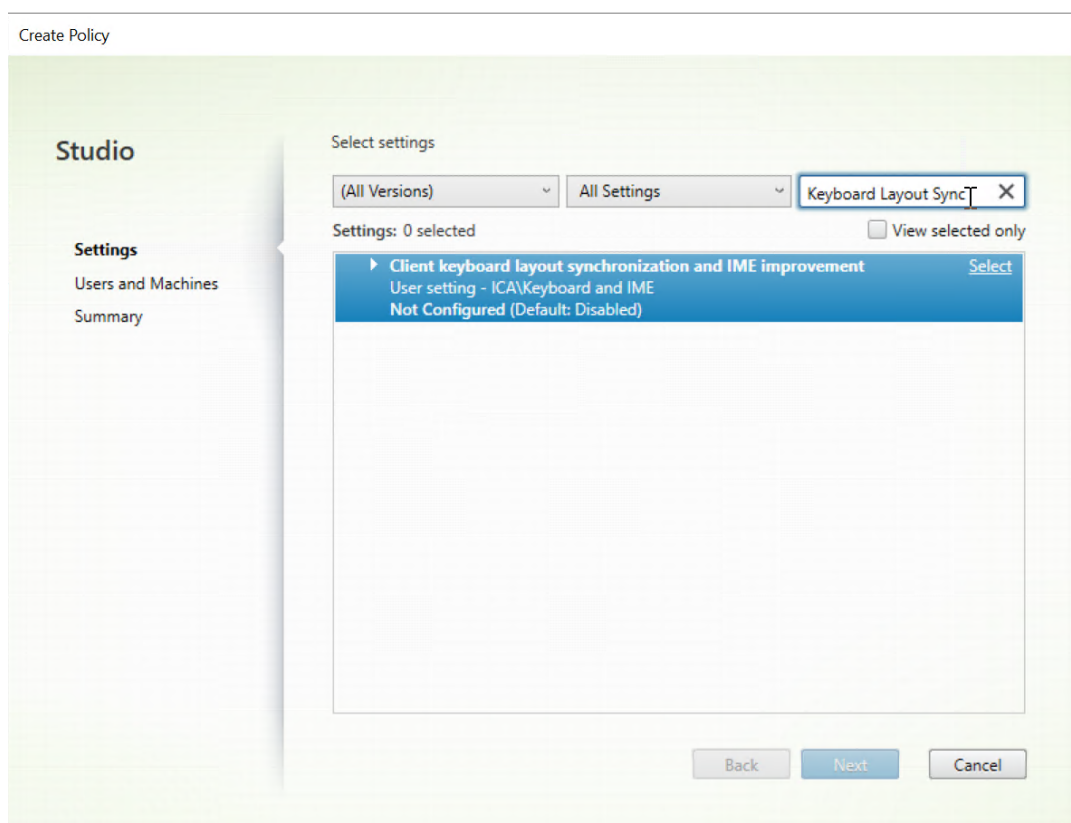
### Configuration

The dynamic keyboard layout synchronization feature is disabled by default. To enable or disable the feature, set the **Client Keyboard Layout Sync and IME Improvement** policy or edit the registry through the `ctxreg` utility.

**Note:**

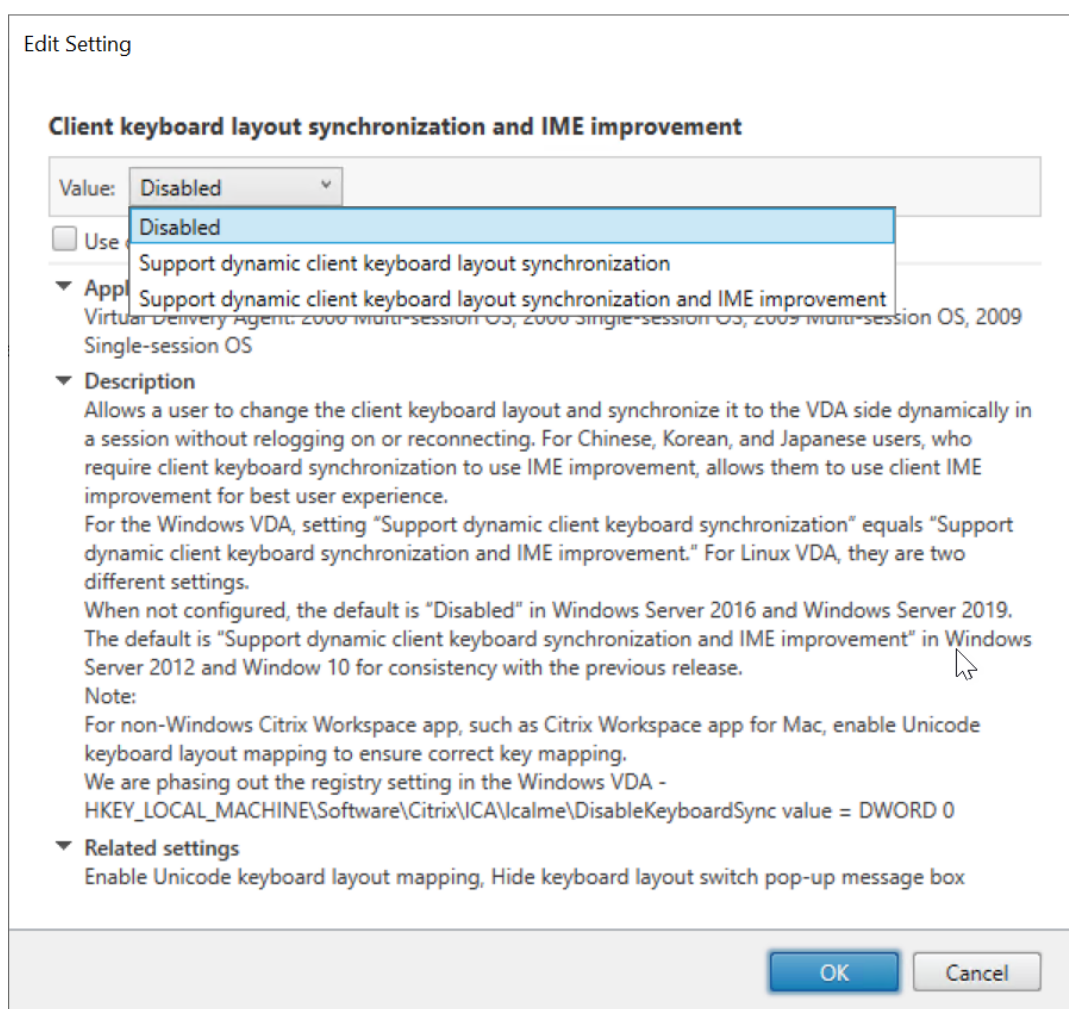
The **Client Keyboard Layout Sync and IME Improvement** policy takes priority over registry settings and can be applied to user and machine objects you specify or all objects in your site. Registry settings on a given Linux VDA apply to all sessions on that VDA.

- Set the **Client Keyboard Layout Sync and IME Improvement** policy to enable or disable the dynamic keyboard layout synchronization feature:
  1. In Studio, right-click **Policies** and select **Create Policy**.
  2. Search for the **Client Keyboard Layout Sync and IME Improvement** policy.



3. Click **Select** next to the policy name.
4. Set the policy.





There are three options available:

- **Disabled:** disables dynamic keyboard layout synchronization and client IME user interface synchronization.
  - **Support dynamic client keyboard layout synchronization:** enables dynamic keyboard layout synchronization regardless of the DWORD value of the **SyncKeyboardLayout** registry key at `HKEY_LOCAL_MACHINE\SYSTEM \CurrentControlSet\Control\Citrix\LanguageBar`.
  - **Support dynamic client keyboard layout synchronization and IME improvement:** enables both dynamic keyboard layout synchronization and client IME user interface synchronization regardless of the DWORD values of the **SyncKeyboardLayout** and **SyncClientIME** registry keys at `HKEY_LOCAL_MACHINE\SYSTEM \CurrentControlSet\Control\Citrix\LanguageBar`.
- Edit the registry through the `ctxreg` utility to enable or disable the dynamic keyboard layout synchronization feature:

To enable this feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\System\
   CurrentControlSet\Control\Citrix\LanguageBar" -v "
   SyncKeyboardLayout" -d "0x00000001"
2 <!--NeedCopy-->
```

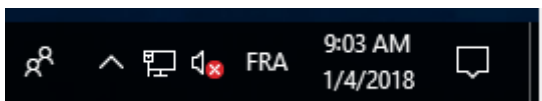
To disable this feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\System\
   CurrentControlSet\Control\Citrix\LanguageBar" -v "
   SyncKeyboardLayout" -d "0x00000000"
2 <!--NeedCopy-->
```

## Usage

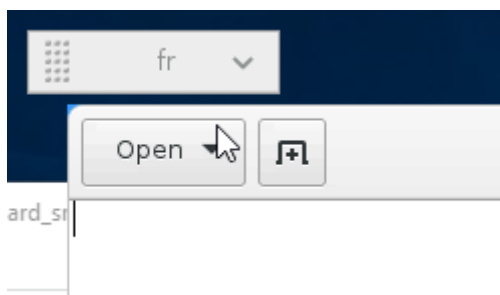
With this feature enabled, when the keyboard layout changes on the client device during a session, the keyboard layout of the session changes accordingly.

For example, if you change the keyboard layout on a client device to French (FR):



Then the keyboard layout of the Linux VDA session also changes to “fr.”

In an application session, you can see this automatic change if you have enabled the language bar:



In a desktop session, you can see this automatic change in the task bar:

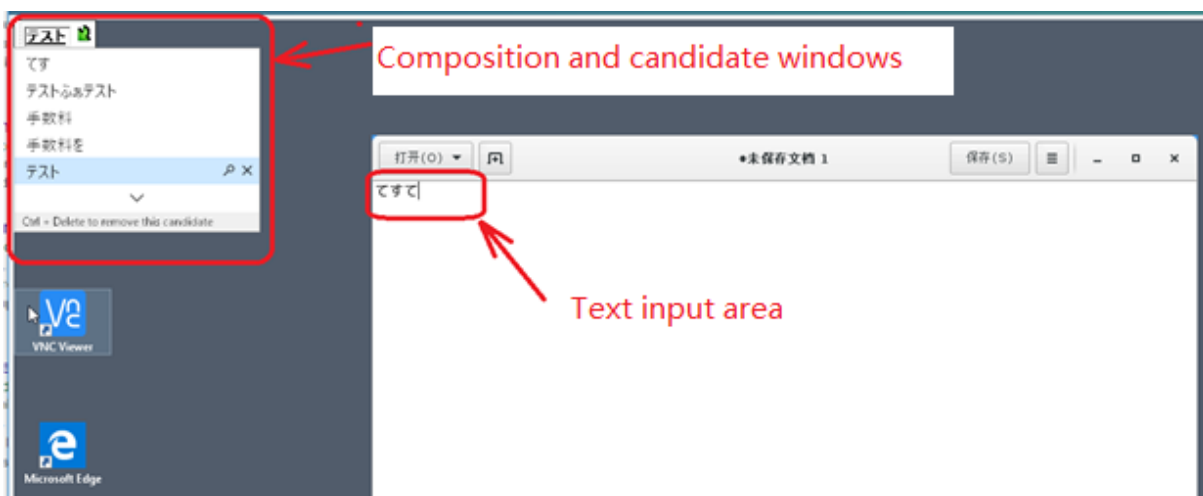


## Client IME user interface synchronization

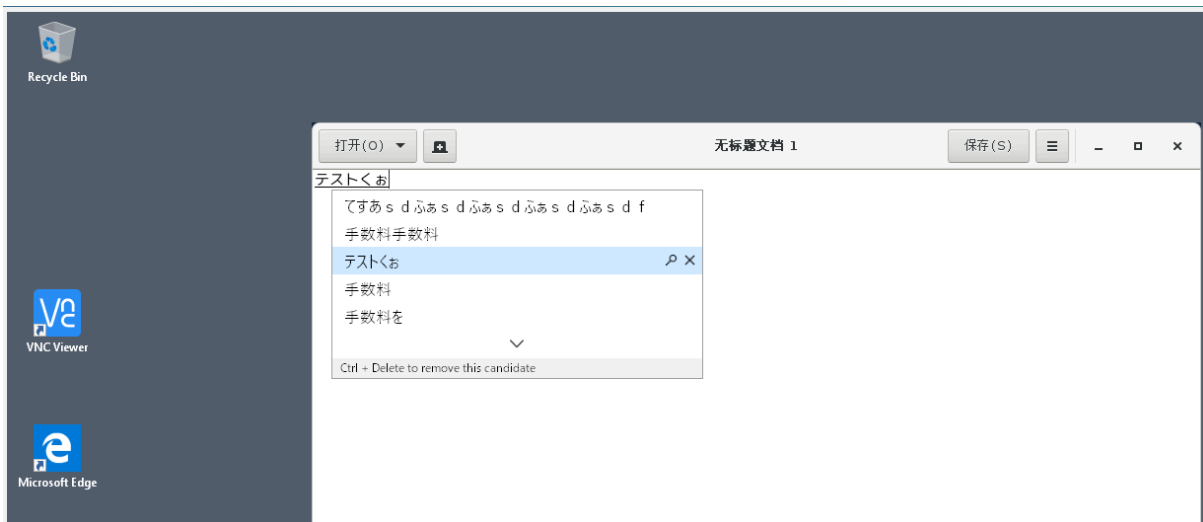
March 10, 2021

### Overview

To date, the client IME user interface (including the composition window and candidate window) was positioned in the upper left corner of the screen. It did not follow the cursor and sometimes was located far from the cursor in the text input area:



Citrix enhances usability and further improves the user experience with the client IME as follows:



### Note:

The feature is available for RHEL 7.x, CentOS 7.x, Ubuntu 16.04, Ubuntu 18.04, and SUSE 12.x. It is supported on Citrix Workspace app for Windows and for Mac.

To use the feature in RHEL 7.x desktop sessions, you must enable **IBus**. For example, set the user interface language to one that requires an IME to input, or add **GTK\_IM\_MODULE=ibus** to the **`\${HOME}/.config/imsettings/xinputrc** file.

The feature installs automatically, but you must enable the feature before you can use it.

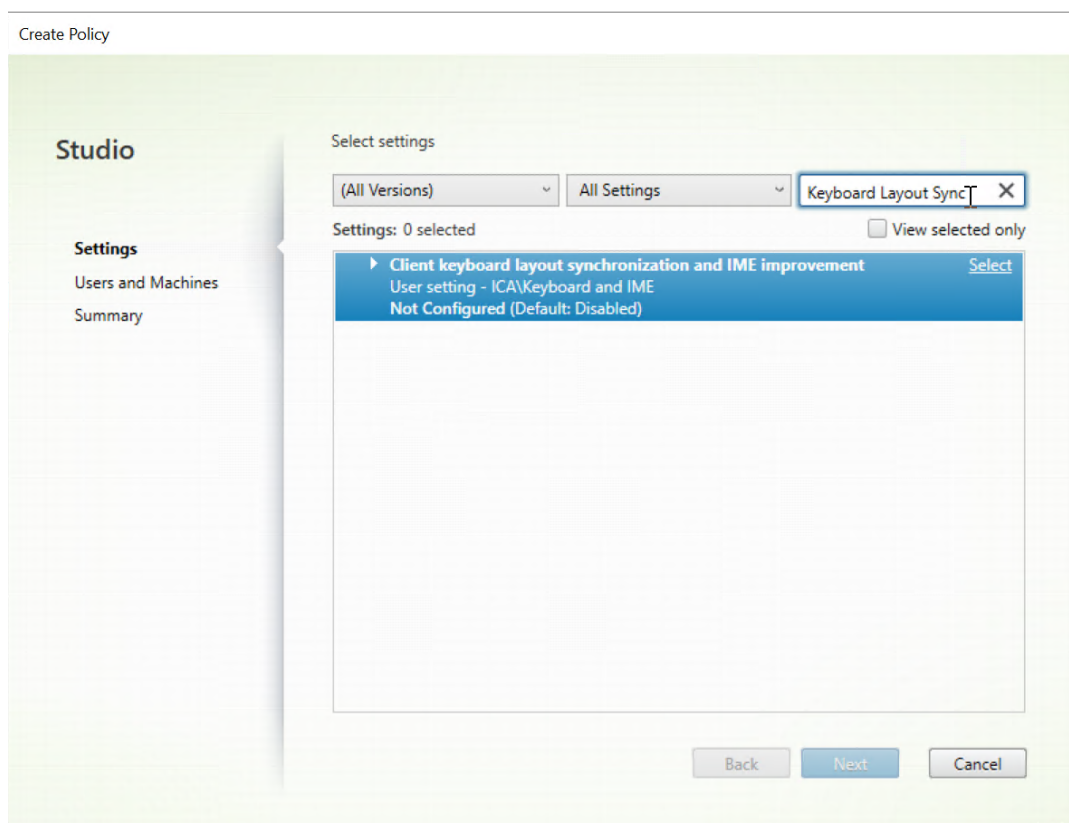
## Enable and disable the feature

The client IME user interface synchronization feature is disabled by default. To enable or disable the feature, set the **Client Keyboard Layout Sync and IME Improvement** policy or edit the registry through the **ctxreg** utility.

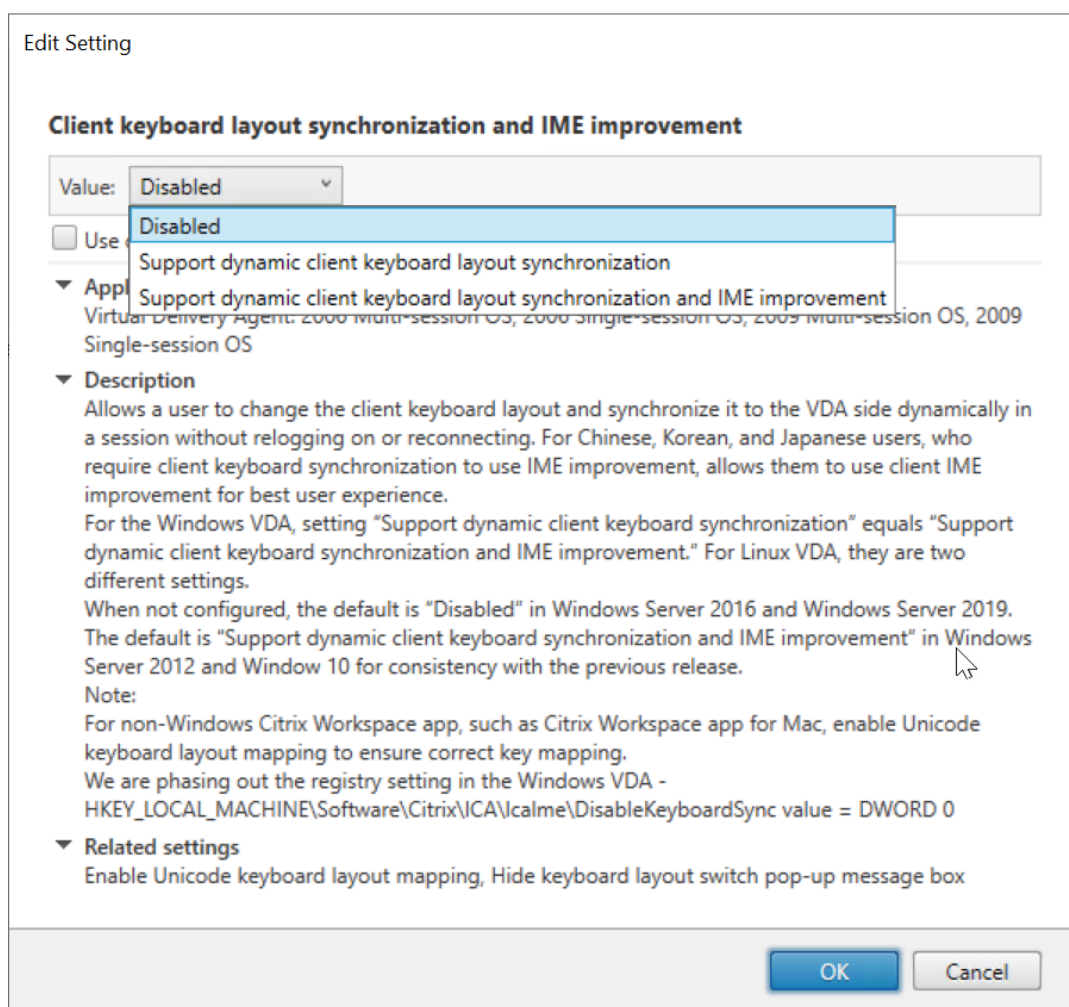
### Note:

The **Client Keyboard Layout Sync and IME Improvement** policy takes priority over registry settings and can be applied to user and machine objects you specify or all objects in your site. Registry settings on a given Linux VDA apply to all sessions on that VDA.

- Set the **Client Keyboard Layout Sync and IME Improvement** policy to enable or disable the client IME user interface synchronization feature:
  1. In Studio, right-click **Policies** and select **Create Policy**.
  2. Search for the **Client Keyboard Layout Sync and IME Improvement** policy.



3. Click **Select** next to the policy name.
4. Set the policy.



There are three options available:

- **Disabled:** disables dynamic keyboard layout synchronization and client IME user interface synchronization.
- **Support dynamic client keyboard layout synchronization:** enables dynamic keyboard layout synchronization regardless of the DWORD value of the **SyncKeyboardLayout** registry key at `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Citrix\LanguageBar`.
- **Support dynamic client keyboard layout synchronization and IME improvement:** enables both dynamic keyboard layout synchronization and client IME user interface synchronization regardless of the DWORD values of the **SyncKeyboardLayout** and **SyncClientIME** registry keys at `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Citrix\LanguageBar`.

- Edit the registry through the `ctxreg` utility to enable or disable the client IME user interface synchronization feature:

To enable the feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\System\
   CurrentControlSet\Control\Citrix\LanguageBar" -v "
   SyncClientIME" -d "0x00000001"
2 <!--NeedCopy-->
```

To disable the feature, run the command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKEY_LOCAL_MACHINE\System\
   CurrentControlSet\Control\Citrix\LanguageBar" -v "
   SyncClientIME" -d "0x00000000"
2 <!--NeedCopy-->
```

## HDX Insight

March 10, 2021

### Overview

The Linux VDA partially supports the HDX Insight feature. HDX Insight is part of the Citrix Application Delivery Management (ADM) and is based on the popular industry standard AppFlow. It enables IT to deliver an exceptional user experience by providing unprecedented end-to-end visibility into the Citrix ICA traffic that passes through the Citrix ADC or Citrix SD-WAN application networking fabric. For more information, see [HDX Insight](#)

### Installation

No dependent packages need installation.

### Usage

HDX Insight analyzes the ICA messages passed through the Citrix ADC between Citrix Workspace app and the Linux VDA. All HDX Insight data is sourced from the NSAP virtual channel and sent uncompressed. The NSAP virtual channel is enabled by default.

The following commands disable and enable the NSAP virtual channel, respectively:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\  
VirtualDesktopAgent" -t "REG_DWORD" -v "EnableNSAP" -d "0x00000000"  
--force  
2 <!--NeedCopy-->
```

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\  
VirtualDesktopAgent" -t "REG_DWORD" -v "EnableNSAP" -d "0x00000001"  
--force  
2 <!--NeedCopy-->
```

## Troubleshooting

### No data points are displayed

There might be two causes:

- HDX Insight is not configured correctly.

For example, AppFlow is not enabled on the Citrix ADC or an incorrect Citrix ADC instance is configured on the Citrix ADM.

- The ICA Control Virtual Channel is not started on the Linux VDA.

```
ps aux | grep -i ctxctl
```

If `ctxctl` is not running, contact your administrator to report a bug to Citrix.

### No application data points are displayed

Verify that the seamless virtual channel is enabled and a seamless application is launched for a while.

## Rendezvous protocol

October 8, 2021

In environments that use the Citrix Gateway service, the Rendezvous protocol allows HDX sessions to bypass the Citrix Cloud Connector and connect directly and securely to the Citrix Gateway service.

Requirements:

- Access to environment using Citrix Workspace and Citrix Gateway service.
- Control Plane: Citrix Virtual Apps and Desktops Service (Citrix Cloud).
- Linux VDA Version 2012 or later.
- Enable the Rendezvous protocol in the Citrix policy. For more information, see [Rendezvous protocol policy setting](#).
- The VDAs must have access to `https://*.nssvc.net`, including all subdomains. If you cannot whitelist all subdomains in that manner, use `https://*.c.nssvc.net` and `https://*.g.nssvc.net` instead. For more information, see the [Internet Connectivity Requirements](#) section of the Citrix Cloud documentation (under Virtual Apps and Desktop service) and the Knowledge Center article [CTX270584](#).
- Cloud Connectors must obtain the VDAs' FQDNs when brokering a session. To achieve this goal, enable DNS resolution for the site: Using the Citrix Virtual Apps and Desktops Remote PowerShell SDK, run the command `Set-BrokerSite -DnsResolutionEnabled $true`. For more information about the Citrix Virtual Apps and Desktops Remote PowerShell SDK, see [SDKs and APIs](#).

**Important:**

The Rendezvous protocol doesn't support transparent or explicit proxies. To use proxies, continue to use the Cloud Connector for ICA traffic.

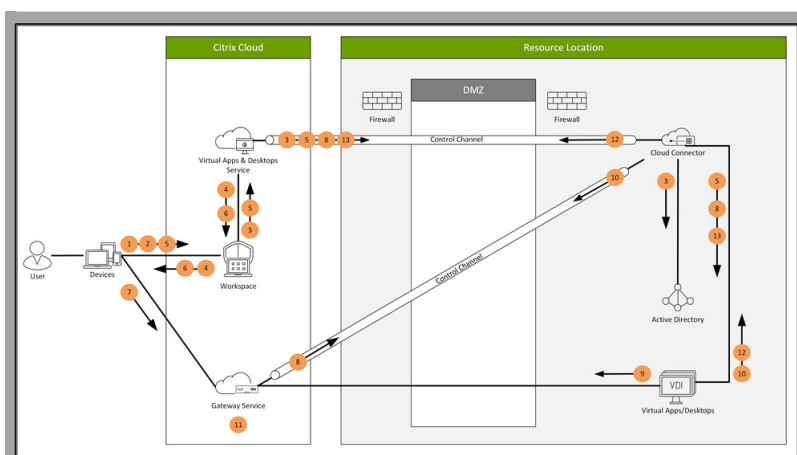
If you enable Rendezvous and the VDA cannot reach the Citrix Gateway service directly, the VDA falls back to proxy the HDX session through the Cloud Connector.

If you meet all requirements, follow these steps to validate if Rendezvous is in use:

1. Launch a terminal on the VDA.
2. Run `su root -c "/opt/Citrix/VDA/bin/ctxquery -f iuStdP"`.
3. The TRANSPORT PROTOCOLS indicates the type of connection:
  - TCP Rendezvous: TCP - SSL - CGP - ICA
  - EDT Rendezvous: UDP - DTLS - CGP - ICA
  - Proxy through Cloud Connector: TCP - CGP - ICA

This diagram is an overview of the Rendezvous connection flow. Follow the steps to understand the flow.





1. Navigate to Citrix Workspace.
2. Enter credentials in Citrix Workspace.
3. If using on-premises Active Directory, the Citrix Virtual Apps and Desktops service authenticates credentials with Active Directory using the Cloud Connector channel.
4. Citrix Workspace displays enumerated resources from the Citrix Virtual Apps and Desktops service.
5. Select resources from Citrix Workspace. The Citrix Virtual Apps and Desktops service sends a message to the VDA to prepare for an incoming session.
6. Citrix Workspace sends an ICA file to the endpoint that contains an STA ticket generated by Citrix Cloud.
7. The endpoint connects to the Citrix Gateway service, provides the ticket to connect to the VDA, and Citrix Cloud validates the ticket.
8. The Citrix Gateway service sends connection information to the Cloud Connector. The Cloud Connector determines if the connection is supposed to be a Rendezvous connection and sends the information to the VDA.
9. The VDA establishes a direct connection to the Citrix Gateway service.
10. If a direct connection between the VDA and the Citrix Gateway service isn't possible, the VDA proxies its connection over the Cloud Connector.
11. The Citrix Gateway service establishes a connection between the endpoint device and the VDA.
12. The VDA verifies its license with the Citrix Virtual Apps and Desktops service through the Cloud Connector.
13. The Citrix Virtual Apps and Desktops service sends session policies to the VDA through the Cloud Connector. Those policies are applied.

## Adaptive transport

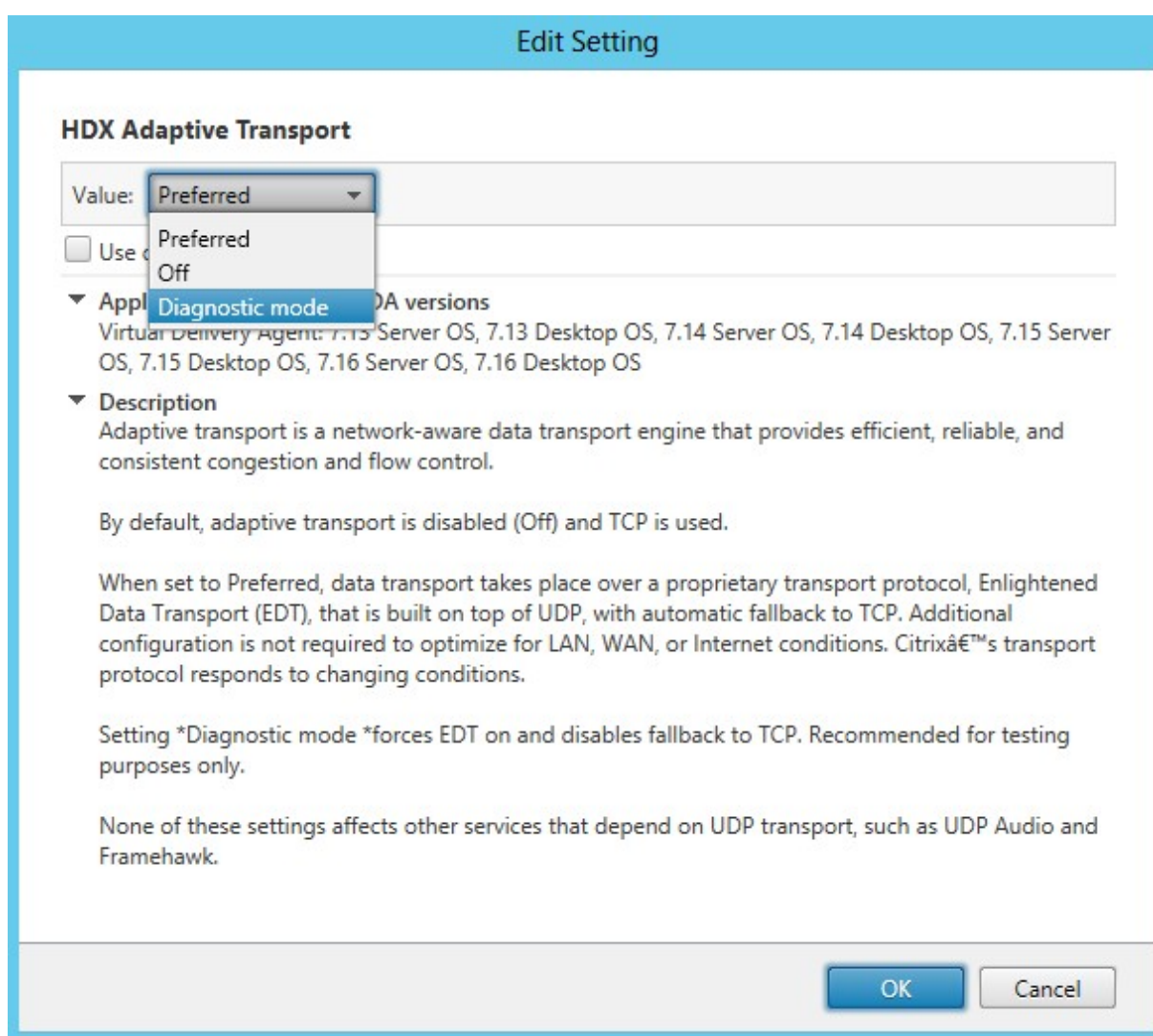
March 10, 2021

Adaptive transport is a data transport mechanism for Citrix Virtual Apps and Desktops. It is faster, more scalable, improves application interactivity, and is more interactive on challenging long-haul WAN and internet connections. For more information about adaptive transport, see [Adaptive transport](#).

## Enable adaptive transport

In Citrix Studio, verify that the **HDX Adaptive Transport** policy is set to **Preferred** or **Diagnostic mode**. **Preferred** is selected by default.

- **Preferred:** Adaptive transport over Enlightened Data Transport (EDT) is used when possible, with fallback to TCP.
- **Diagnostic mode:** EDT is forced on and fallback to TCP is disabled.



## Disable adaptive transport

To disable adaptive transport, set the **HDX Adaptive Transport** policy to **Off** in Citrix Studio.

## Check whether adaptive transport is enabled

To check whether UDP listeners are running, run the following command.

```
1 netstat -an | grep "1494\|2598"  
2 <!--NeedCopy-->
```

In normal circumstances, the output is similar to the following.

```
1 udp          0      0 0.0.0.0:2598      0.0.0.0:*  
2  
3 udp          0      0 :::1494           :::*  
4 <!--NeedCopy-->
```

## EDT MTU discovery

EDT automatically determines the Maximum Transmission Unit (MTU) when establishing a session. Doing so prevents EDT packet fragmentation that might result in performance degradation or failure to establish a session.

Minimum requirements:

- Linux VDA 2012
- Citrix Workspace app 1911 for Windows
- Citrix ADC:
  - 13.0.52.24
  - 12.1.56.22
- Session reliability must be enabled

If using client platforms or versions that do not support this feature, see Knowledge Center article [CTX231821](#) for details about how to configure a custom EDT MTU that is appropriate for your environment.

### WARNING:

Editing the registry incorrectly can cause serious problems that might require you to reinstall your operating system. Citrix cannot guarantee that problems resulting from the incorrect use

of Registry Editor can be solved. Use Registry Editor at your own risk. Be sure to back up the registry before you edit it.

### Enable or disable EDT MTU discovery on the VDA

EDT MTU discovery is disabled by default.

- To enable EDT MTU discovery, set the `MtuDiscovery` registry key by using the following command, restart the VDA, and wait for the VDA to register:

```
/opt/Citrix/VDA/bin/ctxreg create -k "HKLM\System\CurrentControlSet\  
Control\Terminal Server\Wds\icawd"-t "REG_DWORD"-v "MtuDiscovery"-d "0  
x00000001"--force
```

- To disable EDT MTU discovery, delete the `MtuDiscovery` registry value.

This setting is machine-wide and affects all sessions connecting from a supported client.

### Control EDT MTU discovery on the client

You can control EDT MTU discovery selectively on the client by adding the `MtuDiscovery` parameter in the ICA file. To disable the feature, set the following under the `Application` section:

```
MtuDiscovery=Off
```

To re-enable the feature, remove the `MtuDiscovery` parameter from the ICA file.

#### IMPORTANT:

For this ICA file parameter to work, enable EDT MTU discovery on the VDA. If EDT MTU discovery is not enabled on the VDA, the ICA file parameter has no effect.

## Integrate with the Citrix Telemetry Service

March 10, 2021

With the Citrix Telemetry Service (ctxtelemetry) integrated with the Linux VDA software, you can run Citrix Scout, which then uses the `/opt/Citrix/VDA/bin/xdlcollect.sh` script, to collect logs about the Linux VDA.

**Collect**

Select or add machines to collect data from:

+ Add machine | Filter by machine name

Name	Type	Status
<input type="checkbox"/> rgqbe-lvda-1.bvt.local	Linux VDA	
<input type="checkbox"/> rgqbe-lvda-2.bvt.local	Linux VDA	
<input type="checkbox"/> rgqbe-lvda-3.bvt.local	Linux VDA	
<input type="checkbox"/> rgqbe-lvda-31.bvt.local	Linux VDA	
<input type="checkbox"/> rgqbe-lvda-5.bvt.local	Linux VDA	
<input type="checkbox"/> rgqbe-lvda-6.bvt.local	Linux VDA	
<input checked="" type="checkbox"/> rgqbe-lvda-8.bvt.local	Linux VDA	Verified
<input type="checkbox"/> rgqbe-tsvda-1.bvt.local	Windows Multi-session VDA	
<input type="checkbox"/> rgqbe-vda-1.bvt.local	Windows Single-session VDA	

✓ 1 machine selected. Back Continue

**Note:**

After upgrading from Linux VDA 1912 and earlier versions, you must rerun `/opt/Citrix/VDA/sbin/c-txsetup.sh` to configure the variables for the Citrix Telemetry Service (ctxtelemetry). For more information about the variables, see [Easy install](#).

**Enable and disable the Citrix Telemetry Service**

- To enable the service, run the **sudo systemctl enable ctxtelemetry.socket** command.
- To disable the service, run **sudo systemctl disable ctxtelemetry.socket**.

**Ports**

The Citrix Telemetry Service (ctxtelemetry), by default, uses TCP/IP port 7503 to listen for Citrix Scout. It uses TCP/IP port 7502 on the Delivery Controller to communicate with Citrix Scout.

You can use the default ports or change ports through the following variables when you install the Linux VDA.

- **CTX\_XDL\_TELEMETRY\_SOCKET\_PORT** – The socket port for listening for Citrix Scout. The default port is 7503.
- **CTX\_XDL\_TELEMETRY\_PORT** – The port for communicating with Citrix Scout. The default port is 7502.

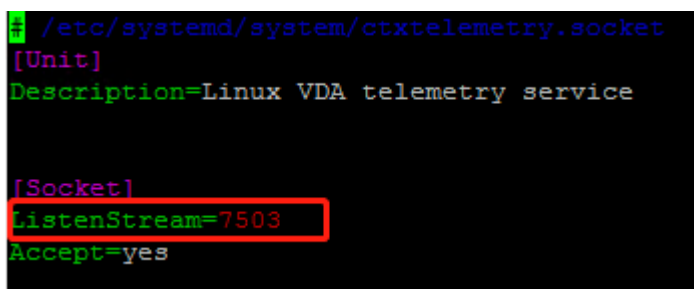
To change ports after you have your VDA installed, do the following:

1. To change a port for communicating with Scout, run the following command.

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\Software\Citrix\
  VirtualDesktopAgent" -v "TelemetryServicePort" -d <port number>
  -t REG_DWORD
2 <!--NeedCopy-->
```

2. To change the socket port for listening for Scout, run the following command to open and edit the `ctxtelemetry.socket` file.

```
1 sudo vi /etc/systemd/system/ctxtelemetry.socket
2 <!--NeedCopy-->
```



```
█ /etc/systemd/system/ctxtelemetry.socket
[Unit]
Description=Linux VDA telemetry service

[Socket]
ListenStream=7503
Accept=yes
```

3. Run the following commands to restart the socket port.

```
1 sudo systemctl daemon-reload
2 sudo systemctl stop ctxtelemetry.socket
3 sudo systemctl start ctxtelemetry.socket
4 <!--NeedCopy-->
```

4. Enable the new ports in your firewall configuration.

If you are using a Ubuntu distribution, for example, run the **sudo ufw allow 7503** command to enable port 7503.

## Debug mode

If the Citrix Telemetry Service does not work as expected, you can enable debug mode to determine the causes.

1. To enable debug mode, run the following command to open the `ctxtelemetry` file and then change the `DebugMode` value to 1.

```
1 sudo vi /opt/Citrix/VDA/sbin/ctxtelemetry
2 <!--NeedCopy-->
```

```
#!/bin/sh
export PATH=/usr/lib/jvm/java-8-openjdk-amd64/jre/bin:/usr/lib/jvm/java-8-openjdk-amd64/bin:${PATH}
# Set this flag to 1 to enter debugging mode
DebugMode=1
# Set this flag to 1 to enter interactive debugging mode
InteractiveDebugMode=0
```

2. Manually stop the Citrix Telemetry Service, or wait 15 minutes for the service to stop automatically.

```
administrator@RGQBE-LVDA-3:~$ sudo netstat -ntlp
Active Internet connections (only servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         State       PID/Program name
tcp        0      0 0.0.0.0:139             0.0.0.0:*               LISTEN      1447/smbd
tcp        0      0 127.0.0.0:53:53        0.0.0.0:*               LISTEN      971/systemd-resolve
tcp        0      0 0.0.0.0:22             0.0.0.0:*               LISTEN      1309/sshd
tcp        0      0 127.0.0.1:631          0.0.0.0:*               LISTEN      25158/cupsd
tcp        0      0 127.0.0.1:5432         0.0.0.0:*               LISTEN      998/postgres
tcp        0      0 0.0.0.0:445            0.0.0.0:*               LISTEN      1447/smbd
tcp6       0      0 :::2598                :::*                   LISTEN      28100/ctxhdx
tcp6       0      0 :::139                 :::*                   LISTEN      1447/smbd
tcp6       0      0 :::7502                :::*                   LISTEN      1958/java
tcp6       0      0 :::7303                :::*                   LISTEN      1/init
tcp6       0      0 :::80                  :::*                   LISTEN      1610/java
tcp6       0      0 :::1494                :::*                   LISTEN      28100/ctxhdx
tcp6       0      0 :::22                  :::*                   LISTEN      1309/sshd
tcp6       0      0 :::1:631               :::*                   LISTEN      25158/cupsd
tcp6       0      0 :::445                 :::*                   LISTEN      1447/smbd
administrator@RGQBE-LVDA-3:~$
```

In this example, you can run the following commands to stop the Citrix Telemetry Service.

```
1 sudo netstat -ntlp
2 Kill -9 1958
3 <!--NeedCopy-->
```

3. To restart the Citrix Telemetry Service, select your Linux VDA on Scout and find `telemetry-debug.log` in `/var/log/xdl/`.

## Service wait time

The `systemd` daemon that opens the socket port starts by default and uses few resources. The Citrix Telemetry Service stops by default and starts only when there is a log collection request from the Delivery Controller. After log collection completes, the service awaits new collection requests for a duration of 15 minutes and stops again if there are not any. You can configure the wait time through the following command. The minimum value is 10 minutes. If you set a value less than 10 minutes, the minimum value, 10 minutes, takes effect. After setting the wait time, stop and restart the service.

```
1 /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\  
   VirtualDesktopAgent" -v "TelemetryServiceIdleTimeoutInMinutes" -d <  
   number> -t REG_DWORD  
2 <!--NeedCopy-->
```

## Verification tests

Before a collection starts, verification tests run automatically for each selected machine. These tests ensure that the requirements are met. If a test fails for a machine, Scout displays a message, with suggested corrective actions. For more information about verification tests, see the [Verification tests](#) section in the Citrix Scout documentation.

## Tracing On

March 10, 2021

### Overview

Collecting logs and reproducing issues slow down the diagnostics and degrade the user experience. The Tracing On feature eases such efforts. Tracing is enabled for the Linux VDA by default.

### Configuration

The `ctxlogd` daemon and the `setlog` utility are now included in the Linux VDA release package. By default, the `ctxlogd` daemon starts after you install and configure the Linux VDA.



### ctxlogd daemon

All the other services that are traced depend on the `ctxlogd` daemon. You can stop the `ctxlogd` daemon if you do not want to keep the Linux VDA traced.

### setlog utility

Tracing On is configured using the `setlog` utility, which is under the `/opt/Citrix/VDA/bin/` path. Only the root user has the privilege to run it. You can use the GUI or run commands to view and change the configurations. Run the following command for help with the `setlog` utility:

```
1 setlog help
2 <!--NeedCopy-->
```

### Values

By default, **Log Output Path** is set to `/var/log/xdl/hdx.log`, **Max Log Size** is set to 200 MB, and you can save up to two old log files under **Log Output Path**.

View the current `setlog` values:

```
1 setlog values
2
3 log_path (Log Output Path) = /var/log/xdl/hdx.log
4
5 log_size (Max Log Size (MiB)) = 200
6
7 log_count (Max Old Log Files) = 2
8 <!--NeedCopy-->
```

View or set a single `setlog` value:

```
1 setlog value <name> [<value>]
2 <!--NeedCopy-->
```

For example:

```
1 setlog value log_size 100
2 <!--NeedCopy-->
```

## Levels

By default, the log level is set to **Warnings**.

View the log levels set for different components:

```
1 setlog levels
2 <!--NeedCopy-->
```

You can set all log levels (including Disable, Inherited, Verbose, Information, Warnings, Errors, and Fatal Errors) by using the following command:

```
1 setlog level <class> [<level>]
2 <!--NeedCopy-->
```

The **<class>** variable specifies one component of the Linux VDA. To cover all components, set it to **all**:

```
1 setlog level all error
2
3 Setting log class ALL to ERROR.
4 <!--NeedCopy-->
```

## Flags

By default, the flags are set as follows:

```
1 setlog flags
2
3 DATE = true
4
5 TIME = true
6
7 NAME = true
8
9 PID = true
10
11 TID = false
12
```

```
13 SID = true
14
15 UID = false
16
17 GID = false
18
19 CLASS = false
20
21 LEVEL = false
22
23 FUNC = true
24
25 FILE = false
26 <!--NeedCopy-->
```

View the current flags:

```
1 setlog flags
2 <!--NeedCopy-->
```

View or set a single log flag:

```
1 setlog flag <flag> [<state>]
2 <!--NeedCopy-->
```

### Restore Defaults

Revert all levels, flags, and values to the default settings:

```
1 setlog default
2 <!--NeedCopy-->
```

#### Important:

The `ctxlogd` service is configured using the `/var/xdl/.ctxlog` file, which only root users can create. Other users do not have write permission to this file. We recommend that root users not give write permission to other users. Failure to comply can cause the arbitrary or malicious configuration to `ctxlogd`, which can affect server performance and therefore the user experience.

## Troubleshooting

The `ctxlogd` daemon fails and you cannot restart the `ctxlogd` service when the `/var/xdl.ctxlog` file is missing (for example, accidentally deleted).

`/var/log/messages`:

```
1 Apr 1 02:28:21 RH72 citrix-ctxlogd[17881]: Failed to open logging
   configuration file.
2
3 Apr 1 02:28:21 RH72 systemd: ctxlogd.service: main process exited, code
   =exited, status=1/FAILURE
4
5 Apr 1 02:28:21 RH72 systemd: Unit ctxlogd.service entered failed state.
6
7 Apr 1 02:28:21 RH72 systemd: ctxlogd.service failed.
8 <!--NeedCopy-->
```

To solve this issue, run `setlog` as a root user to recreate the `/var/xdl.ctxlog` file. Then restart the `ctxlogd` service on which other services depend.

## Shadow sessions

March 10, 2021

The session shadowing feature allows domain administrators to view users' ICA sessions in an intranet. The feature uses noVNC to connect to the ICA sessions and is supported only with RHEL 7.x and Ubuntu 16.04.

### Note:

To use the session shadowing feature, the version of Citrix Director must be 7.16 or later.

## Installation and configuration

### Dependencies

Two new dependencies, `python-websockify` and `x11vnc`, are required for session shadowing. The `python-websockify` and `x11vnc` dependencies are automatically installed when you install the Linux VDA on Ubuntu 16.04. On RHEL 7.x, you must manually install `python-websockify` and `x11vnc` after you install the Linux VDA.

Run the following command on RHEL 7.x to install `python-websocketify` and `x11vnc` (`x11vnc` version 0.9.13 or later).

```
1 sudo yum install -y python-websocketify x11vnc
2 <!--NeedCopy-->
```

To resolve `python-websocketify` and `x11vnc`, enable the following repositories on RHEL 7.x:

- Extra Packages for Enterprise Linux (EPEL)

The EPEL repository is required for both `python-websocketify` and `x11vnc`. Run the following command to enable the EPEL repository:

```
1 sudo yum install https://dl.fedoraproject.org/pub/epel/epel-
   release-latest-$(rpm -E '%{
2  rhel }
3  ').noarch.rpm
4 <!--NeedCopy-->
```

- Optional RPMs

Run either of the following commands to enable the optional RPMs repository for installing some dependency packages of `x11vnc`:

For workstation:

```
1 subscription-manager repos --enable=rhel-7-workstation-optional-
   rpms
2 <!--NeedCopy-->
```

For server:

```
1 subscription-manager repos --enable=rhel-7-server-optional-rpms
2 <!--NeedCopy-->
```

## Port

The session shadowing feature automatically selects available ports from within 6001-6099 to build up connections from the Linux VDA to Citrix Director. Therefore, the number of ICA sessions that you

can shadow concurrently is limited to 99. Ensure that enough ports are available to meet your requirements, especially for multi-session shadowing.

## Registry

The following table lists related registries:

Registry	Description	Default Value
EnableSessionShadowing	Enables or disables the session shadowing feature	1 (Enabled)
ShadowingUseSSL	Determines whether to encrypt the connection between the Linux VDA and Citrix Director	0 (Disabled)

Run the `ctxreg` command on the Linux VDA to change the registry values. For example, to disable session shadowing, run the following command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\Software\Citrix\  
VirtualDesktopAgent" -v "EnableSessionShadowing" -d 0x00000000
```

## SSL

The noVNC connection between the Linux VDA and Citrix Director uses the WebSocket protocol. For session shadowing, whether `ws://` or `wss://` is chosen is determined by the previously mentioned "ShadowingUseSSL" registry. By default, `ws://` is chosen. However, for security reasons, we recommend that you use `wss://` and install certificates on each Citrix Director client and on each Linux VDA server. Citrix disclaims any security responsibility for the Linux VDA session shadowing by using `ws://`.

### Obtain server and root SSL certificates

Certificates must be signed by a trusted Certificate Authority (CA).

A separate server certificate (including the key) is required for each Linux VDA server on which you want to configure SSL. A server certificate identifies a specific computer, so you must know the Fully Qualified Domain Name (FQDN) of each server. For convenience, you can use a wildcard certificate for the whole domain instead. In this case, you must know at least the domain name.

In addition to installing a server certificate on each server, you must install a root certificate from the same CA on each Citrix Director client that communicates with the Linux VDA server. Root certificates are available from the same CAs that issue the server certificates. You can install server and client certificates from a CA that is bundled with your operating system, from an enterprise CA (a CA that your organization makes accessible to you), or from a CA not bundled with your operating system. Consult the security team of your organization to find out which of the methods they require for obtaining certificates.

**Important:**

- The Common Name for a server certificate must be the exact FQDN of the Linux VDA server or at least the correct wildcard plus domain characters. For example, vda1.basedomain.com or \*.basedomain.com.
- Hashing algorithms including the SHA1 and MD5 are too weak for signatures in digital certificates for some browsers to support. So SHA-256 is specified as the minimum standard.

**Install a root certificate on each Citrix Director client**

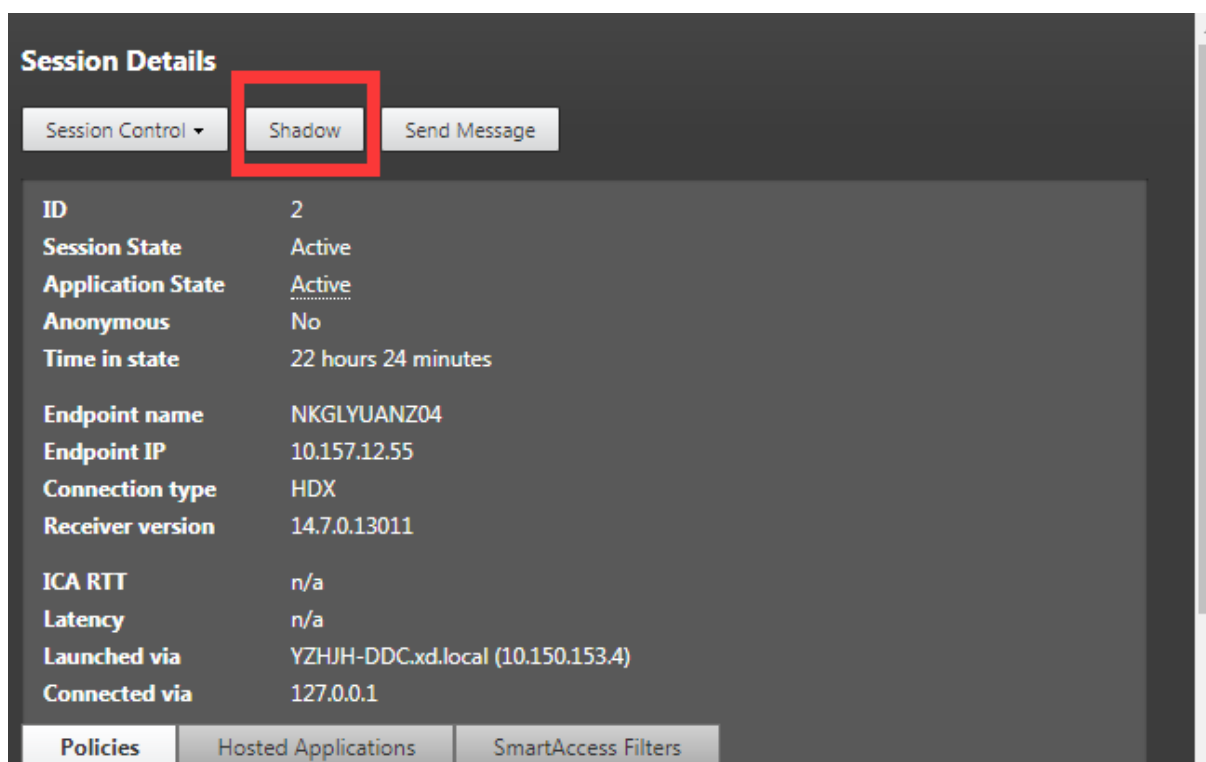
Session shadowing uses the same registry-based certificate store as IIS, so you can install root certificates using IIS or the Microsoft Management Console (MMC) Certificates snap-in. When you receive a certificate from a CA, you can restart the Web Server Certificate Wizard in IIS and the wizard installs the certificate. Alternatively, you can view and import certificates on the computer using the MMC and add the certificate as a standalone snap-in. Internet Explorer and Google Chrome import the certificates installed on your operation system by default. For Mozilla Firefox, you must import your root SSL certificates on the **Authorities** tab of Certificate Manager.

**Install a server certificate and its key on each Linux VDA server**

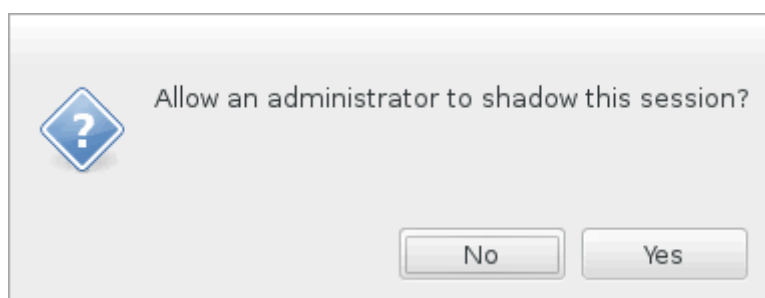
Name the server certificates “shadowingcert.\*” and the key file “shadowingkey.\*” (\* can indicate the format, for example, shadowingcert.csr and shadowingkey.key). Put server certificates and key files under the path **/etc/xdl/shadowingssl** and protect them properly with restricted permissions. An incorrect name or path makes the Linux VDA unable to find a specific certificate or key file and therefore causes connection failure with Citrix Director.

**Usage**

From Citrix Director, find the target session and click **Shadow** in the **Session Details** view to send a shadowing request to the Linux VDA.



After the connection initializes, a confirmation appears on the ICA session client (not the Citrix Director client) to ask the user for permission to shadow the session.



If the user clicks **Yes**, a window appears on the Citrix Director side, indicating that the ICA session is being shadowed.

For more information about the usage, see the [Citrix Director Documentation](#).

## Limitations

- Session shadowing is designed for use in an Intranet only. It does not work for external networks even connecting through Citrix Gateway. Citrix disclaims any responsibility for the Linux VDA session shadowing in an external network.
- With session shadowing enabled, a domain administrator can only view the ICA sessions, but has no permission to write or control it.



- After an administrator clicks **Shadow** from Citrix Director, a confirmation appears to ask the user for permission to shadow the session. A session can be shadowed only when the session user gives the permission.
- The previously mentioned confirmation has a timeout limitation, which is 20s. A shadowing request fails when the time runs out.
- One ICA session can be shadowed by only one administrator in one Citrix Director window. If an ICA session has been shadowed by administrator A and meanwhile, administrator B sends a shadowing request, the confirmation for getting the user permission reappears on the user device. If the user agrees, the shadowing connection for administrator A stops and a new shadowing connection is built for administrator B. It is the same if another shadowing request for the same ICA session is sent by the same administrator.
- To use session shadowing, install Citrix Director 7.16 or later.
- A Citrix Director client uses an FQDN rather than an IP address to connect to the target Linux VDA server. Therefore, the Citrix Director client must be able to resolve the FQDN of the Linux VDA server.

## Troubleshooting

If session shadowing fails, perform debugging on both the Citrix Director client and the Linux VDA.

### On the Citrix Director client

Through the developer tools of the browser, check the output logs on the **Console** tab. Or, check the response of the ShadowLinuxSession API on the **Network** tab. If the confirmation for getting the user permission appears but the connection fails to be built, manually ping the FQDN of the Linux VDA to verify that Citrix Director can resolve the FQDN. If there is an issue with the `wss://` connection, check your certificates.

### On the Linux VDA

Verify that the confirmation for getting the user permission appears in response to a shadowing request. If it does not, check the `vda.log` and `hdx.log` files for clues. To obtain the `vda.log` file, do the following:

1. Find the `/etc/xdl/ctx-vda.conf` file. Uncomment the following line to enable the `vda.log` configuration:

```
Log4jConfig=" /etc/xdl/log4j.xml"
```

2. Open `/etc/xdl/log4j.xml`, locate the `com.citrix.dmc` part, and change “info” to “trace” as follows:

```
1 <!-- Broker Agent Plugin - Director VDA plugin Logger -->
2
3 <logger name="com.citrix.dmc">
4
5 <level value="trace"/>
6
7 </logger>
8 <!--NeedCopy-->
```

3. Run the `service ctxvda restart` command to restart the `ctxvda` service.

If there is an error during connection build-up:

1. Check for any firewall limitation that stops session shadowing from opening the port.
2. Verify that certificates and key files are named properly and put under the correct path if it is the SSL scenario.
3. Verify that there are enough ports left between 6001-6099 for new shadowing requests.

## Browser content redirection

December 21, 2021

### Overview

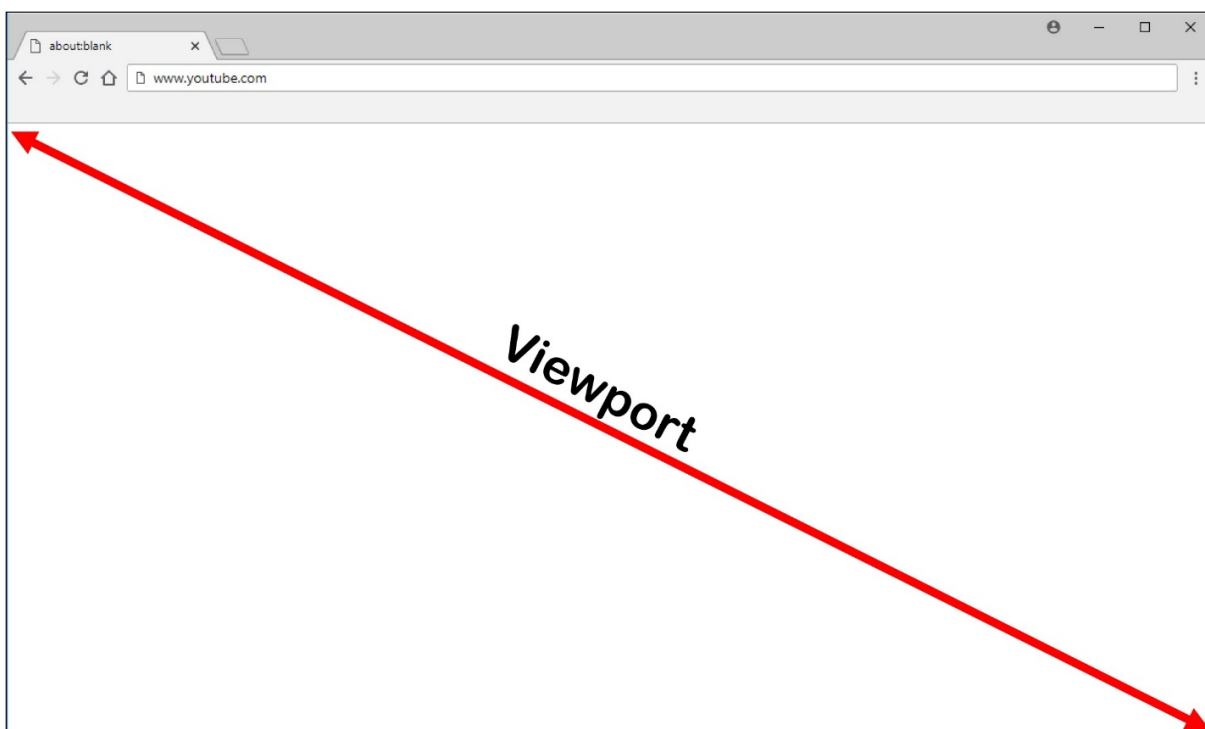
The Linux VDA supports browser content redirection in Google Chrome. Browser content redirection provides the ability of rendering webpages in the allow list on the client side. This feature uses Citrix Workspace app to instantiate a corresponding rendering engine on the client side, which fetches the HTTP and HTTPS content from the URL.

#### Note:

You can specify which webpages are redirected to the client side by using an allow list. Conversely, you can specify which webpages are not redirected to the client side by using a block list.

This overlay web layout engine runs on the client instead of on the VDA and uses the client CPU, GPU, RAM, and network.

Only the browser viewport is redirected. The viewport is the rectangular area in your browser where content displays. The viewport does not include items such as the address bar, favorites bar, and status bar. Those items are still running in the browser on the VDA.



## System requirements

### Windows client:

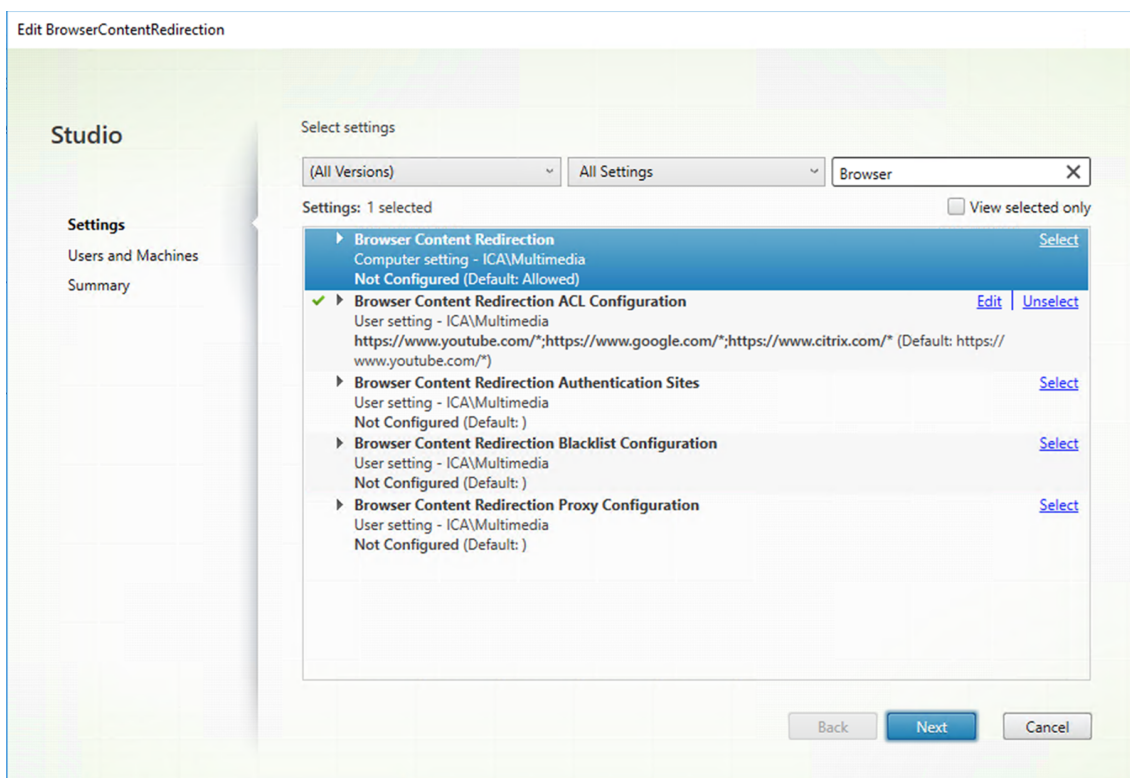
- Citrix Workspace app 1809 for Windows or later

### Linux VDA:

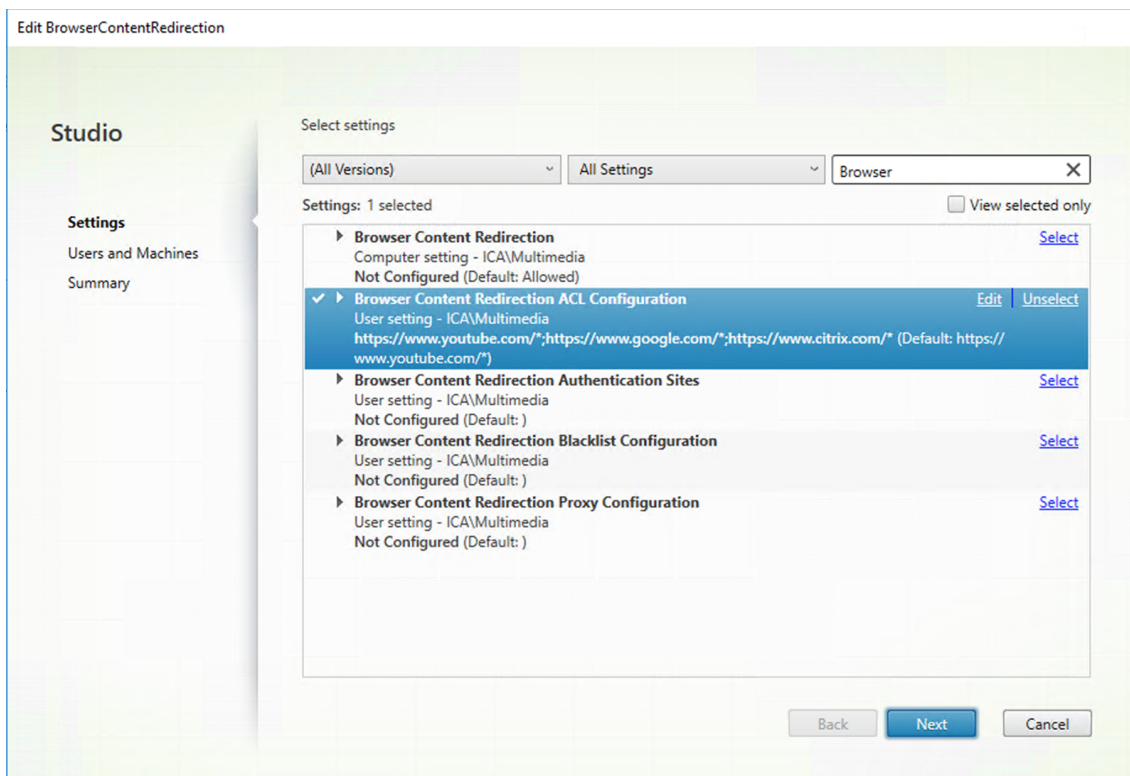
- VDA operating system: Ubuntu 16.04, Ubuntu 18.04, RHEL 7.8, RHEL 8.2, RHEL 8.1, SLES 12.5
- Browser on the VDA: Google Chrome v66 or later with the Citrix browser content redirection extension added

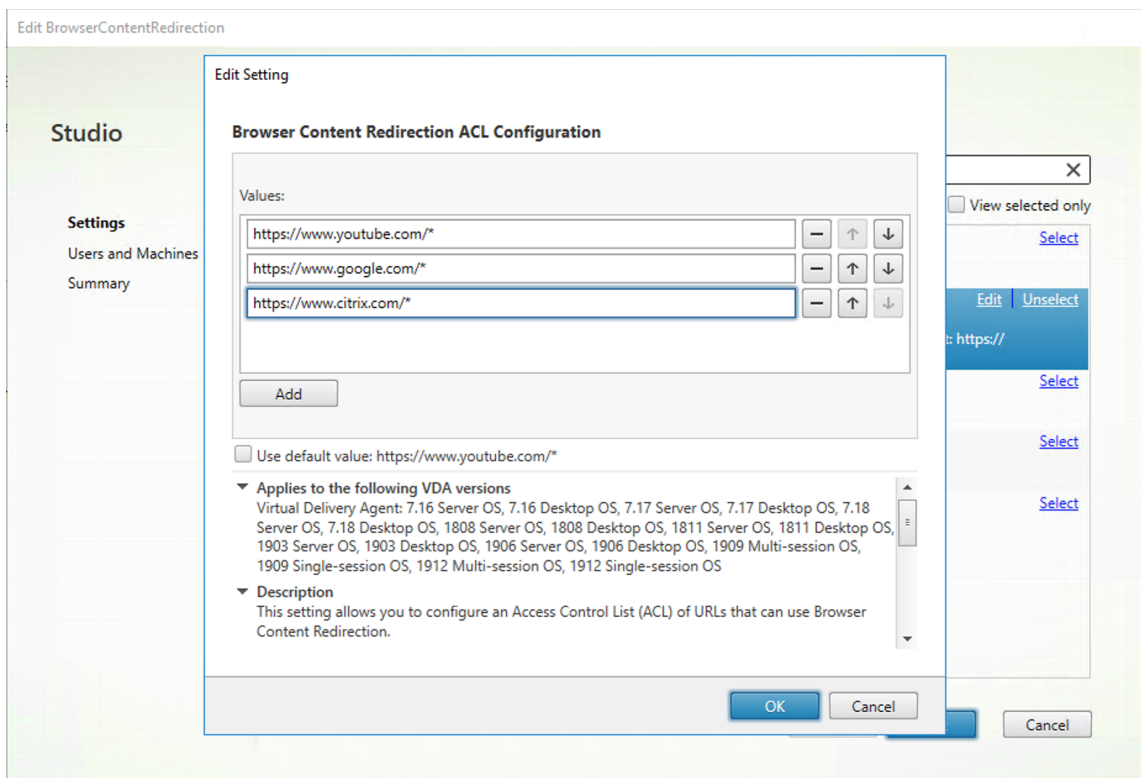
## Configure browser content redirection

1. In Citrix Studio, configure a policy that specifies an allow list of URLs that can use browser content redirection and a block list of URLs that cannot. Browser content redirection is set to **Allowed** by default.

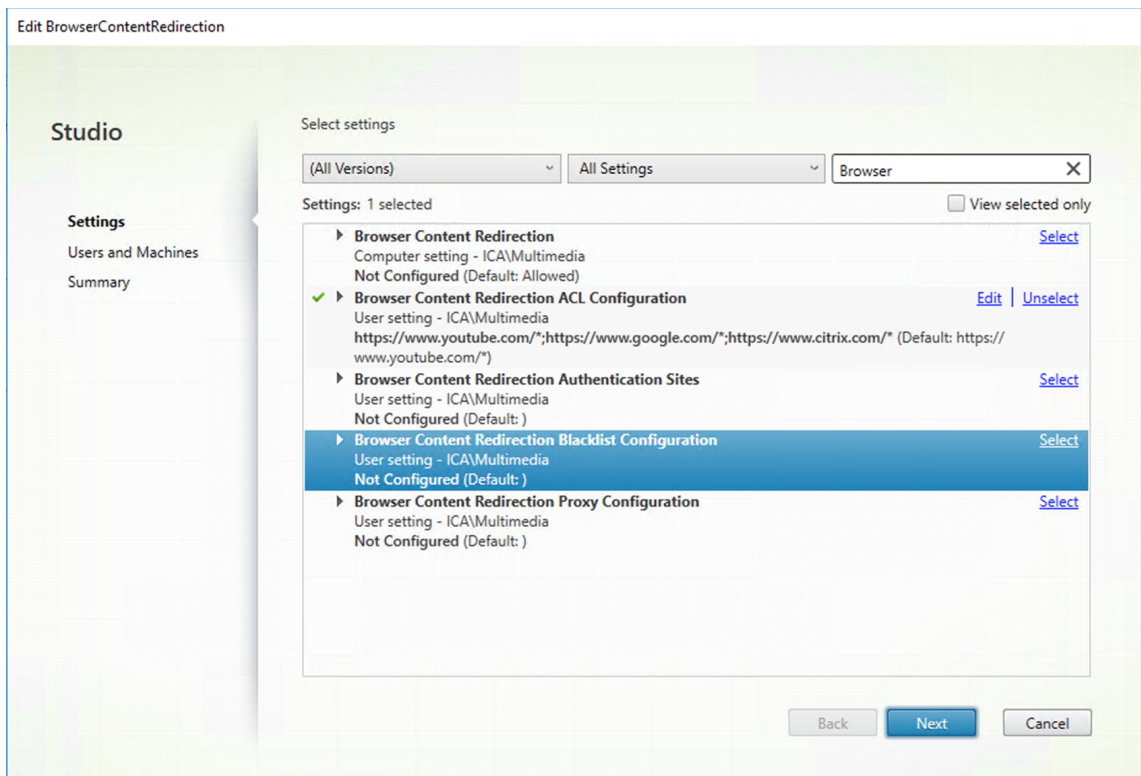


The **Browser Content Redirection ACL Configuration** setting specifies an allow list of URLs that can use browser content redirection.





The **Browser Content Redirection Blacklist Configuration** setting specifies a block list of URLs that cannot use browser content redirection.



**Note:**

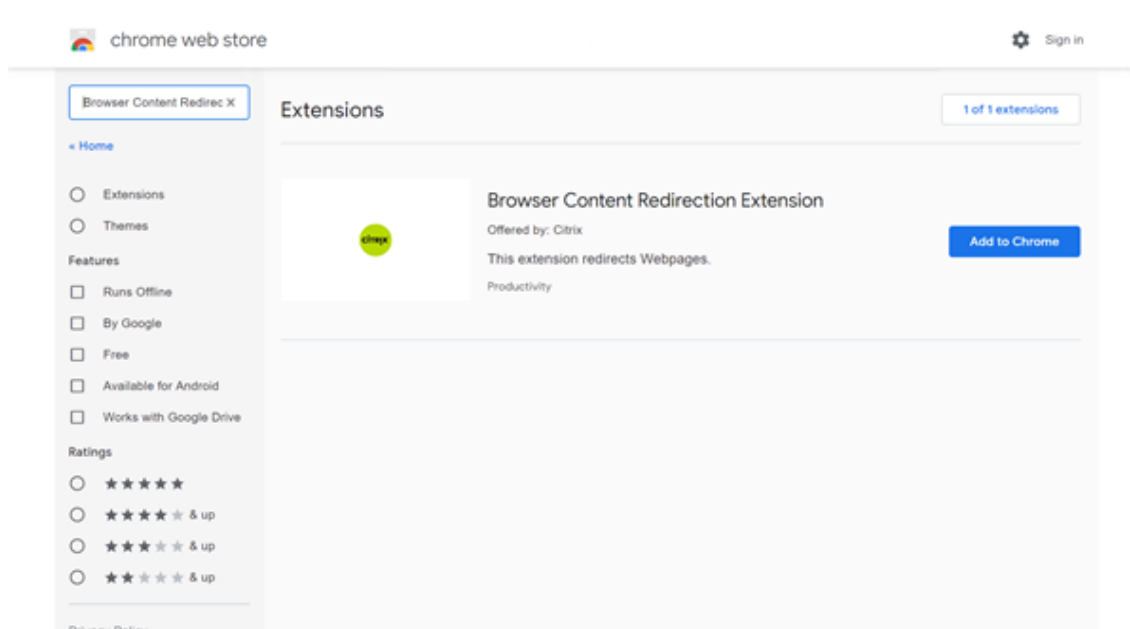
The Linux VDA currently does not support the **Browser Content Redirection Proxy Configuration** setting.

2. For the browser on the VDA to detect whether a URL (being navigated to) matches an allow list or a block list, add the Citrix browser content redirection extension from the Chrome Web Store. Click **Add to Chrome** on the VDA.

**Important:**

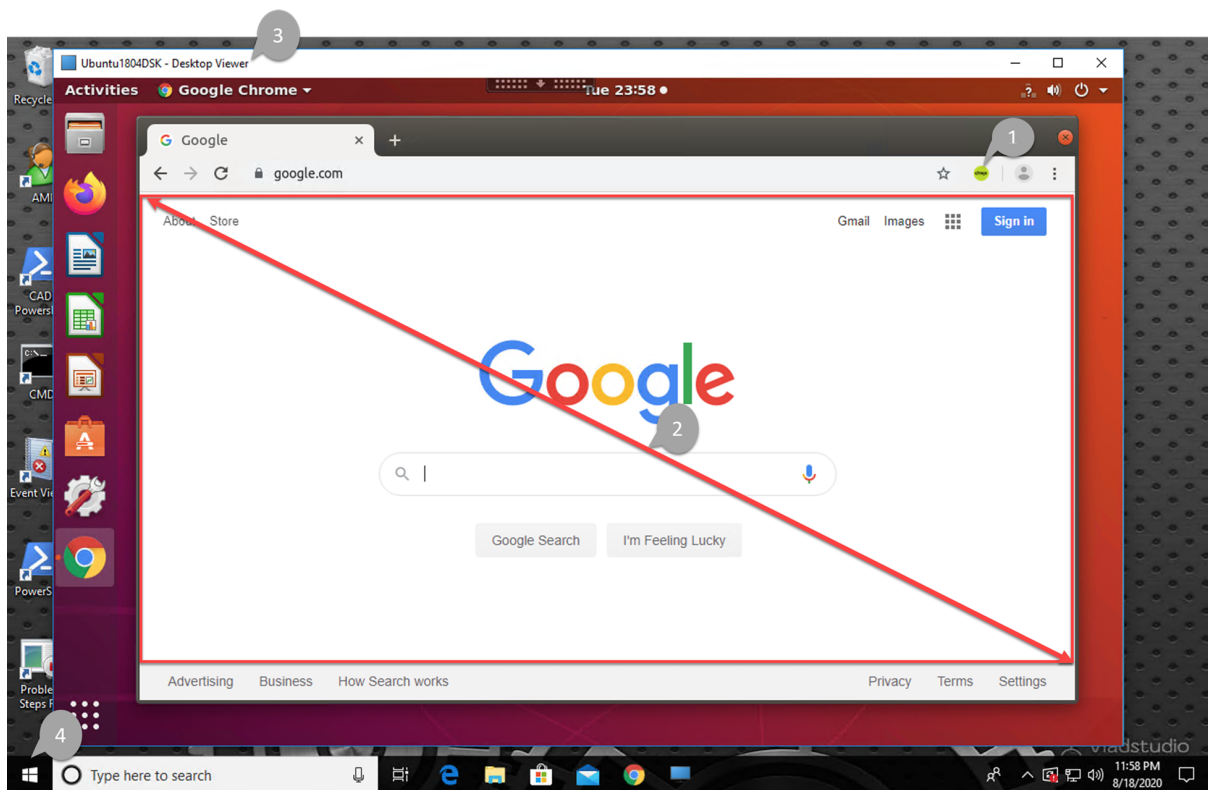
The extension is not required on the client. Add it only on the VDA.

Chrome extensions are installed on a per-user basis. Updating a golden image to add or remove an extension is not required.



If a match to a URL is found in an allow list (for example, <https://www.mycompany.com/>) but not in any block list, a virtual channel (CTXCSB) instructs the Citrix Workspace app that a redirection is required and relays the URL. Citrix Workspace app then instantiates a local rendering engine and displays the website.

Citrix Workspace app then blends back the website into the virtual desktop browser content area seamlessly.



1. Icon of the Citrix browser content redirection extension

The color of the extension icon specifies the status of the Chrome extension. It is one of the three colors:

- Green: Active and connected
- Gray: Not active/idle on the current tab
- Red: Broken/Not working

2. Viewport rendered on the client or blended back to the virtual desktop

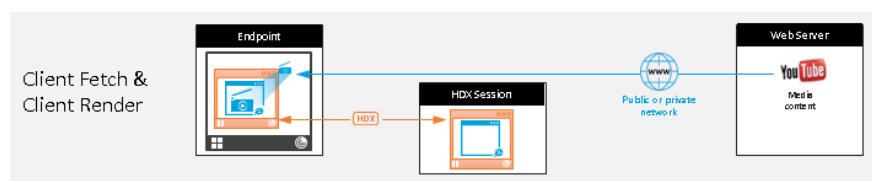
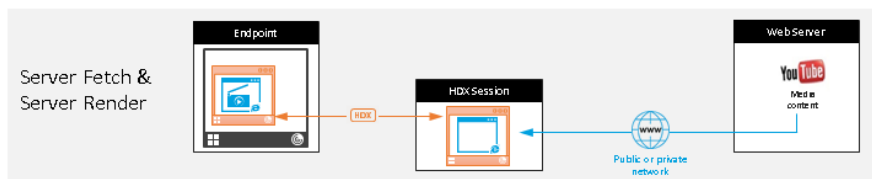
3. Linux VDA

4. Windows client

**Redirection scenarios**

Here are scenarios of how the Citrix Workspace app fetches content:

## Redirection scenarios



### Benefits:

- Better end user experience (Adaptive Bit Rate (ABR))
- Reduced VDA resource usage (CPU/RAM/IO)
- Reduced bandwidth consumption

- **Server fetch and server render:** There is no redirection because you did not add the site to the allow list or the redirection failed. We fall back to rendering the webpage on the VDA and use Thinwire to remote the graphics. Use policies to control the fallback behavior. This scenario causes high CPU, RAM, and bandwidth consumption on the VDA.
- **Client fetch and client render:** Because the Citrix Workspace app contacts the web server directly, it requires Internet access. This scenario offloads all the network, CPU, and RAM usage from your Citrix Virtual Apps and Desktops site.

### Fallback mechanism

There might be times when client redirection fails. For example, if the client machine does not have direct Internet access, an error response might go back to the VDA. In such cases, the browser on the VDA can then reload and render the page on the server.

## Support Citrix Workspace app for HTML5

March 10, 2021

Starting with this release, you can use Citrix Workspace app for HTML5 to access Linux virtual apps and desktops directly without connecting your client to Citrix Gateway. For information about Citrix Workspace app for HTML5, see the [Citrix documentation](#).

### Enable this feature

This feature is disabled by default. To enable it, do the following:



1. In Citrix StoreFront, enable Citrix Workspace app for HTML5.

For the detailed procedure, see Step 1 of Knowledge Center article [CTX208163](#).

2. Enable WebSocket connections.

- a) In Citrix Studio, set the **WebSockets connections** policy to **Allowed**.

You can also set the other WebSocket policies. For a full list of the WebSocket policies, see [WebSockets policy settings](#).

- b) On the VDA, restart the `ctxvda` service and the `ctxhdx` service, in this order, for your setting to take effect.
- c) On the VDA, run the following command to check whether the WebSocket listener is running.

```
netstat -an | grep 8008
```

When the WebSocket listener is running, the command output is similar to the following:

```
tcp 0 0 :::8008 :::* LISTEN
```

**Note:** You can also enable TLS encryption to secure WebSocket connections. For information about enabling TLS encryption, see [Secure user sessions using TLS](#).

## Monitor Linux sessions in Citrix Director

June 22, 2022

The following metrics are available for Linux sessions in Citrix Director. To view the metrics, find the target session in Citrix Director and check the **Session Details** panel.

- ICA RTT

Starting with Linux VDA Version 1903, ICA RTT metrics are available. To view ICA RTT metrics, use Citrix Director 1903 or later and create the **ICA round trip calculation** and **ICA round trip calculation interval** policies in Citrix Studio. For information about policy creation, see [Create a policy using Studio](#).

- Protocol

Starting with Linux VDA Version 1909, protocol information is available. The transport protocol of a Linux session appears as **UDP** or **TCP** in the **Session Details** panel.

## Monitor service daemon

March 10, 2021

The monitor service daemon monitors key services by performing periodical scans. When detecting exceptions, the daemon restarts or stops service processes and cleans up process residuals for releasing resources. The detected exceptions are recorded in the `/var/log/xdl/ms.log` file.

### Configuration

The monitor service daemon starts automatically when you start the VDA.

You can configure the feature through the `scanningpolicy.conf`, `rulesets.conf`, and `whitelist.conf` files with administrator privileges. The configuration files are located at `/opt/Citrix/VDA/sbin`.

To make your changes in the `scanningpolicy.conf`, `rulesets.conf`, and `whitelist.conf` files take effect, run the following command to restart the monitor service daemon.

```
1 service ctxmonitorservice restart
2 <!--NeedCopy-->
```

- **scanningpolicy.conf**

This configuration file enables or disables the monitor service daemon. It sets the service detection interval and specifies whether to repair detected exceptions.

- MonitorEnable: true/false (true by default)
- DetectTime: 20 (unit: seconds, default value: 20, minimum value: 5)
- AutoRepair: true/false (true by default)
- MultBalance: false
- ReportAlarm: false

- **rulesets.conf**

This configuration file specifies the target services to monitor. There are four monitored services by default as shown in the following screen capture.

```
MonitorUser: all
MonitorType: 3
ProcessName: ctxhdx
Operation: 4
DBRecord: false
MonitorUser: all
MonitorType: 3
ProcessName: ctxvda
Operation: 4
DBRecord: false
MonitorUser: all
MonitorType: 3
ProcessName: ctxpolicyd
Operation: 4
DBRecord: false
MonitorUser: all
MonitorType: 3
ProcessName: Xorg
Operation: 8
DBRecord: false
```

To configure each service to monitor, set the following fields.

- MonitorUser: all
- MonitorType: 3
- ProcessName: <> (The process name cannot be left blank and must be exactly matched.)
- Operation: 1/2/4/8 (1 = stop the service when exceptions are detected. 2 = kill the service when exceptions are detected. 4 = restart the service. 8 = clean up the Xorg process residuals.)
- DBRecord: false

- **whitelist.conf**

The target services specified in the **rulesets.conf** file must also be configured in **whitelist.conf** file. The white list configuration is a secondary filter for security.

To configure the white list, include only the process names (which must be match exactly) in the **whitelist.conf** file. For an example, see the following screen capture.

```
ctxcdmnd  
ctxcdmmount  
ctxcdmstat  
ctxceip  
ctxclipboard  
ctxconnect  
ctxcredentialctl  
ctxctl  
ctxcupsd  
ctxdisconnect  
ctxeuem  
ctxfiletransfer  
ctxgfx  
ctxhdx  
ctxism  
ctxlogd  
ctxlogin  
ctxmonitorservice  
ctxmrvc  
ctxpolicyd  
ctxscardsd  
ctxvhcid  
ctxvda  
Xorg
```

**Note:**

Before you stop the `ctxvda`, `ctxhdx`, and `ctxpolicyd` services, run the `service ctxmonitorservice stop` command to stop the monitor service daemon. Otherwise, the monitor service daemon restarts the services you stopped.

## Secure user sessions using TLS

February 18, 2022

As of Version 7.16, the Linux VDA supports TLS encryption for secure user sessions. TLS encryption is disabled by default.

### Enable TLS encryption

To enable TLS encryption for secure user sessions, obtain certificates and enable TLS encryption on both the Linux VDA and the Delivery Controller (the Controller).

### **Obtain certificates**

Obtain server certificates in PEM format and root certificates in CRT format from a trusted Certificate Authority (CA). A server certificate contains the following sections:

- Certificate
- Unencrypted private key
- Intermediate certificates (optional)

An example of a server certificate:

```
-----BEGIN CERTIFICATE-----
MIIDTCCArAgAwIBAgIJA1ALuncp1qGXCMaOGCSqGSIb3DQEBAQAMGcxCzAJBgNV
BAYTA1VLMR.IwEAYDVQIEwIDYwL1cm1kZ2UxEjAQBGNVBACTCUNhbwJvdXJzTEU
MBIGAlUEChMLQ210cm14IFR1c3QxGjAYBgNVBAMTEWVhMDAxLmNpdHJpdGUubmV0
MB4XDTA4MDkzMDEwNTk1MloXDTI4MDkyNTEwNTk1MlowYXNjaG9uYmVhYTA1Vl
MR.IwEAYDVQIEwIDYwL1cm1kZ2UxEjAQBGNVBACTCUNhbwJvdXJzTEUwIGAlUE
ChMLQ210cm14IFR1c3QxGzAZBgNVBAsTE1N1cnZ1c1BDZkZ0aWZpY2FOZTEgMB4G
A1UEAxMyZWwMDEtc2MwMDEuY210cm10ZS5uZmVzZmVzZmVzZmVzZmVzZmVzZmVz
gY0AMIGJAoGBALCTD0xc1vbI0L0F66xg05gkVneIckVp+37p5KV8B661wCVzr6p9
t72Fa+9ocCcf2x/ue274NXFc4f4qGRDsrEw13yxM6COyBf7L6psrCDNnBf1q8TJH
4xoPIUeaw4MvK/3PvYfHhKs4fz8yy1I4VdnXVhHw+OFQ2Bq3NhwsRhnAgMBAAGj
gdwgdKvCQYDVR0TBAlwADABgNVHQ4EFgQURLiDzyot+CUXSh9xMfp1M+/08y0w
gZkGAlUDIwSBKTCBj0AU85kNIEP30cVhcoss1s1seDQwGSKha6RpmGcxCzAJBgNV
BAYTA1VLMR.IwEAYDVQIEwIDYwL1cm1kZ2UxEjAQBGNVBACTCUNhbwJvdXJzTEU
MBIGAlUEChMLQ210cm14IFR1c3QxGjAYBgNVBAMTEWVhMDAxLmNpdHJpdGUubmV0
ggkAy8nc8dc32EwEQYjYzIzIAyb4QgEBAQAgvMAOGCSqGSIb3DQEBAQAA4GB
AD5a8YhWIXjC2Nt2zdXnbp200yUTowE1Bwqe/9cGaP6CpJoxJ7F3a2/8IpaT68
Ve1Bu1SEY1GKCGcw93pc7sPKqb8pGBRIS/dygb+geFk1qYvbu0Ijotr3pkXae
b6CF3tNLudHUrWf610rB72zbyz3P1Ix+HEwtLj0j5Z4K
-----END CERTIFICATE-----

-----BEGIN RSA PRIVATE KEY-----
MIICXgIBAAKBoGqk0zncXIr2yNc98eusyYDxiB11T/t+6u11fAeupvg1c6+q
fBe9hwvvaAnH9s7ntu+DVXXIOH6hk7KxMNd2MTGjsgX+y+qbK7AgzWt9avEy
R+MaDYf1Hm1uDFZP9z1cn4RyR0H8/MstsoFQ511R4cPtEUNgatZcLEYZwIDAQAB
AoGBAKwBgZu/bk18edgB8YpU7d1iBx89I0s4b/apJm+Jdmjxb8N96rsP024p9Ea
FTuc9+1L8mEroLubSicCXjsJFc+cxg9VvaNaEeKkBJ73SoCUErQ5x0yb/1Adck/
FXzU0tqytUe/KHgcsGjtjrSeqlJqMm+yyzBAatVRRtZGdwAHAKEA311KRZjINSuz
Enm12RTI3ngBhP/S3GEbvJfKsD5n2R190+ooEPxc1vvp5ne8Q0zupshbJFEPbOC
ykZ6UassFwJBAMTISyPnV9ewPzJoanJZIJCMtNXDch51xx1j1yzv+Qmr8RuQz9PV
fIenmTrfZ+wo4DaKg+8ar20vOnKFOHFAMDECOQDEwR1H6cE3wyCfN1u942M9Xkhr
GvSpr7+6b///vL6Nwv3CwPv9n8DTP1+wuDKJ29nCVrte119M1aMTYjs3a1NvAKEA
qy5JzZcbNryZMbV032jju7ZPISnhTGO1x0jZMSLLTPGpNLN34b0k3sTc1r8L42E
uQjTQRm+wdsrVF31FazkQJANudmsUv3gZkHmGaV2hz1dXIFhyOIVv+31eZhQY6
h5EmxS2S50TvyNGt2e6m2gaZnjTagH59TCHvR85nof2g==
-----END RSA PRIVATE KEY-----

-----BEGIN CERTIFICATE-----
MIIDGTCCAKAgAwIBAgIJA1AMvJwvHXad9HMAOGCSqGSIb3DQEBAQAMGcxCzAJBgNV
BAYTA1VLMR.IwEAYDVQIEwIDYwL1cm1kZ2UxEjAQBGNVBACTCUNhbwJvdXJzTEU
MBIGAlUEChMLQ210cm14IFR1c3QxGjAYBgNVBAMTEWVhMDAxLmNpdHJpdGUubmV0
MB4XDTA4MDkzMDEwNTk1MloXDTI4MDkyNTEwNTk1MlowYXNjaG9uYmVhYTA1Vl
EjAQBGNVBACTCUNhbwJyAWRnZTESMBAGAlUEBxMjQ2Ftm91cm51MRQwEgYDVQQK
EwVtDaxRyaXgvgVzdEaMbGAlUEAXMRy2EwMDEuY210cm10ZS5uZmVzZmVzZmVzZmVz
KozIhvcNAQEBBQADgY0AMIGJAoGBAKVzmF7Uj7u0nvo3qwdffOnr3qkNH2DxpwrZ
zh8cI9Vv+UFRU1C6o87izLtbMFn3FOU712cfkHN3ZG117p89pdyjket1Ms1Ve3w
acoqrVvD+fNsvJjunTbaCywTALjmfSfHeZJXVscrpEhknOnkMS16tcrya/K/
oss1zV3AgMBAAGjgcwgcKwDAYDVR0TBAlwAwEw/zAdBgnVHQ4EFgQU85kNIEP3
0cVhcoss1s1seDQwGSIwZkGAlUDIwSBKTCBj0AU85kNIEP30cVhcoss1s1seDQw
GSKha6RpmGcxCzAJBgNVBAYTA1VLMR.IwEAYDVQIEwIDYwL1cm1kZ2UxEjAQBGNV
BACTCUNhbwJvdXJzTEUwIGAlUEChMLQ210cm14IFR1c3QxGjAYBgNVBAMTEWVh
MDAxLmNpdHJpdGUubmV0ggkAy8nc8dc32EwEQYjKozIhvcNAQEBBQADgYEAIZ4Z
gXLLXf12RNqh/awtsb41UgV8BZKAsg5ZhnA1TiXbz2C13ec53Fb6nigMw5T11
UNCLXmXRu1D400tESLX9ACUNH3194yXoguJKs08n121jj2TVfB832Rm5DBY3g
UmKORn/hdqM1Cope5w06as6+HN4wU0+HEtUMWE=
-----END CERTIFICATE-----
```

## Enable TLS encryption

### Enable TLS encryption on the Linux VDA

On the Linux VDA, use the `enable_vdassl.sh` tool to enable (or disable) TLS encryption. The tool is located in the `/opt/Citrix/VDA/sbin` directory. For information about the options available in the tool, run the `/opt/Citrix/VDA/sbin/enable_vdassl.sh -help` command.

**Tip:** A server certificate must be installed on each Linux VDA server and root certificates must be installed on each Linux VDA server and client.

### Enable TLS encryption on the Controller

**Note:**

You can enable TLS encryption only for entire delivery groups. You cannot enable TLS encryption for specific applications.

In a PowerShell window on the Controller, run the following commands in sequence to enable TLS encryption for the target delivery group.

1. `Add-PSSnapin citrix.*`
2. `Get-BrokerAccessPolicyRule -DesktopGroupName 'GROUPNAME' | Set-BrokerAccessPolicyRule -HdxSslEnabled $true`

**Note:**

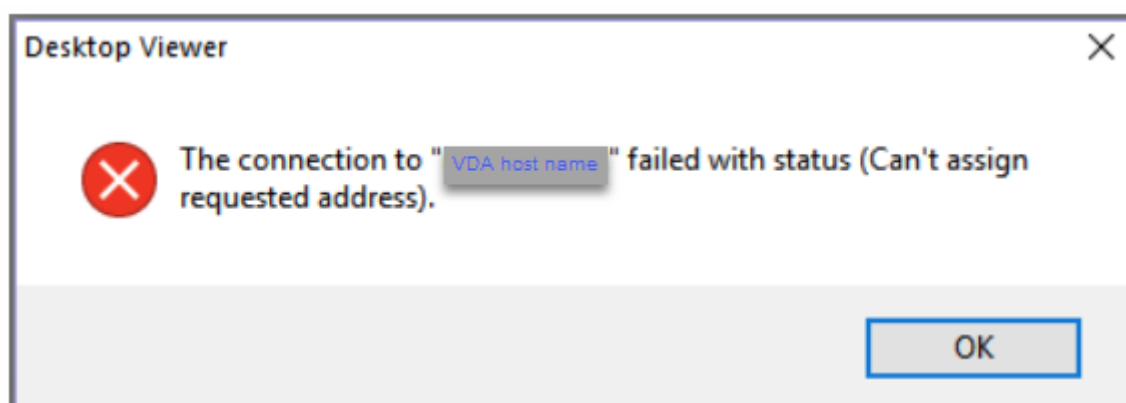
To ensure that only VDA FQDNs are contained in an ICA session file, you can also run the `Set-BrokerSite -DnsResolutionEnabled $true` command. The command enables DNS resolution. If you disable DNS resolution, an ICA session file discloses VDA IP addresses and provides FQDNs only for the TLS-related items such as SSLProxyHost and UDPDTLSPort.

To disable TLS encryption on the Controller, run the following commands in sequence:

1. `Add-PSSnapin citrix.*`
2. `Get-BrokerAccessPolicyRule -DesktopGroupName 'GROUPNAME' | Set-BrokerAccessPolicyRule -HdxSslEnabled $false`
3. `Set-BrokerSite -DnsResolutionEnabled $false`

## Troubleshooting

The following “Can’t assign requested address” error might occur in Citrix Workspace app for Windows when you try to access a published desktop session:



As a workaround, add an entry to the **hosts** file, which is similar to:

```
<IP address of the Linux VDA> <FQDN of the Linux VDA>
```

On Windows machines, the **hosts** file typically locates at `C:\Windows\System32\drivers\etc\hosts`.

## Secure user sessions using DTLS

March 10, 2021

DTLS encryption is a fully supported feature starting with the 7.18 release. By default, this feature is enabled on the Linux VDA. For more information, see [Transport Layer Security](#).

### Enable DTLS encryption

#### Verify that adaptive transport is enabled

In Citrix Studio, verify that the **HDX Adaptive Transport** policy is set to **Preferred** or **Diagnostic mode**.

#### Enable SSL encryption on the Linux VDA

On the Linux VDA, use the `enable_vdassl.sh` tool to enable (or disable) SSL encryption. The tool is located at `/opt/Citrix/VDA/sbin`. For information about the options available in the tool, run the `/opt/Citrix/VDA/sbin/enable_vdassl.sh -h` command.

#### Note:

Currently, the Linux VDA supports both DTLS 1.0 and DTLS 1.2. DTLS 1.2 requires Citrix Receiver for Windows 4.12, or Citrix Workspace app 1808 for Windows or later. If your client supports only DTLS 1.0 (for example, Citrix Receiver for Windows 4.11), set `SSLMinVersion` to `TLS_1.0` and



[SSLCipherSuite to COM or ALL](#) using the `enable_vdassl.sh` tool.

## Text-based session watermark

March 10, 2021

Text-based session watermarks help to deter and enable tracking data theft. This traceable information appears on the session desktop as a deterrent to those using photographs and screen captures to steal data. You can specify a watermark that is a layer of text, which displays over the entire session screen without changing the content of the original document.

### Important:

Text-based session watermarking is not a security feature. The solution does not prevent data theft completely, but it provides some level of deterrent and traceability. We do not guarantee complete information traceability when using this feature. However, we recommend that you combine this feature with other security solutions as applicable.

The session watermark is text and is applied to the session that is delivered to the user. The session watermark carries information for tracking data theft. The most important data is the identity of the logon user of the current session in which the screen image was taken. To trace the data leakage more effectively, include other information such as server or client internet protocol address and a connect time.

To adjust the user experience, use the [Session Watermark policy settings](#) to configure the placement and watermark appearance on the screen.

## Limitations

- Session watermarks are not supported in sessions where browser content redirection is used. To use the session watermark feature, ensure that browser content redirection is disabled.
- Session watermark is not supported and does not appear if the session is running in full-screen hardware accelerated H.264 or H.265 encoding mode with legacy NVIDIA drivers (in this case, `NvCaptureType` is set to 2 in the registry).
- Watermarks are not visible for session shadowing.
- If you press the Print Screen key to capture a screen, the screen captured at the VDA side does not include the watermarks. We recommend that you take measures to avoid screen captures being copied.

## Pass-through authentication by using smart cards

March 10, 2021

Users can use a smart card connected to the client device for authentication when logging on to a Linux virtual desktop session. This feature is implemented through smart card redirection over the ICA smart card virtual channel. Users can also use the smart card within the session. Use cases include adding a digital signature to a document, encrypting or decrypting an email, and authenticating to a website that requires smart card authentication.

The Linux VDA uses the same configuration as the Windows VDA for this feature. For more information, see the [Configure the smart card environment](#) section in this article.

The availability of pass-through authentication by using smart cards is contingent on the following conditions:

- The Linux VDA is installed on RHEL 7 or RHEL 8.
- Smart cards supported by OpenSC are used.
- Citrix Workspace app for Windows is used.

### Note:

Using a mapped smart card within a Linux VDA session to sign on to Citrix Gateway is not officially supported.

### Smart card support on RHEL 8

Smart card authentication depends on the pam\_krb5 module, which is deprecated on RHEL 8. To use smart card authentication on RHEL 8, build the pam\_krb5 module as follows:

1. Download the pam\_krb5-2.4.8-6 source code from

[https://centos.pkgs.org/7/centos-x86\\_64/pam\\_krb5-2.4.8-6.el7.x86\\_64.rpm.html](https://centos.pkgs.org/7/centos-x86_64/pam_krb5-2.4.8-6.el7.x86_64.rpm.html).

1. Build and install the pam\_krb5 module on RHEL 8.

```
1 yum install -y opensc pcsc-lite pcsc-lite-libs pcsc-lite-ccid nss-  
   tools  
2 yum install gcc krb5-devel pam-devel autoconf libtool  
3 rpm2cpio pam_krb5-2.4.8-6.el7.src.rpm | cpio -div  
4 tar xvzf pam_krb5-2.4.8.tar.gz  
5 cd pam_krb5-2.4.8  
6 ./configure --prefix=/usr  
7 make  
8 make install
```

```
9 <!--NeedCopy-->
```

2. Verify that pam\_krb5.so exists under /usr/lib64/security/.

```
1 ls -l /usr/lib64/security | grep pam_krb5
2 <!--NeedCopy-->
```

## Install the Linux VDA software on RHEL 7, RHEL 8

Install the Linux VDA software using the RPM package manager or [easy install](#), see the [Installation overview](#) section.

After the VDA installation is complete, verify that the VDA can register to the Delivery Controller and the published Linux desktop sessions can be launched successfully using password authentication.

## Ensure that OpenSC supports your smart card

OpenSC is a widely used smart card driver on RHEL 7.4+. As a fully compatible replacement of CoolKey, OpenSC supports many types of smart cards (see [Smart Card Support in Red Hat Enterprise Linux](#)).

In this article, the YubiKey 4 smart card is used as an example to illustrate the configuration. YubiKey 4 is an all-in-one USB CCID PIV device that can easily be purchased from Amazon or other retail vendors. The OpenSC driver supports YubiKey 4.



If your organization requires some other more advanced smart card, prepare a physical machine with RHEL 7 or RHEL 8 and the OpenSC package installed. For information about the OpenSC installation, see [Install the smart card driver](#). Insert your smart card, and run the following command to verify that OpenSC supports your smart card:

```
1 pkcs11-tool --module opensc-pkcs11.so --list-slots
```

## Configuration

### Prepare a root certificate

A root certificate is used to verify the certificate on the smart card. Do the following to download and install a root certificate.

1. Obtain a root certificate in PEM format, typically from your CA server.

You can run a command similar to the following to convert a DER file (\*.crt, \*.cer, \*.der) to PEM. In the following command example, **certnew.cer** is a DER file.

```
1 openssl x509 -inform der -in certnew.cer -out certnew.pem
2 <!--NeedCopy-->
```

2. Install the root certificate to the `openssl` directory. The **certnew.pem** file is used as an example.

```
1 cp certnew.pem <path where you install the root certificate>
2 <!--NeedCopy-->
```

To create a path for installing the root certificate, run `sudo mkdir -p <path where you install the root certificate>`.

### Configure the smart card environment

You can use the `ctxsmartlogon.sh` script to configure the smart card environment or do the configuration manually.

- Use the `ctxsmartlogon.sh` script to configure the smart card environment

**Note:**

The `ctxsmartlogon.sh` script adds PKINIT information to the default realm. You can change this setting through the `/etc/krb5.conf` configuration file.

Before using smart cards for the first time, run the `ctxsmartlogon.sh` script to configure the smart card environment.

```
1 sudo /opt/Citrix/VDA/sbin/ctxsmartlogon.sh
2 <!--NeedCopy-->
```

The results resemble the following:

```
#####
# ctxsmartlogon.sh sets up smart card logon for the Linux VDA, which
# includes automatic installation of the necessary packages and changes to
# the configuration files.
#
# Note:
# The ctxsmartlogon.sh adds pkinit information to the default realm. You can
# change this setting through the /etc/krb5.conf configuration file.
#####
Step 1:Enable smart card logon.
Do you want enable smart card logon? (y/n)[y] y
Step 2:Select the Active Directory integration method.
Please select which Active Directory integration method to use:
1: Winbind
2: SSSD
3: Centrify
Select one of the above options (1-3)[1] 1
Step 3:Install dependent packages.
Installing, please wait...
[krb5-pkinit][pam_krb5] already installed.
[pcsc-lite][pcsc-lite-ccid][pcsc-lite-libs][coolkey] already installed.
Packages installed. [Success]
Step 4:Configure krb5.conf.
Specify the path to the root CA (e.g., /etc/pki/CA/certs/root.pem):/etc/pki/CA/certs/root.pem
/etc/krb5.conf configure successfully.
Step 5:Configure PAM files.
Specify the path to the smart card PKCS11 driver (e.g., /usr/lib64/pkcs11/libcoolkeypk11.so):/usr/lib64/pkcs11/libcoolkeypk11.so
/etc/pam.d/ctxfsc configure successfully.
/etc/pam.d/smartcard-auth configure successfully.
ctxsmartlogon.sh executed successfully. SmartCard is ready.
```

To disable smart cards:

```
1 sudo /opt/Citrix/VDA/sbin/ctxsmartlogon.sh
2 <!--NeedCopy-->
```

The results resemble the following:

```
#####
# ctxsmartlogon.sh sets up smart card logon for the Linux VDA, which
# includes automatic installation of the necessary packages and changes to
# the configuration files.
#
# Note:
# The ctxsmartlogon.sh adds pkinit information to the default realm. You can
# change this setting through the /etc/krb5.conf configuration file.
#####
Step 1:Enable smart card logon.
Do you want enable smart card logon? (y/n)[y] n
ctxsmartlogon.sh exit.
```

- Manually configure the smart card environment

The Linux VDA uses the same smart card environment with the Windows VDA. In the environment, multiple components must be configured, including the Domain Controller, Microsoft Certificate Authority (CA), Internet Information Services, Citrix StoreFront, and Citrix Workspace

app. For information about the configuration based on the YubiKey 4 smart card, see Knowledge Center article [CTX206156](#).

Before proceeding to the next step, ensure that all components are correctly configured, the private key and user certificate are downloaded to the smart card, and you can successfully log on to the Windows VDA using the smart card.

### **Install the PC/SC Lite packages**

PCSC Lite is an implementation of the Personal Computer/Smart Card (PC/SC) specification in Linux. It provides a Windows smart card interface for communicating to smart cards and readers. Smart card redirection in the Linux VDA is implemented on the PC/SC level.

Run the following command to install the PC/SC Lite packages.

```
1 yum install pcsc-lite pcsc-lite-ccid pcsc-lite-libs
2 <!--NeedCopy-->
```

### **Install the smart card driver**

OpenSC is a widely used smart card driver on RHEL. If OpenSC is not installed, run the following command to install it.

```
1 yum install opensc
2 <!--NeedCopy-->
```

### **Install the PAM modules for smart card authentication**

Run the following command to install the pam\_krb5 and krb5-pkinit modules.

RHEL 7:

```
1 yum install pam_krb5 krb5-pkinit
2 <!--NeedCopy-->
```

RHEL 8:

```
1 yum install krb5-pkinit
2 <!--NeedCopy-->
```

The `pam_krb5` module is a pluggable authentication module that PAM-aware applications can use to check passwords and obtain ticket-granting tickets from the Key Distribution Center (KDC). The `krb5-pkinit` module contains the PKINIT plug-in that allows clients to obtain initial credentials from the KDC using a private key and a certificate.

### Configure the `pam_krb5` module

The `pam_krb5` module interacts with the KDC to get Kerberos tickets using certificates in the smart card. To enable `pam_krb5` authentication in PAM, run the following command:

```
1 authconfig --enablekrb5 --update
2 <!--NeedCopy-->
```

In the `/etc/krb5.conf` configuration file, add PKINIT information according to the actual realm.

#### Note:

The `pkinit_cert_match` option specifies matching rules that the client certificate must match before it is used to attempt PKINIT authentication. The syntax of the matching rules is:

*[relation-operator] component-rule ...*

where `relation-operator` can be either `&&`, meaning all component rules must match, or `||`, meaning only one component rule must match.

Here is an example of a generic `krb5.conf` file:

```
1 EXAMPLE.COM = {
2
3
4     kdc = KDC.EXAMPLE.COM
5
6     auth_to_local = RULE:[1:$1@$0]
7
8     pkinit_anchors = FILE:<path where you install the root certificate
9         >/certnew.pem
10
11     pkinit_kdc_hostname = KDC.EXAMPLE.COM
```

```

12     pkinit_cert_match = ||<EKU>msScLogin,<KU>digitalSignature
13
14     pkinit_eku_checking = kpServerAuth
15
16 }
17
18 <!--NeedCopy-->

```

The configuration file resembles the following after you add the PKINIT information.

```

CTXDEV.LOCAL = {
    kdc = ctx-ad.ctxdev.local
    auth_to_local = RULE:[1:$1@$0]
    pkinit_kdc_hostname = ctx-ad.ctxdev.local
    pkinit_anchors = FILE:/etc/pki/CA/certs/certnew.pem
    pkinit_eku_checking = kpServerAuth
    pkinit_cert_match = ||<EKU>msScLogin,<KU>digitalSignature
}

```

### Configure PAM authentication

PAM configuration files tell what modules are used for PAM authentication. To add pam\_krb5 as an authentication module, add the following line to the `/etc/pam.d/smartcard-auth` file:

```
auth [success=done ignore=ignore default=die] pam_krb5.so preauth_options=X509_user_identity=PKCS11:/usr/lib64/pkcs11/opensc-pkcs11.so
```

The configuration file resembles the following after modification if Winbind is used.

```

#%PAM-1.0
# This file is auto-generated.
# User changes will be destroyed the next time authconfig is run.
auth        required      pam_env.so
auth        [success=done ignore=ignore default=die] pam_krb5.so preauth_options=X509_user_identity=PKCS11:/usr/lib64/pkcs11/libcoolkeypk11.so
auth        sufficient    pam_permit.so
auth        required      pam_deny.so

account     required      pam_unix.so broken_shadow
account     sufficient    pam_localuser.so
account     sufficient    pam_succeed_if.so uid < 1000 quiet
account     [default=bad success=ok user_unknown=ignore] pam_winbind.so
account     [default=bad success=ok auth_err=ignore user_unknown=ignore ignore=ignore] pam_krb5.so
account     required      pam_permit.so

password    required      pam_pkcs11.so

session     optional      pam_keyinit.so revoke
session     required      pam_limits.so
-session    optional      pam_systemd.so
#session    optional      pam_oddjob_mkhomedir.so umask=0077
session     optional      pam_mkhomedir.so umask=0077
session     [success=1 default=ignore] pam_succeed_if.so service in crond quiet use_uid
session     required      pam_unix.so
session     optional      pam_winbind.so
session     optional      pam_krb5.so

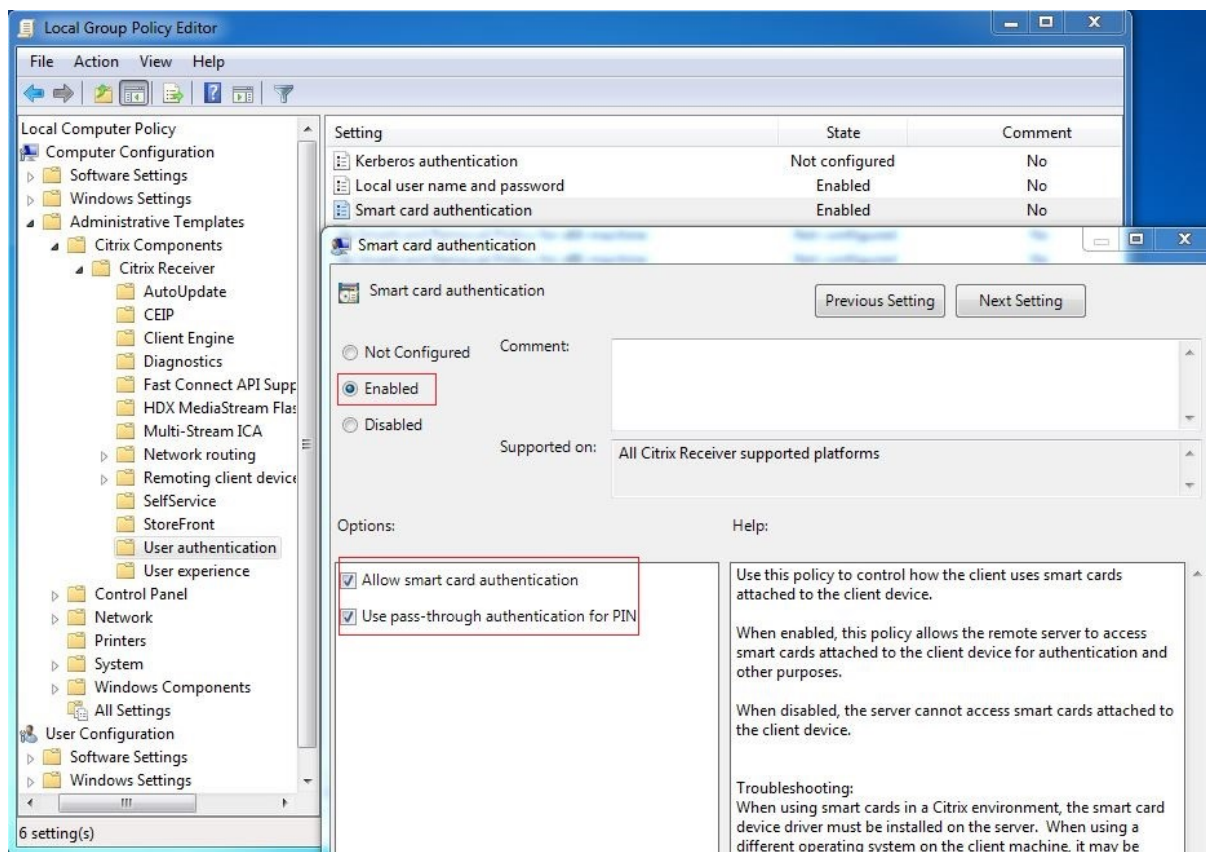
```



### (Optional) Single sign-on by using smart cards

Single sign-on (SSO) is a Citrix feature that implements pass-through authentication with virtual desktop and application launches. This feature reduces the number of times that users type their PIN. To use SSO with the Linux VDA, configure Citrix Workspace app. The configuration is the same with the Windows VDA. For more information, see Knowledge Center article [CTX133982](#).

Enable the smart card authentication as follows when configuring the group policy in Citrix Workspace app.



### Fast smart card logon

Fast smart card is an improvement over the existing HDX PC/SC-based smart card redirection. It improves performance when smart cards are used in high-latency WAN environments. For more information, see [Smart cards](#).

The Linux VDA supports fast smart card on the following versions of Citrix Workspace app:

- Citrix Receiver for Windows 4.12
- Citrix Workspace app 1808 for Windows and later

### Enable fast smart card logon on the client

Fast smart card logon is enabled by default on the VDA and disabled by default on the client. On the client, to enable fast smart card logon, include the following parameter in the default.ica file of the associated StoreFront site:

```
1 [WFClient]
2 SmartCardCryptographicRedirection=On
3 <!--NeedCopy-->
```

### Disable fast smart card logon on the client

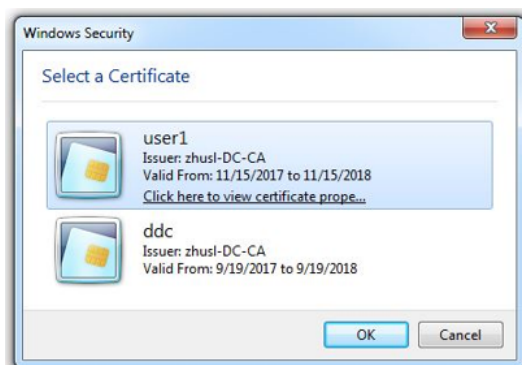
To disable fast smart card logon on the client, remove the **SmartCardCryptographicRedirection** parameter from the default.ica file of the associated StoreFront site.

## Usage

### Log on to the Linux VDA by using a smart card

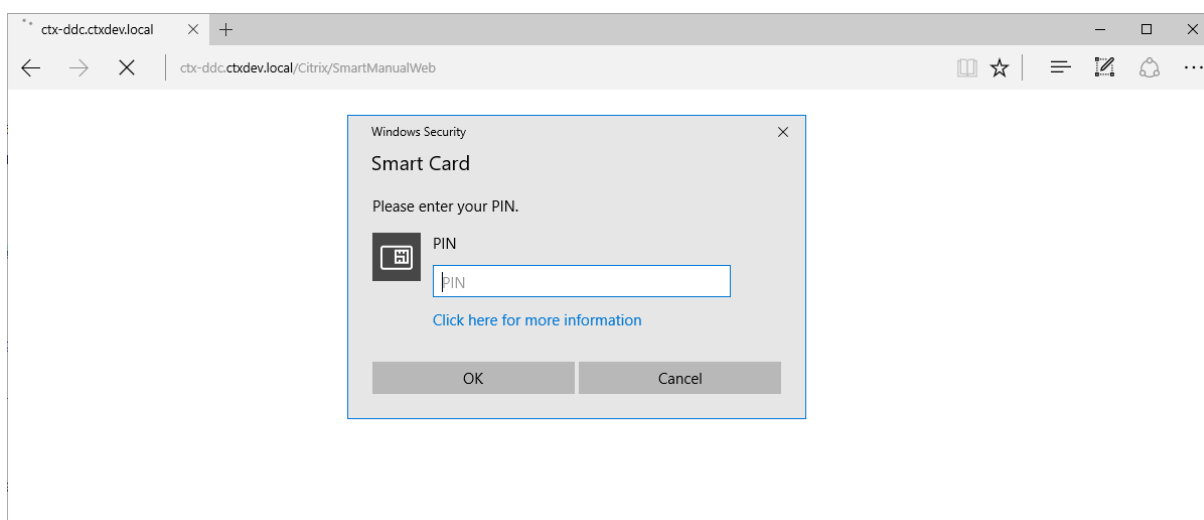
Users can use a smart card to log on to the Linux VDA in both SSO and non-SSO scenarios.

- In the SSO scenario, users are automatically logged on to StoreFront by using the cached smart card certificate and PIN. When users launch a Linux virtual desktop session in StoreFront, the PIN is passed to the Linux VDA for smart card authentication.
- In the non-SSO scenario, users are prompted to select a certificate and type a PIN to log on to StoreFront.



When users launch a Linux virtual desktop session in StoreFront, a dialog box for logon to the Linux VDA appears as follows. The user name is extracted from the certificate in the smart card and users must type the PIN again for logon authentication.

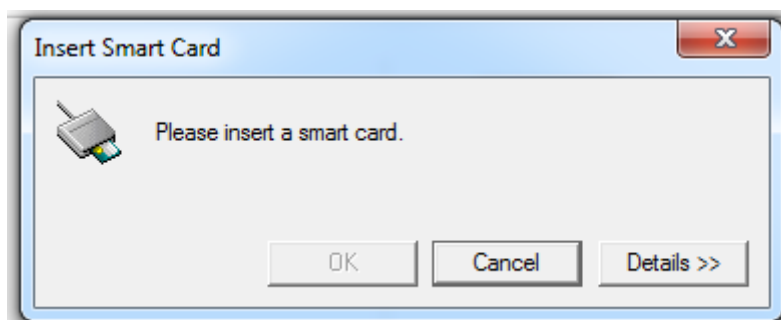
This behavior is the same with the Windows VDA.



### Reconnect to a session by using a smart card

To reconnect to a session, ensure that the smart card is connected to the client device. Otherwise, a gray caching window appears on the Linux VDA side and exits quickly because reauthentication fails without the smart card connected. No other prompt is provided in this case to remind you to connect the smart card.

On the StoreFront side, however, if a smart card is not connected when you try to reconnect to a session, the StoreFront web might give an alert as follows.



### Limitation

#### Smart card removal policy

Now, the Linux VDA uses only the default behavior for smart card removal. When you remove the smart card after logging on to the Linux VDA successfully, the session still keeps connected and the session screen is not locked.

### Support for other smartcards and the PKCS#11 library

Although only the OpenSC smart card is listed on our support list, you can try using other smart cards and the PKCS#11 library because Citrix is providing a generic smart card redirection solution. To switch to your specific smart card or the PKCS#11 library:

1. Replace all the `opensc-pkcs11.so` instances with your PKCS#11 library.
2. To set the path of your PKCS#11 library to the registry, run the following command:

```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\
  CurrentControlSet\Control\Citrix\VirtualChannels\Scard" -v "
  PKCS11LibPath" -d "PATH"
2 <!--NeedCopy-->
```

where **PATH** points to your PKCS#11 library such as `/usr/lib64/pkcs11/opensc-pkcs11.so`

3. Disable fast smart card logon on the client.

## Double-hop single sign-on authentication

March 10, 2021

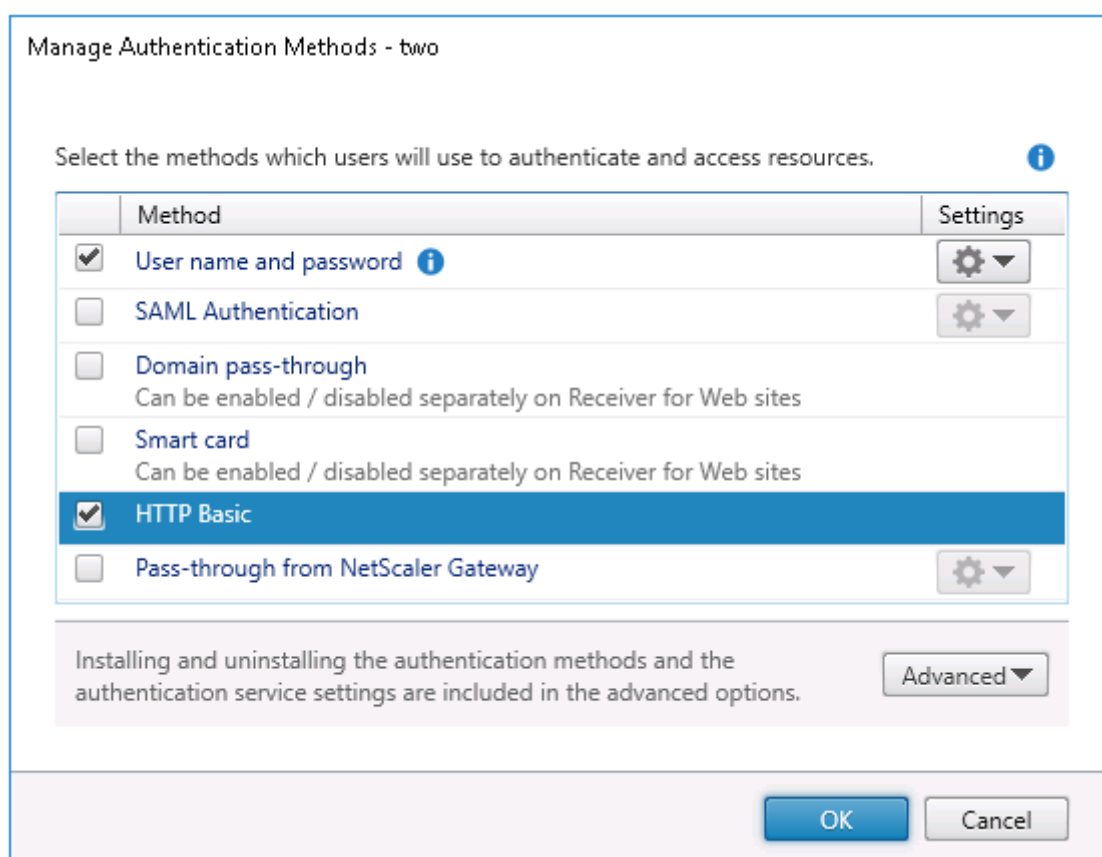
The feature injects user credentials entered for accessing a StoreFront store to the AuthManager module of Citrix Workspace app for Linux and Citrix Receiver for Linux 13.10. After injection, you can use the client to access virtual desktops and applications from within a Linux virtual desktop session, without entering user credentials for a second time.

#### Note:

This feature is supported on Citrix Workspace app for Linux and Citrix Receiver for Linux 13.10.

To enable the feature:

1. On the Linux VDA, install Citrix Workspace app for Linux or Citrix Receiver for Linux 13.10.  
Download the app from the [Citrix download page](#) for Citrix Workspace app or for Citrix Receiver.  
The default installation path is `/opt/Citrix/ICAClient/`. If you install the app to a different path, set the `ICAROOT` environment variable to point to the actual installation path.
2. In the Citrix StoreFront management console, add the **HTTP Basic** authentication method for the target store.



3. Add the following key to the AuthManager configuration file (\$ICAROOT/config/AuthManConfig.xml) for allowing the HTTP Basic authentication:

```

1 <Protocols>
2     <HTTPBasic>
3         <Enabled>True</Enabled>
4     </HTTPBasic>
5 </Protocols>
6 <!--NeedCopy-->

```

4. Run the following commands to install the root certificate in the specified directory.

```

1 cp rootcert.pem $ICAROOT/keystore/cacerts/
2 $ICAROOT/util/ctx_rehash $ICAROOT/keystore/cacerts/
3 <!--NeedCopy-->

```

5. Run the following command to enable the feature:

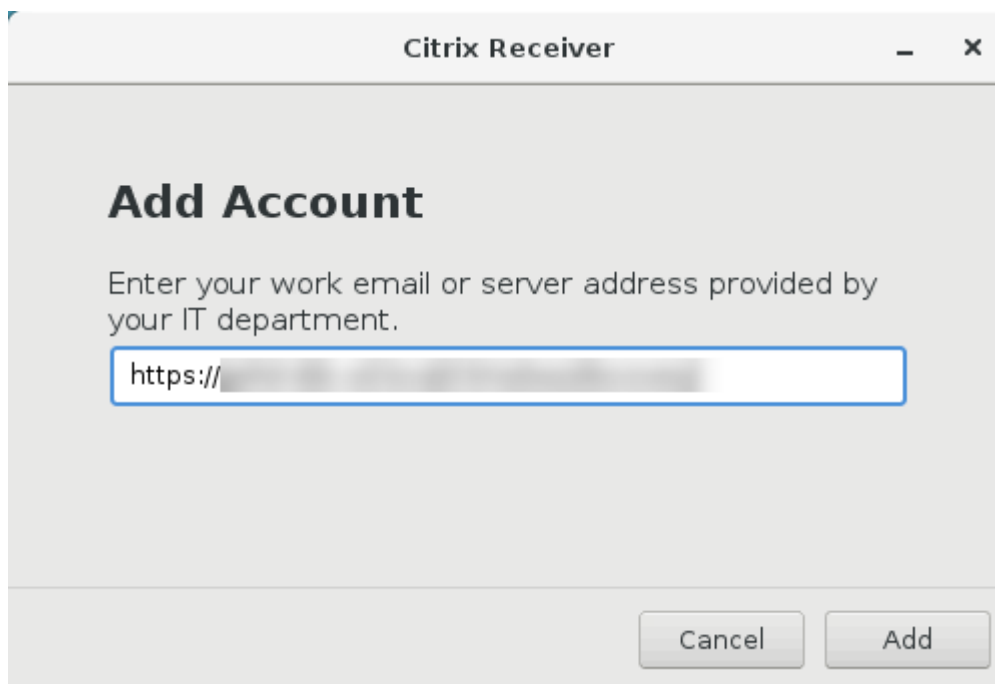
```
1 /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\
   CurrentControlSet\Control\Citrix" -v "LurSsonEnabled" -d "0
   x00000001"
2 <!--NeedCopy-->
```

6. Launch a Linux virtual desktop session and start Citrix Workspace app for Linux or Citrix Receiver for Linux 13.10 within that session.

You are prompted for a store account the first time you start Citrix Workspace app for Linux or Citrix Receiver for Linux 13.10 within a Linux virtual desktop session. Later on, you are automatically logged on to the store you specified earlier.

**Note:**

Enter an HTTPS URL as your store account.



## Configure unauthenticated sessions

March 10, 2021

Use the information in this article to configure unauthenticated sessions. No special settings are required when installing the Linux VDA to use this feature.

**Note:**

When configuring unauthenticated sessions, consider that session prelaunch is not supported. Session prelaunch is also not supported on Citrix Workspace app for Android.

**Create an unauthenticated store**

To support an unauthenticated session on the Linux VDA, [create an unauthenticated store](#) using Store-Front.

**Enable unauthenticated users in a Delivery Group**

After creating an unauthenticated store, enable unauthenticated users in a Delivery Group to support an unauthenticated session. To enable unauthenticated users in a Delivery Group, follow the instructions in the [Citrix Virtual Apps and Desktops documentation](#).

**Set the unauthenticated session idle time**

An unauthenticated session has a default idle timeout of 10 minutes. This value is configured through the registry setting **AnonymousUserIdleTime**. Use the **ctxreg** tool to change this value. For example, to set this registry setting to five minutes:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\  
    CurrentControlSet\Control\Citrix" -v AnonymousUserIdleTime -d 0  
    x00000005  
2 <!--NeedCopy-->
```

**Set the maximum number of unauthenticated users**

To set the maximum number of unauthenticated users, use the registry key **MaxAnonymousUserNumber**. This setting limits the number of unauthenticated sessions running on a single Linux VDA concurrently. Use the **ctxreg** tool to configure this registry setting. For example, to set the value to 32:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\System\  
    CurrentControlSet\Control\Citrix" -v MaxAnonymousUserNumber -d 0  
    x00000020  
2 <!--NeedCopy-->
```

**Important:**

Limit the number of unauthenticated sessions. Too many sessions being launched concurrently can cause problems on the VDA, including running out of available memory.

**Troubleshooting**

Consider the following when configuring unauthenticated sessions:

- **Failed to log on to an unauthenticated session.**

Verify that the registry was updated to include the following (set to 0):

```
1 sudo /opt/Citrix/VDA/bin/ctxreg read -k "HKLM\System\CurrentControlSet
   \Control\Citrix" -v MaxAnonymousUserNumber
2 <!--NeedCopy-->
```

Verify that the **nscd** service is running and configured to enable **passwd** cache:

```
1 ps uax | grep nscd
2 cat /etc/nscd.conf | grep 'passwd' | grep 'enable-cache'
3 <!--NeedCopy-->
```

Set the **passwd** cache variable to **no** if it is enabled, then restart the **nscd** service. You might need to reinstall the Linux VDA after changing this configuration.

- **The lock screen button is displayed in an unauthenticated session with KDE.**

The lock screen button and menu are disabled by default in an unauthenticated session. However, they can still be displayed in KDE. In KDE, to disable the lock screen button and menu for a particular user, add the following lines to the configuration file **\$Home/.kde/share/config/kdeglobals**. For example:

```
1 [KDE Action Restrictions]
2 action/lock_screen=false
3 <!--NeedCopy-->
```

However, if the **KDE Action Restrictions** parameter is configured as immutable in a global wide **kdeglobals** file such as **/usr/share/kde-settings/kde-profile/default/share/config/kdeglobals**, the user configuration has no effect.



To resolve this issue, modify the system-wide `kdeglobals` file to remove the `[$i]` tag at the `[KDE Action Restrictions]` section, or directly use the system-wide configuration to disable the lock screen button and menu. For details about the KDE configuration, see the [KDE System Administration/Kiosk/Keys page](#).

## Configure LDAPS

October 7, 2021

Secure LDAP (LDAPS) allows you to enable the Secure Lightweight Directory Access Protocol for your Active Directory managed domains to provide communications over SSL (Secure Socket Layer)/TLS (Transport Layer Security).

By default, LDAP communications between client and server applications are not encrypted. LDAP using SSL/TLS (LDAPS) enables you to protect the LDAP query content between the Linux VDA and the LDAP servers.

The following Linux VDA components have dependencies on LDAPS:

- Broker agent: Linux VDA registration with a Delivery Controller
- Policy service: Policy evaluation

Configuring LDAPS involves:

- Enable LDAPS on the Active Directory (AD)/LDAP server
- Export the root CA for client use
- Enable/disable LDAPS on the Linux VDA
- Configure LDAPS for third-party platforms
- Configure SSSD
- Configure Winbind
- Configure Centrify
- Configure Quest

### Enable LDAPS on the AD/LDAP server

You can enable LDAP over SSL (LDAPS) by installing a properly formatted certificate from either a Microsoft certification authority (CA) or a non-Microsoft CA.

**Tip:**

LDAP over SSL/TLS (LDAPS) is automatically enabled when you install an Enterprise Root CA on a domain controller.

For more information about how to install the certificate and verify the LDAPS connection, see [How to enable LDAP over SSL with a third-party certification authority](#) on the Microsoft Support site.

When you have a multi-tier (such as a two-tier or three-tier) certificate authority hierarchy, you do not automatically have the appropriate certificate for LDAPS authentication on the domain controller.

For information about how to enable LDAPS for domain controllers using a multi-tier certificate authority hierarchy, see the [LDAP over SSL \(LDAPS\) Certificate](#) article on the Microsoft TechNet site.

### Enable root certificate authority for client use

The client must be using a certificate from a CA that the LDAP server trusts. To enable LDAPS authentication for the client, import the root CA certificate to a trusted keystore.

For more information about how to export Root CA, see [How to export Root Certification Authority Certificate](#) on the Microsoft Support website.

### Enable or disable LDAPS on the Linux VDA

To enable or disable LDAPS on the Linux VDA, run the following script (while logged on as an administrator):

The syntax for this command includes the following:

- Enable LDAP over SSL/TLS with the root CA certificate provided:

```
1 /opt/Citrix/VDA/sbin/enable_ldaps.sh -Enable pathToRootCA
2 <!--NeedCopy-->
```

- Enable LDAP over SSL/TLS with channel binding:

```
1 /opt/Citrix/VDA/sbin/enable_ldaps.sh -Enablecb pathToRootCA
2 <!--NeedCopy-->
```

#### Note:

The root CA certificate for channel binding must be in PEM format. Before enabling channel binding, make sure to create a Python3 virtual environment. For more information, see [Create a Python3 virtual environment](#).

- Fall back to LDAP without SSL/TLS

```
1 /opt/Citrix/VDA/sbin/enable_ldaps.sh -Disable
2 <!--NeedCopy-->
```

The Java keystore dedicated for LDAPS is located in **/etc/xdl/.keystore**. Affected registry keys include:

```
1 HKLM\Software\Citrix\VirtualDesktopAgent\ListOfLDAPServers
2
3 HKLM\Software\Citrix\VirtualDesktopAgent\ListOfLDAPServersForPolicy
4
5 HKLM\Software\Citrix\VirtualDesktopAgent\UseLDAPS
6
7 HKLM\Software\Policies\Citrix\VirtualDesktopAgent\Keystore
8
9 HKLM\Software\Citrix\VirtualDesktopAgent\EnableChannelBinding
10 <!--NeedCopy-->
```

## Configure LDAPS for third-party platform

Besides the Linux VDA components, several third-party software components that adhere to the VDA might also require secure LDAP, such as SSSD, Winbind, Centrify, and Quest. The following sections describe how to configure secure LDAP with LDAPS, STARTTLS, or SASL sign and seal.

### Tip:

Not all of these software components prefer to use SSL port 636 to ensure secure LDAP. And most of the time, LDAPS (LDAP over SSL on port 636) cannot coexist with STARTTLS on port 389.

## SSSD

Configure the SSSD secure LDAP traffic on port 636 or port 389 as per the options. For more information, see the [SSSD LDAP Linux man page](#).

## Winbind

The Winbind LDAP query uses the ADS method. Winbind supports only the StartTLS method on port 389. Affected configuration files are **ldap.conf** at **/etc/openldap/ldap.conf** and **smb.conf** at **/etc/samba/smb.conf**. Change the files as follows:

```
1 ldap.conf:
```

```
2
3 TLS_REQCERT never
4
5 smb.conf:
6
7 ldap ssl = start tls
8 ldap ssl ads = yes
9 client ldap sasl wrapping = plain
10 <!--NeedCopy-->
```

Alternately, secure LDAP can be configured by SASL GSSAPI sign and seal, but it cannot coexist with TLS/SSL. To use SASL encryption, change the **smb.conf** configuration:

```
1 smb.conf:
2
3 ldap ssl = off
4 ldap ssl ads = no
5 client ldap sasl wrapping = seal
6 <!--NeedCopy-->
```

## Centrify

Centrify does not support LDAPS on port 636. However, it does provide secure encryption on port 389. For more information, see the [Centrify site](#).

## Quest

Quest Authentication Service does not support LDAPS on port 636, but it provides secure encryption on port 389 using a different method.

## Troubleshooting

The following issues might arise when you use this feature:

- **LDAPS service availability**

Verify that the LDAPS connection is available on the AD/LDAP server. The port is on 636 by default.

- **Linux VDA registration failed when LDAPS is enabled**

Verify that the LDAP server and ports are configured correctly. Check the Root CA Certificate first and ensure that it matches the AD/LDAP server.

- **Incorrect registry change by accident**

If the LDAPS related keys were updated by accident without using **enable\_ldaps.sh**, it might break the dependency of LDAPS components.

- **LDAP traffic is not encrypted through SSL/TLS from Wireshark or any other network monitoring tools**

By default, LDAPS is disabled. Run **/opt/Citrix/VDA/sbin/enable\_ldaps.sh** to force it.

- **There is no LDAPS traffic from Wireshark or any other networking monitoring tool**

LDAP/LDAPS traffic occurs when Linux VDA registration and Group Policy evaluation occur.

- **Failed to verify LDAPS availability by running `ldp connect` on the AD server**

Use the AD FQDN instead of the IP Address.

- **Failed to import Root CA certificate by running the `/opt/Citrix/VDA/sbin/enable_ldaps.sh` script**

Provide the full path of the CA certificate, and verify that the Root CA Certificate is the correct type. It is supposed to be compatible with most of the Java Keytool types supported. If it is not listed in the support list, you can convert the type first. We recommend the base64 encoded PEM format if you encounter a certificate format problem.

- **Failed to show the Root CA certificate with `Keytool -list`**

When you enable LDAPS by running `/opt/Citrix/VDA/sbin/enable_ldaps.sh`, the certificate is imported to `/etc/xdm/.keystore`, and the password is set to protect the keystore. If you forget the password, you can rerun the script to create a keystore.

## Create a Python3 virtual environment

May 10, 2022

This article details the prerequisites and steps to create a Python3 virtual environment without network connection. Alternatively, if you are connecting to the network, run `ctxsetup.sh` to create a Python3 virtual environment.

### Prerequisites

- You must have administrative privileges to access the `/opt/Citrix/VDA/sbin/ctxpython3` directory.
- The wheel files of Python3 packages are in place. You can download the wheel files from <https://pypi.org/>.

## Create a Python3 virtual environment

Complete the following steps to create a Python3 virtual environment:

1. Install Python3 dependencies.

### For RHEL:

```
1 yum -y install python36-devel krb5-devel gcc
2 <!--NeedCopy-->
```

### For Ubuntu:

```
1 apt-get -y install python3-dev python3-pip python3-venv libkrb5-
  dev
2 <!--NeedCopy-->
```

### For SUSE:

```
1 zypper -i -n install python3-devel python3-setuptools krb5-devel
  gcc libffi48-devel
2 <!--NeedCopy-->
```

2. Create a Python3 virtual environment.

### For RHEL, Ubuntu:

```
1 sudo python3 -m venv /opt/Citrix/VDA/sbin/ctxpython3
2 <!--NeedCopy-->
```

### For SUSE:

```
1 sudo python3 -m venv /opt/Citrix/VDA/sbin/ctxpython3
2
3 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m pip install
  setuptools==40.6.2
4 <!--NeedCopy-->
```

3. Install LDAPS dependencies.

**For RHEL, Ubuntu:**

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m pip install
  cffi == 1.14.2 cryptography == 3.1 decorator == 4.4.2 gssapi
  ==1.6.2 ldap3==2.8.1 netifaces == 0.10.9 pg8000 == 1.17.0
  psutil == 5.8.0 pyasn1 == 0.4.8 pycparser == 2.20 scramp ==
  1.2.0 six == 1.15.0 termcolor == 1.1.0
2 <!--NeedCopy-->
```

**For SUSE:**

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m easy_install
  cffi == 1.14.2 cryptography == 3.1 decorator == 4.4.2 gssapi
  ==1.6.2 ldap3==2.8.1 netifaces == 0.10.9 pg8000 == 1.17.0
  psutil == 5.8.0 pyasn1 == 0.4.8 pycparser == 2.20 scramp ==
  1.2.0 six == 1.15.0 termcolor == 1.1.0
2 <!--NeedCopy-->
```

4. Install XDPing dependencies.

**For RHEL, Ubuntu:**

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m pip install
  cffi == 1.14.2 cryptography == 3.1 decorator == 4.4.2 gssapi
  ==1.6.2 ldap3==2.8.1 netifaces == 0.10.9 pg8000 == 1.17.0
  psutil == 5.8.0 pyasn1 == 0.4.8 pycparser == 2.20 scramp ==
  1.2.0 six == 1.15.0 termcolor == 1.1.0
2
3 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m pip install /
  opt/Citrix/VDA/sbin/ctxpython3/packages/xdping-*.whl
4 <!--NeedCopy-->
```

**For SUSE:**

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m easy_install
  cffi == 1.14.2 cryptography == 3.1 decorator == 4.4.2 gssapi
  ==1.6.2 ldap3==2.8.1 netifaces == 0.10.9 pg8000 == 1.17.0
  psutil == 5.8.0 pyasn1 == 0.4.8 pycparser == 2.20 scramp ==
  1.2.0 six == 1.15.0 termcolor == 1.1.0
```

```
2
3 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m easy_install /
   opt/Citrix/VDA/sbin/ctxpython3/packages/xdping-*.whl
4 <!--NeedCopy-->
```

## XDPing

March 10, 2021

### Description

The Linux XDPing tool is a command-line based application that automates the process of checking for common configuration issues with a Linux VDA environment.

The Linux XDPing tool performs over 150 individual tests on the system, which are broadly categorized as follows:

- Check whether Linux VDA system requirements are met
- Identify and display machine information including the Linux distributions
- Check the Linux kernel compatibility
- Check for any known Linux distribution issues that can impact the Linux VDA operation
- Check the Security-Enhanced Linux (SELinux) mode and compatibility
- Identify network interfaces and check network settings
- Check storage partitioning and available disk space
- Check machine host and domain name configuration
- Check DNS configuration and perform lookup tests
- Identify underlying hypervisors and check virtual machine configuration. Support for:
  - Citrix Hypervisor
  - Microsoft HyperV
  - VMware vSphere
- Check time settings and check whether network time synchronization is operational
- Check whether PostgreSQL service is properly configured and operational
- Check whether the firewall is enabled and required ports are open
- Check Kerberos configuration and perform authentication tests
- Check the LDAP search environment for the group policy service engine
- Check whether Active Directory integration is set up properly and the current machine is joined to the domain. Support for:
  - Samba Winbind
  - Dell Quest Authentication Services



- Centrify DirectControl
- SSSD
- Check the integrity of the Linux computer object in Active Directory
- Check Pluggable Authentication Module (PAM) configuration
- Check the core dump pattern
- Check whether packages required by the Linux VDA are installed
- Identify the Linux VDA package and check the integrity of the installation
- Check the integrity of the PostgreSQL registry database
- Check whether the Linux VDA services are properly configured and operational
- Check the integrity of the VDA and HDX configuration
- Probe each configured Delivery Controller to test that the Broker Service is reachable, operational, and responsive
- Check whether the machine is registered with the Delivery Controller farm
- Check the state of each active or disconnected HDX session
- Scan log files for the Linux VDA related errors and warnings
- Check whether the version of Xorg is suitable

### Use the Linux XDPing tool

XDPing comes with the single executable named `xdping` that is run from the command shell.

To display the command-line options, use the `--help` option:

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m xdping --help
2 <!--NeedCopy-->
```

To run the full suite of tests, run `xdping` without any command-line options:

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m xdping
2 <!--NeedCopy-->
```

To check the environment before installing the Linux VDA package, run the `pre-flight` tests:

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m xdping --preflight
2 <!--NeedCopy-->
```

To run specific test categories only, for example, the time and Kerberos tests, use the `-T` option:

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m xdping -T time,  
   kerberos  
2 <!--NeedCopy-->
```

To probe a particular XenDesktop Controller:

```
1 sudo /opt/Citrix/VDA/sbin/ctxpython3/bin/python3 -m xdping -d myddc.  
   domain.net  
2 <!--NeedCopy-->
```

### Sample Output

The following is a sample output from running the Kerberos test:

```
sudo xdping -T kerberos  
  
Root User -----  
User:          root  
EUID:          0  
Verify user is root [Pass]  
  
Kerberos -----  
Kerberos version: 5  
Verify Kerberos available [Pass]  
Verify Kerberos version 5 [Pass]  
KRB5CCNAME:    [Not set]  
               Distro default FILE:/tmp/krb5cc_%{uid}  
KRB5CCNAME type: [Supported]  
KRB5CCNAME format: [Default]  
Verify KRB5CCNAME cache type [Pass]  
Verify KRB5CCNAME format [Pass]  
Configuration file: /etc/krb5.conf [Exists]
```

```
Verify Kerberos configuration file found [Pass]
Keytab file: /etc/krb5.keytab [Exists]
Default realm: XD2.LOCAL
Default realm KDCs: [NONE SPECIFIED]
Default realm domains: [NONE SPECIFIED]
DNS lookup realm: [Enabled]
DNS lookup KDC: [Enabled]
Weak crypto: [Disabled]
Clock skew limit: 300 s
Verify system keytab file exists [Pass]
Verify default realm set [Pass]
Verify default realm in upper-case [Pass]
Verify default realm not EXAMPLE.COM [Pass]
Verify default realm domain mappings [Pass]
Verify default realm master KDC configured [Pass]
Verify Kerberos weak crypto disabled [Pass]
Verify Kerberos clock skew setting [Pass]
Default ccache: [Not set]
    Distro default FILE:/tmp/krb5cc_%{uid}
Default ccache type: [Supported]
Default ccache format: [Default]
Verify default credential cache cache type [Pass]
Verify default credential cache format [Pass]
UPN system key [MYVDA1$@██████████]: [MISSING]
SPN system key [host/██████████@██████████]: [Exists]
Verify Kerberos system keys for UPN exist [ERROR]
No system keys were found for the user principal name (UPN) of
the machine account. For the Linux VDA to mutually authenticate
with the Delivery Controller, the system keytab file must
contain keys for both the UPN and host-based SPN of the machine
account.

Verify Kerberos system keys for SPN exist [Pass]
Kerberos login: [FAILED AUTHENTICATION]
    Keytab contains no suitable keys for MYVDA1$@██████████
    while getting initial credentials
Verify KDC authentication [ERROR]
Failed to authenticate and obtain a Ticket Granting Ticket (TGT)
from the KDC authentication service for the machine account UPN
MYVDA1$@██████████. Check that the Kerberos configuration is
valid and the keys in the system keytab are current.

Summary -----
The following tests did not pass:
Verify Kerberos system keys for UPN exist [ERROR]
Verify KDC authentication [ERROR]
```

## Configure Xauthority

March 10, 2021

The Linux VDA supports environments that use X11 display functionality (including `xterm` and `gvim`) for interactive remoting. This feature provides a security mechanism necessary to ensure secure communication between XClient and XServer.

There are two methods to secure permission for this secure communication:

- **Xhost.** By default, Xhost allows only the localhost XClient to communicate with XServer. If you choose to allow a remote XClient to access XServer, the Xhost command must be run to grant permission on the specific machine. Or, you can alternately use **xhost +** to allow any XClient to connect to XServer.
- **Xauthority.** The `.Xauthority` file can be found in each user's home directory. It is used to store credentials in cookies used by xauth for authentication of XServer. When an XServer instance (Xorg) is started, the cookie is used to authenticate connections to that specific display.

### How it works

When Xorg starts up, a `.Xauthority` file is passed to the Xorg. This `.Xauthority` file contains the following elements:

- Display number
- Remote request protocol
- Cookie number

You can browse this file using the `xauth` command. For example:

```
1 # xauth -f ~/.Xauthority
2
3 # > list
4
5 # > us01msip06:107 MIT-MAGIC-COOKIE-1
   fb228d1b695729242616c5908f11624b
6 <!--NeedCopy-->
```

If XClient connects to the Xorg remotely, two prerequisites must be met:

- Set the **DISPLAY** environment variable to the remote XServer.
- Get the `.Xauthority` file which contains one of the cookie numbers in Xorg.

## Configure Xauthority

To enable Xauthority on the Linux VDA for remote X11 display, you must create the following two registry keys:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\System\
   CurrentControlSet\Control\Citrix\Xorg" -t "REG_DWORD" -v "
   XauthEnabled" -d "0x00000001" --force
2
3 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\System\
   CurrentControlSet\Control\Citrix\Xorg" -t "REG_DWORD" -v "ListenTCP"
   -d "0x00000001" --force
4 <!--NeedCopy-->
```

After enabling Xauthority, pass the `.Xauthority` file to the XClient manually or by mounting a shared home directory:

- Pass the `.Xauthority` file to the XClient manually

After launching an ICA session, the Linux VDA generates the `.Xauthority` file for the XClient and stores the file in the logon user's home directory. You can copy this `.Xauthority` file to the remote XClient machine, and set the `DISPLAY` and `XAUTHORITY` environment variables. `DISPLAY` is the display number stored in the `.Xauthority` file and `XAUTHORITY` is the file path of Xauthority. For an example, see the following command:

```
1 export DISPLAY={
2   Display number stored in the Xauthority file }
3
4
5 export XAUTHORITY={
6   the file path of .Xauthority }
7
8 <!--NeedCopy-->
```

### Note:

If the `XAUTHORITY` environment variable is not set, the `~/.Xauthority` file is used by default.

- Pass the `.Xauthority` file to the XClient by mounting a shared home directory

The convenient way is to mount a shared home directory for the logon user. When the Linux VDA starts an ICA session, the `.Xauthority` file is created under the logon user's home directory. If this home directory is shared with the XClient, the user does not need to transmit this

.*Xauthority* file to the XClient manually. After the *DISPLAY* and *XAUTHORITY* environment variables are set correctly, the GUI is displayed in the XServer desktop automatically.

## Troubleshooting

If XAuthority does not work, follow the troubleshooting steps:

1. As an administrator with root privilege, retrieve all Xorg cookies:

```
1 ps aux | grep -i xorg
2 <!--NeedCopy-->
```

This command displays the Xorg process and the parameters passed to Xorg while starting. Another parameter displays which .*Xauthority* file is used. For example:

```
1 /var/xdm/xauth/.Xauthority110
2 <!--NeedCopy-->
```

Display the cookies using the **Xauth** command:

```
1 Xauth -f /var/xdm/xauth/.Xauthority110
2 <!--NeedCopy-->
```

2. Use the *Xauth* command to show the cookies contained in *~/.Xauthority*. For the same display number, the displayed cookies must be the same in the .*Xauthority* files of Xorg and XClient.
3. If the cookies are the same, check the remote display port accessibility by using the IP address of the Linux VDA (for example, 10.158.11.11) and the published desktop display number (for example, 160).

Run the following command on the XClient machine:

```
1 telnet 10.158.11.11 6160
2 <!--NeedCopy-->
```

The port number is the sum of 6000 + <display number>.

If this telnet operation fails, the firewall might be blocking the request.

## Federated Authentication Service

April 6, 2021

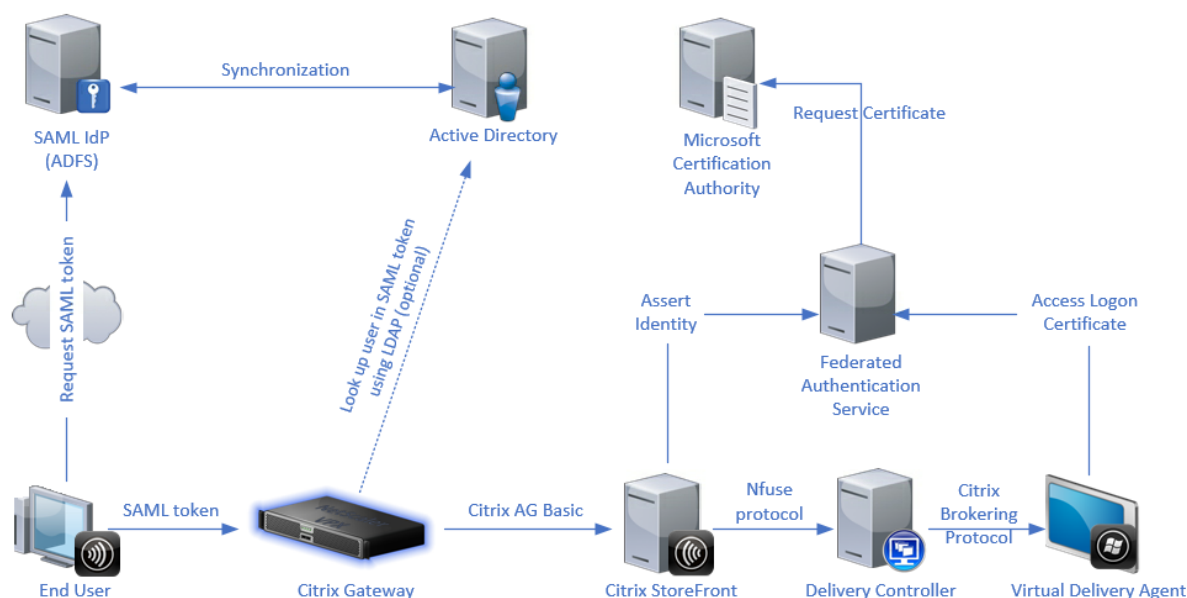
### Overview

The Citrix Federated Authentication Service (FAS) is a privileged component designed to integrate with Active Directory Certificate Services. It dynamically issues certificates for users, allowing them to log on to an Active Directory environment as if they had a smart card. This functionality allows StoreFront to use a broader range of authentication options, such as Security Assertion Markup Language (SAML) assertions. SAML is commonly used as an alternative to traditional Windows user accounts on the Internet.

#### Note:

To use SAML authentication, you must configure FAS on the VDA properly.

The following diagram shows FAS integrated with a Microsoft Certification Authority and providing support services for StoreFront and VDAs.



Trusted StoreFront servers contact the FAS when users request access to the Citrix environment. The FAS grants a ticket that allows a single Citrix Virtual Apps or Citrix Virtual Desktops session to authenticate with a certificate for that session. When a VDA needs to authenticate a user, it connects to the FAS and redeems the ticket. Only the FAS has access to the user certificate's private key. The VDA must send each signing and decryption operation that it needs to perform with the certificate to the FAS.

## Requirements

FAS is supported on Windows Server 2008 R2 and later.

- We recommend installing FAS on a server that does not contain other Citrix components.
- The Windows Server must be secured for accessing a registration authority certificate and a private key to automatically issue certificates for domain users and for accessing those user certificates and private keys.

In a Citrix Virtual Apps or Citrix Virtual Desktops Site:

- The Delivery Controllers must be minimum version 7.9.
- The StoreFront server must be minimum version 3.6 (version provided with the XenApp and XenDesktop 7.9 ISO).
- The Linux VDAs must be minimum version 7.18. Verify that the Federated Authentication Service Group Policy configuration has been applied correctly to the VDAs before creating Machine Catalogs in the usual way. For more information, see the **Configure Group Policy** section in this article.

References:

- Active Directory Certificate Services  
<https://social.technet.microsoft.com/wiki/contents/articles/1137.active-directory-certificate-services-ad-cs-introduction.aspx>
- Configuring Windows for Certificate Logon  
<http://support.citrix.com/article/CTX206156>
- Installing the Federated Authentication Service  
[Federated Authentication Service](#)

## Configure Windows for Certificate Logon

For information on configuring Windows for certificate logon, open Knowledge Center article [CTX206156](#) to download and read the **Smart\_card\_config\_Citrix\_Env.pdf** file (hereinafter “the PDF file”). Perform the following steps according to the PDF file while noting the differences or complements that are given in each step. Pay special attention to the target machine you are operating on, for example, the AD, Delivery Controller, or StoreFront.

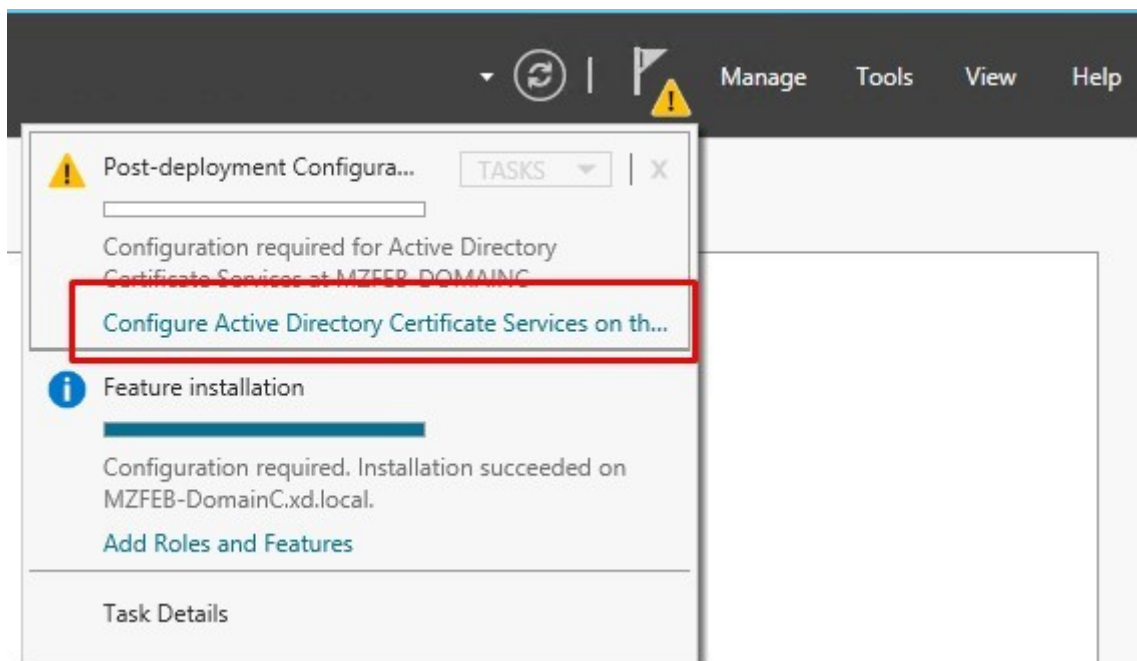
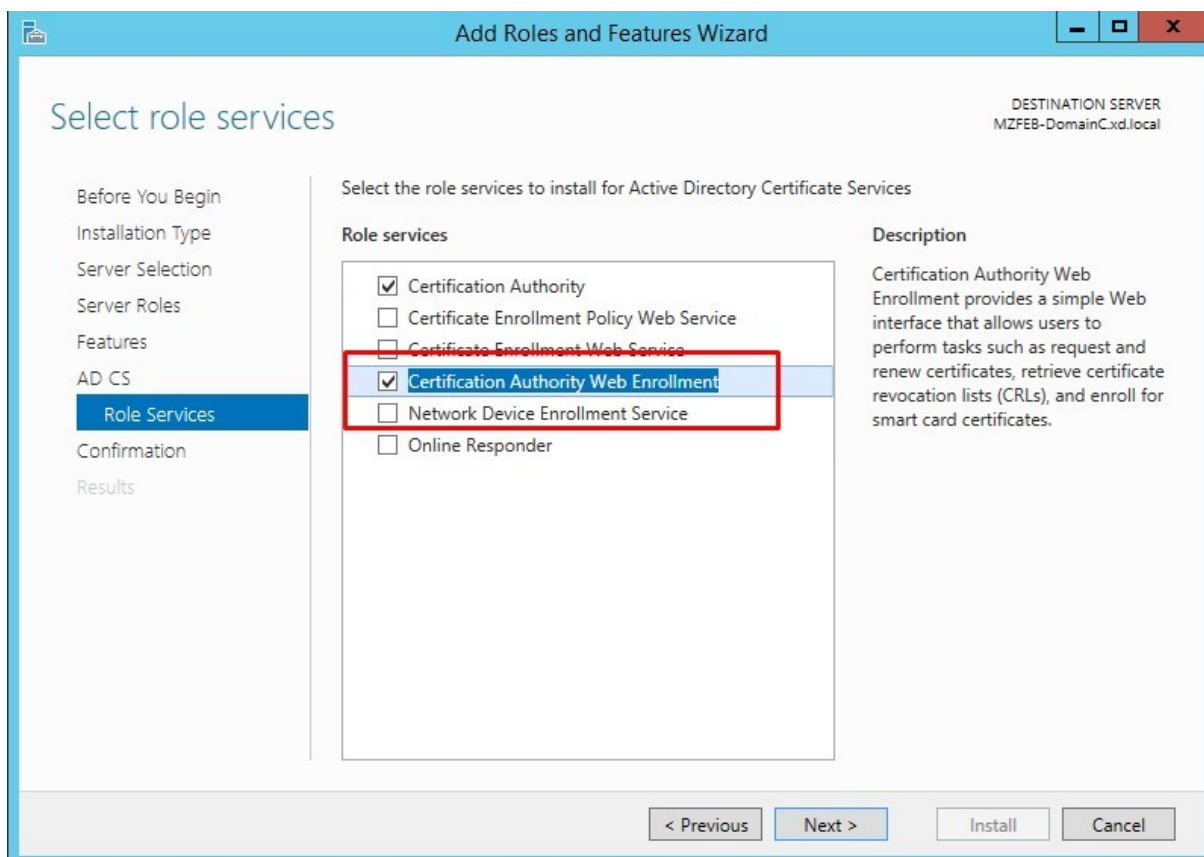
### Set up a Windows domain (on AD)

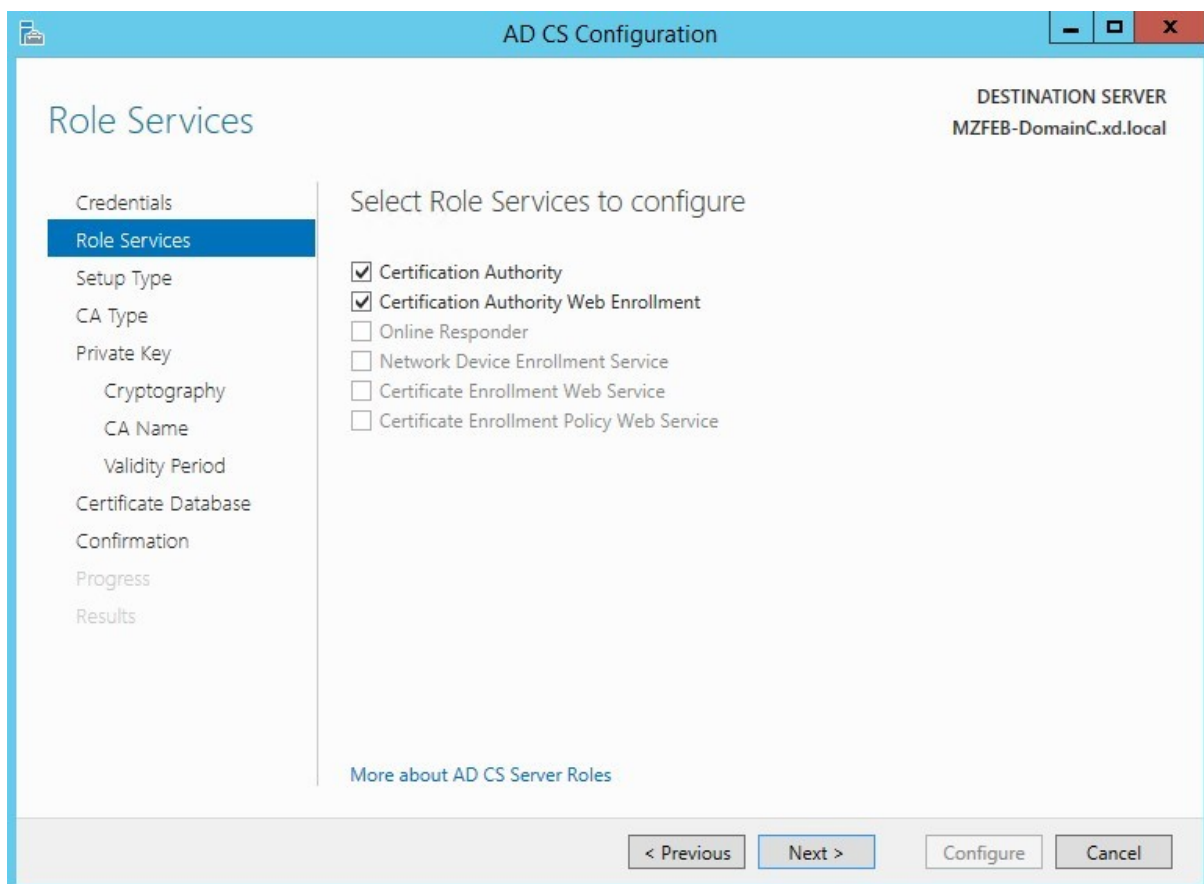
#### Install domain controller roles

See the **Installing Domain Controller Roles** section of the PDF file.

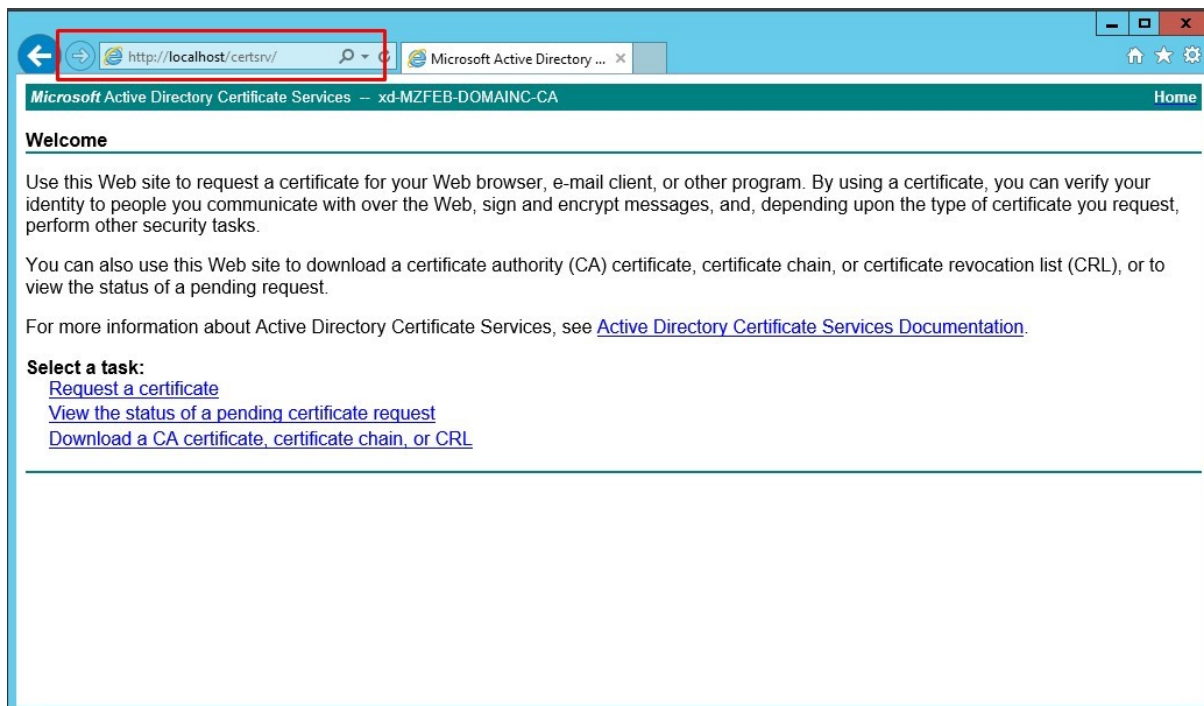
During installation of the Active Directory Certificate Services, ensure that the following options are selected:







Open <http://localhost/certsrv/> to check whether it displays the following welcome page. If yes, the Active Directory Certificate Services are installed successfully.



### **Prepare the Certificate Authority for smart card usage**

No complement. See the **Preparing the Certificate Authority for Smart card usage** section of the PDF file.

### **Issue a Domain Controller certificate**

No complement. See the **Issuing a Domain Controller Certificate** section of the PDF file.

### **Configure Microsoft IIS for HTTPS (on StoreFront)**

#### **Configure HTTPS on Microsoft IIS**

No complement. See the **Configuring HTTPS on Microsoft IIS** section of the PDF file.

### **Non-domain joined computers**

See the **Non-Domain Joined Computers** section of the PDF file.

### **Retrieve the CA Certificate from the Microsoft CA (on AD)**

No complement. See the **Retrieving the CA Certificate from the Microsoft CA** section of the PDF file.

### **Install the trusted CA certificate on Windows**

No complement. See the **Installing the Trusted CA Certificate on Windows** section of the PDF file.

### **Configure Citrix StoreFront (on StoreFront)**

#### **Create the store**

See the **Creating the Store** section of the PDF file.

After the preceding IIS configuration, the base URL of the common store is forcibly set to <https://> rather than <http://>. Because FAS does not share the store with smart cards, a new store is needed for FAS. The Linux VDA FAS is compatible with any StoreFront authentication methods. For example, the FAS store can be configured to use passwords or SAML, but cannot use both at the same time. When SAML is selected, the URL of StoreFront automatically redirects to IdP and the password authentication method is ignored.

Create Store

### StoreFront

- ✓ Getting Started
- Store Name**
- Delivery Controllers
- Remote Access
- Authentication Methods
- XenApp Services URL
- Summary

#### Store name and access

Enter a name that helps users identify the store. The store name appears in Citrix Receiver as part of the user's account.

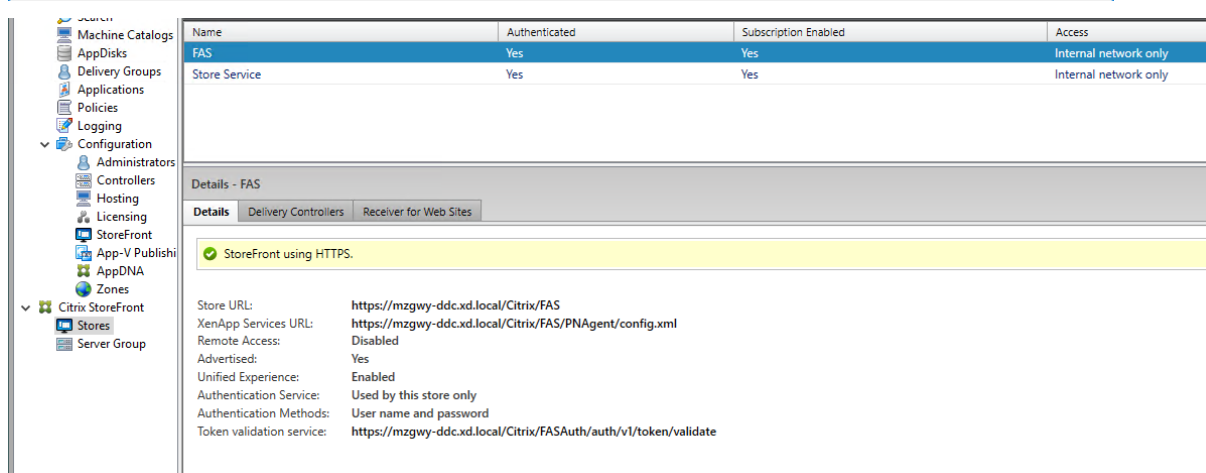
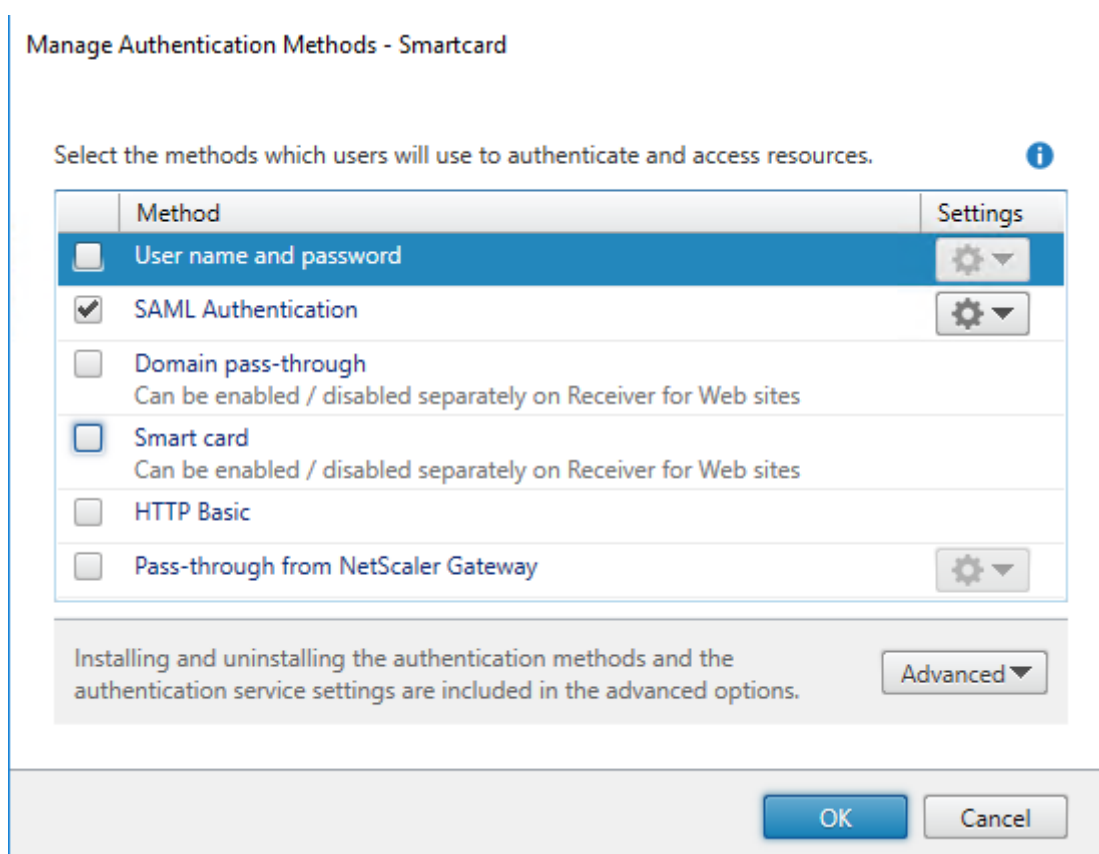
**i** Store name and access type cannot be changed, once the store is created.

Store Name:

Allow only unauthenticated (anonymous) users to access this store  
Unauthenticated users can access the store without presenting credentials.

#### Receiver for Web Site Settings

Set this Receiver for Web site as IIS default  
When this is checked, the Receiver for Web site created with the store will be set as the default IIS website. This setting will override any previous defaults configured for the IIS sites.



Start Internet Explorer and open the URL of the FAS store (for example, <https://mzgwyy-ddc.xd.local/Citrix/FASWeb>).

**Note:** The URL of the FAS store must have **Web** appended.

## Install and set up FAS

The installation and setup process consists of the following steps:

1. Install the Federated Authentication Service

2. Enable the Federated Authentication Service plug-in on StoreFront servers
3. Configure Group Policy
4. Use the Federated Authentication Service administration console to: (a) Deploy the provided templates, (b) Set up certificate authorities, and (c) Authorize the Federated Authentication Service to use your certificate authority
5. Configure user rules

For instructions on each of the steps, see [Federated Authentication Service](#). Note the following differences or complements in each of the steps. Pay special attention to the target machine you operating on, for example, the AD, Delivery Controller, StoreFront, or the FAS server.

### **Install the Federated Authentication Service (on the FAS server)**

For security, install FAS on a dedicated server that is secured in a similar way to a domain controller or certificate authority.

### **Enable the Federated Authentication Service plug-in on a StoreFront store (on StoreFront)**

Ensure that the following command uses the same FAS store name that you typed when configuring StoreFront. For example, FAS is the store name in this example:

```
$StoreVirtualPath = "/Citrix/FAS"
```

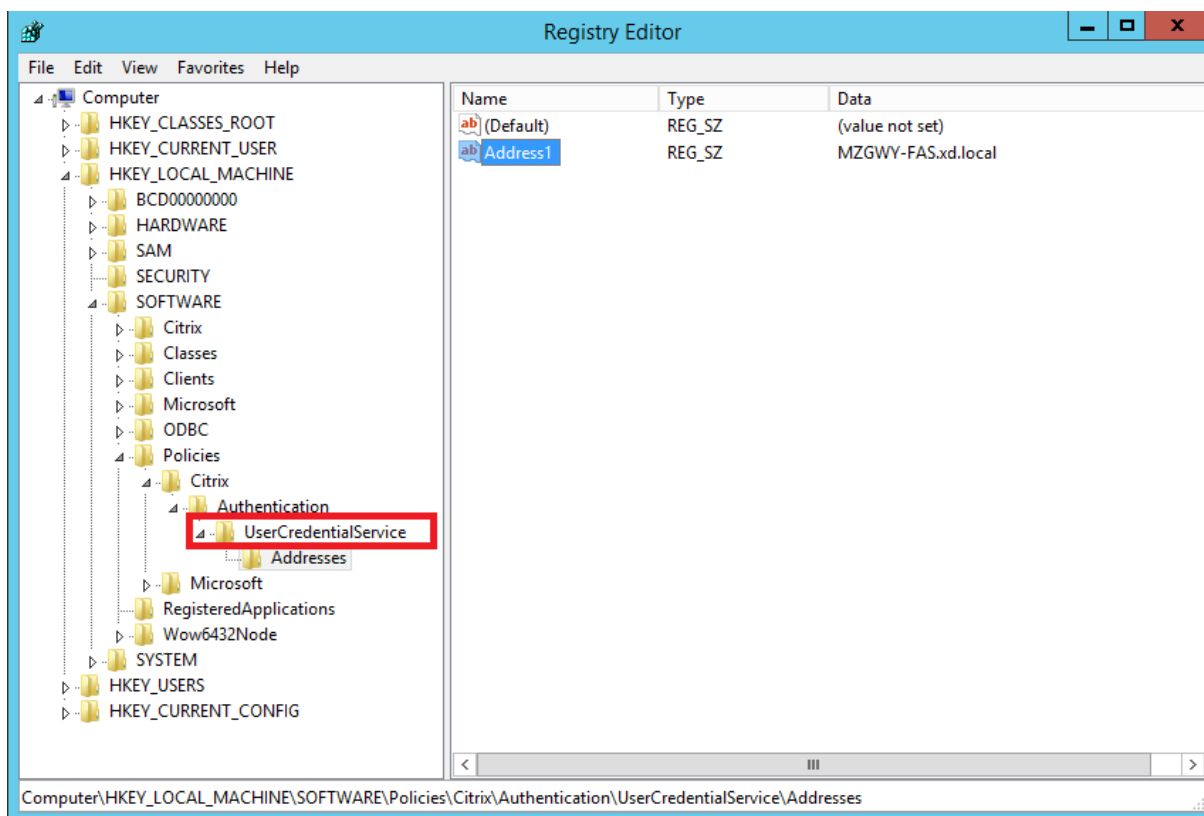
### **Configure the Delivery Controller (on Delivery Controller)**

To use the Federated Authentication Service, configure the Delivery Controller to trust the StoreFront servers that can connect to it: run the **Set-BrokerSite -TrustRequestsSentToTheXmlServicePort \$true** PowerShell cmdlet. Sometimes, you might need to run `Add-PSSnapin citrix.*` first.

### **Configure Group Policy (on the FAS server and on the AD)**

You must be an administrator to be able to perform Steps 1–7 in this section. Step 1 must be done on the FAS server and Steps 2–7 must be done on the AD.

After you complete Steps 1–7, check in the Registry Editor of the FAS server to confirm that the FAS policy has been set.



### Enable in-session certificate support

The Linux VDA does not support in-session certificates.

### Use the Federated Authentication Service administration console (on the FAS server)

No complement. See the [Federated Authentication Service](#) article.

### Deploy certificate templates (on the FAS server)

No complement. See the [Federated Authentication Service](#) article.

### Set up Active Directory Certificate Services (on the FAS server)

No complement. See the [Federated Authentication Service](#) article.

### Authorize the Federated Authentication Service (on the FAS server)

No complement. See the [Federated Authentication Service](#) article.

### Configure user rules (on the FAS server)

No complement. See the [Federated Authentication Service](#) article.

For more information, see also the **Delegated Enrollment Agents** and **Access Control List configuration** parts in the **Security considerations** section of the [Federated Authentication Service](#) article.

### Federated Authentication Service ADFS deployment

For information on how to deploy the ADFS IdP for Federated Authentication Service, see [Federated Authentication Service ADFS deployment](#).

## Configure the Linux VDA

### FAS support on RHEL 8/CentOS 8

FAS depends on the pam\_krb5 module, which is deprecated on RHEL 8/CentOS 8. To use FAS on RHEL 8/CentOS 8, build the pam\_krb5 module as follows:

1. Download the pam\_krb5-2.4.8-6 source code from the following website:  
[https://centos.pkgs.org/7/centos-x86\\_64/pam\\_krb5-2.4.8-6.el7.x86\\_64.rpm.html](https://centos.pkgs.org/7/centos-x86_64/pam_krb5-2.4.8-6.el7.x86_64.rpm.html).
2. Build and install the pam\_krb5 module on RHEL 8/CentOS 8.

```
1 yum install make gcc krb5-devel pam-devel autoconf libtool
2 rpm2cpio pam_krb5-2.4.8-6.el7.src.rpm | cpio -div
3 tar xvzf pam_krb5-2.4.8.tar.gz
4 cd pam_krb5-2.4.8
5 ./configure --prefix=/usr
6 make
7 make install
8 <!--NeedCopy-->
```

3. Verify that pam\_krb5.so exists under /usr/lib64/security/.

```
1 ls -l /usr/lib64/security | grep pam_krb5
2 <!--NeedCopy-->
```

### Set FAS servers

For fresh Linux VDA installation, to use FAS, type the FQDN of each FAS server when you are asked for CTX\_XDL\_FAS\_LIST during the execution of ctxinstall.sh or ctxsetup.sh. Because the Linux VDA does



not support AD Group Policy, you can provide a semicolon-separated list of FAS servers instead. If any server address is removed, fill its blank with the **<none>** text string and do not modify the order of server addresses.

For upgrading an existing Linux VDA installation, you can rerun `ctxsetup.sh` to set the FAS servers. Or you can run the following commands to set the FAS servers and to restart the `ctxvda` service to make your setting take effect.

```
1 sudo /opt/Citrix/VDA/bin/ctxreg create -k "HKLM\Software\Citrix\  
VirtualDesktopAgent\Authentication\UserCredentialService" -t "REG_SZ"  
" -v "Addresses" -d "<Your-FAS-Server-List>" --force  
2  
3 service ctxvda restart  
4 <!--NeedCopy-->
```

To update the FAS servers through `ctxreg`, run the following commands:

```
1 sudo /opt/Citrix/VDA/bin/ctxreg update -k "HKLM\Software\Citrix\  
VirtualDesktopAgent\Authentication\UserCredentialService" -v "  
Addresses" -d "<Your-FAS-Server-List>"  
2  
3 service ctxvda restart  
4 <!--NeedCopy-->
```

### Install a root CA certificate

For the verification of users' certificates, install the root CA certificate on the VDA. Obtain the AD root certificate from the preceding **Retrieve the CA Certificate from the Microsoft CA (on AD)** step, or download its DER format from the root CA server <http://CA-SERVER/certsrv>.

#### Note:

The following commands also apply to configuring an intermediate certificate.

Convert a DER file (.crt, .cer, .der) to PEM by running the command similar to the following:

```
1 sudo openssl x509 -inform der -in root.cer -out root.pem  
2 <!--NeedCopy-->
```

Then, install the root CA certificate to the `openssl` directory by running the command similar to the following:

```
1 sudo cp root.pem /etc/pki/CA/certs/  
2 <!--NeedCopy-->
```

**Note:**

Do not put the root CA certificate under the **/root** path. Otherwise, FAS does not have the read permission to the root CA certificate.

## Configure FAS

Run the following script to configure FAS parameters:

```
1 sudo /opt/Citrix/VDA/sbin/ctxfascfg.sh  
2 <!--NeedCopy-->
```

**Note:**

The preceding script handles only scenarios with a single root CA certificate.

If there are intermediate certificates in your environment, add the intermediate paths to `/etc/krb5.conf` as follows:

```
[realms]  
EXAMPLE.COM = {  
...  
pkinit_anchors = FILE:/etc/pki/CA/certs/root.pem  
pkinit_pool = FILE:/etc/pki/CA/certs/intermediate.pem  
...  
}
```

Two environment variables are added so that `ctxfascfg.sh` can be run in silent mode:

- **CTX\_FAS\_ADINTEGRATIONWAY=winbind | sssd | centrify** – Denotes the Active Directory integration method, which equals to `CTX_EASYINSTALL_ADINTEGRATIONWAY` when `CTX_EASYINSTALL_ADINTEGRATIONWAY` is specified. If `CTX_EASYINSTALL_ADINTEGRATIONWAY` is not specified, `CTX_FAS_ADINTEGRATIONWAY` uses its own value setting.
- **CTX\_FAS\_ROOT\_CA\_PATH=<root\_CA\_certificate>** – Specifies the full path of the root CA certificate.

Choose the correct Active Directory integration method and then type the correct path of the root CA certificate (for example, `/etc/pki/CA/certs/root.pem`).

The script then installs the `krb5-pkinit` and `pam_krb5` packages and sets the relevant configuration files.

## Limitation

- FAS supports limited platforms and AD integration methods, see the following matrix:

	Winbind	SSSD	Centrify
RHEL 8.3	Yes	Yes	Yes
RHEL 8.2	Yes	Yes	Yes
RHEL 8.1	Yes	Yes	Yes
RHEL 7.9	Yes	Yes	Yes
RHEL 7.8	Yes	Yes	Yes
Ubuntu 20.04	Yes	No	Yes
Ubuntu 18.04	Yes	No	Yes
Ubuntu 16.04	Yes	No	Yes
SLES 12.5	Yes	No	Yes

- FAS does not support lock screen yet. If you click the lock button in a session, you cannot log back on to the session again by using FAS.
- This release supports only the common FAS deployments summarized in the [Federated Authentication Service architectures overview](#) article and does not include **Windows 10 Azure AD Join**.

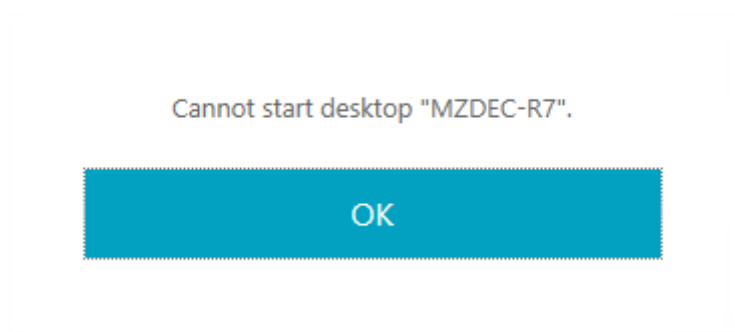
## Troubleshooting

Before troubleshooting FAS, ensure that the Linux VDA is installed and configured correctly so that a non-FAS session can be launched successfully on the common store by using password authentication.

If non-FAS sessions work properly, set the HDX log level of the **Login** class to VERBOSE and the VDA log level to TRACE. For information on how to enable trace logging for the Linux VDA, see Knowledge Center article [CTX220130](#).

### FAS server configuration error

Launching a session from the FAS store fails. For example, see the following screen capture:



Check `/var/log/xdl/hdx.log` and find the error log similar to the following:

```
1 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin: query2fas: failed
   to retrieve data: No such file or directory.
2
3 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin:
   sayhello2fas_internal: Failed to query.
4
5 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin:
   sayhello2fas_convertcredential: exit.
6
7 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin: LoginFasValidate:
   Failed to start FAS.
8
9 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin: receive_data:
   LoginFASValidate - parameters check error.
10
11 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin: receive_data: Exit
    FAILURE
12
13 2018-03-27 10:17:56.722 <P10122:S2> citrix-ctxlogin: main: EXITING
    login process..., FAILURE
14 <!--NeedCopy-->
```

### Solution

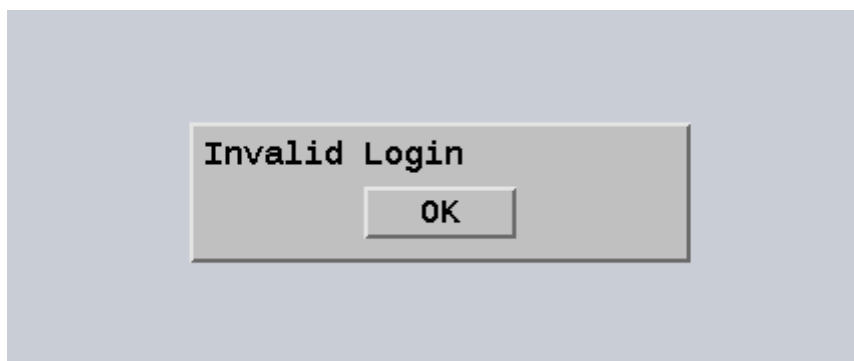
Run the following command to verify that the Citrix registry value “HKEY\_LOCAL\_MACHINE\SOFTWARE\Citrix\Virtual Desktop Agent” is set to <Your-FAS-Server-List>.

```
1 sudo /opt/Citrix/VDA/bin/ctxreg dump | grep "UserCredentialService"
2 <!--NeedCopy-->
```

If the existing setting is incorrect, follow the preceding [Set FAS servers](#) step to set it again.

### Incorrect root CA certificate configuration

Launching a session from the FAS store fails. A gray window appears and disappears several seconds later.



Check `/var/log/xdl/hdx.log` and find the error log similar to the following:

```
1 2018-03-27 10:15:52.227 <P9099:S3> citrix-ctxlogin: validate_user:
   pam_authenticate err,can retry for user user1@CTXFAS.LAB
2
3 2018-03-27 10:15:52.228 <P9099:S3> citrix-ctxlogin: logout_user:
   closing session and pam transaction
4
5 2018-03-27 10:15:52.228 <P9099:S3> citrix-ctxlogin: validate_user: Exit
   (user=user1@CTXFAS.LAB)=INVALID_PASSWORD
6
7 2018-03-27 10:15:52.228 <P9099:S3> citrix-ctxlogin: LoginBoxValidate:
   failed validation of user 'user1@CTXFAS.LAB', INVALID_PASSWORD
8
9 2018-03-27 10:15:52.228 <P9099:S3> citrix-ctxlogin: Audit_login_failure
   : Not yet implemented
10 <!--NeedCopy-->
```

### Solution

Verify that the full path of the root CA certificate is set correctly in `/etc/krb5.conf`. The full path is similar to the following:

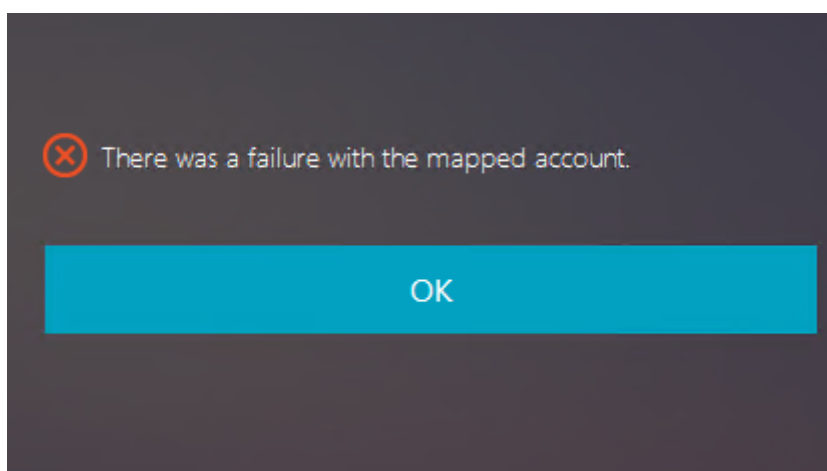
```
1 [realms]
```

```
2
3 EXAMPLE.COM = {
4
5
6     .....
7
8     pkinit_anchors = FILE:/etc/pki/CA/certs/root.pem
9
10    .....
11
12 }
13
14 <!--NeedCopy-->
```

If the existing setting is incorrect, follow the preceding [Install a root CA certificate](#) step to set it again. Alternatively, check whether the root CA certificate is valid.

### Shadow account mapping error

FAS is configured by SAML authentication. The following error might occur after an ADFS user enters the user name and password on the ADFS logon page.



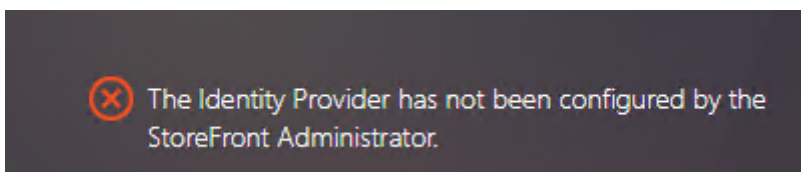
This error indicates that the ADFS user has been verified successfully, but there is no shadow user configured on AD.

### Solution

Set the Shadow Account on AD.

## ADFS not configured

The following error occurs during a logon attempt to the FAS store:



The issue occurs when the FAS store is configured to use SAML authentication but the ADFS deployment is missing.

## Solution

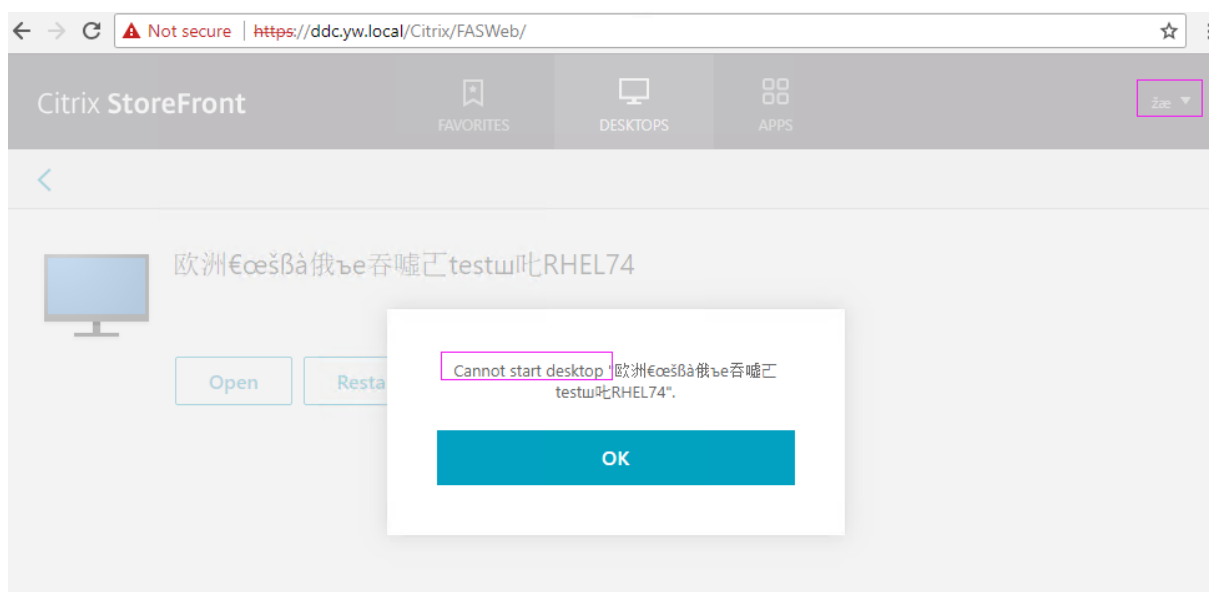
Deploy the ADFS IdP for Federated Authentication Service. For more information, see [Federated Authentication Service ADFS deployment](#).

## Related information

- The common FAS deployments are summarized in the [Federated Authentication Service architectures overview](#) article.
- “How-to” articles are introduced in the [Federated Authentication Service configuration and management](#) article.

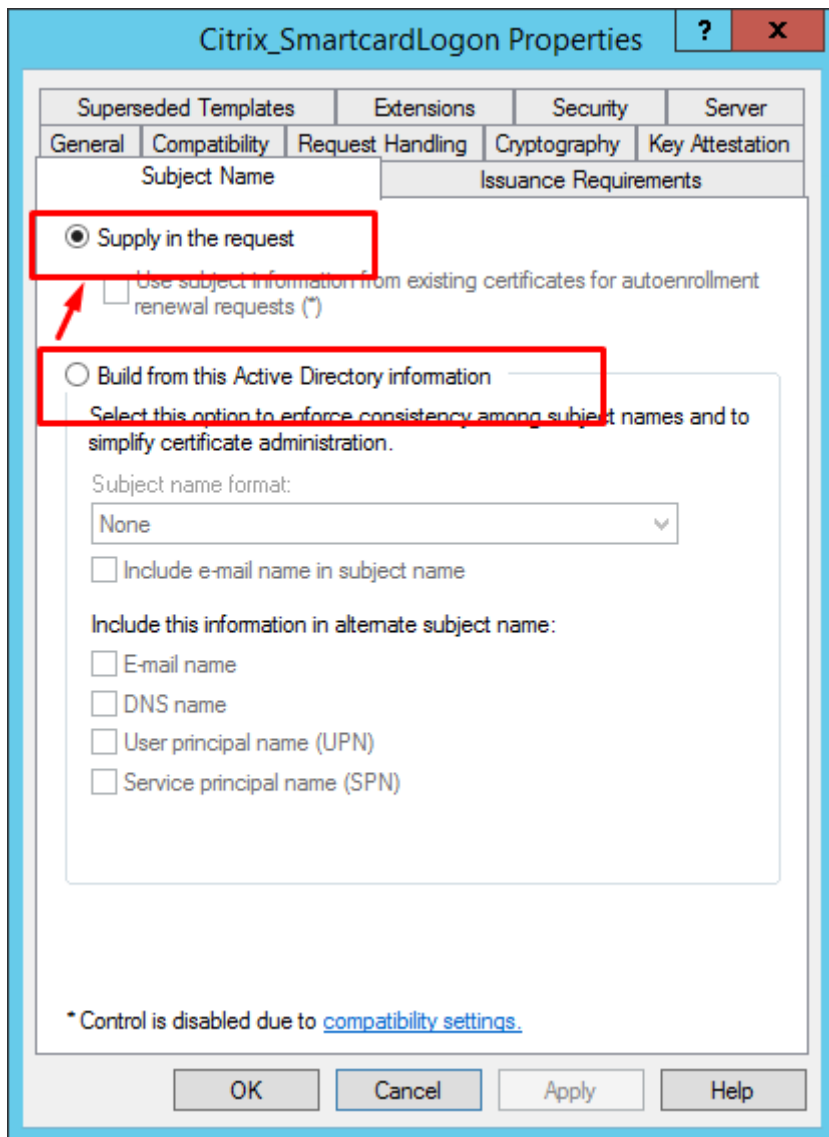
## Known issue

When FAS is in use, you can fail when trying to launch a published desktop or app session with non-English characters.



### Workaround

Right-click **Manage Templates** in the CA tool to change the **Citrix\_SmartcardLogon** template from **Build from this Active Directory information** to **Supply in the request**:







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