Delivering Microsoft Skype for Business to XenApp and XenDesktop Users

CITRIX

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Purpose of this document

This document serves as a guide to prepare an IT organization for successfully evaluating Unified Communications (UC) in desktop and application virtualization environments. **Microsoft Skype for Business, formerly known as Lync** has become an enterprise standard "must have" application for desktop users. In years past, it was acceptable to use Lync for chat and presence only. However today, Skype is the #1 meetings provider with 1+ Billion meetings per year. 90 of the Fortune 100 companies are running Microsoft Skype for Business for media rich video calling, voice calling, conferencing, and screen sharing. Over 100 million people are using Skype for Business to communicate for work, in 2018.

Without proper consideration and design for optimization, virtual desktop and virtual application users will very likely find the Microsoft Skype for Business experience to be subpar. Citrix and Microsoft both provide technologies to optimize this experience, to make Skype for Business responsive with crisp video and audio, even when working remotely in a virtual desktop. However, with multiple combinations of Skype for Business infrastructures, clients, endpoint types, and user locations one must find the right "recipe" to deliver Skype for Business optimally.

The **Citrix® HDX™ RealTime Optimization Pack** in conjunction with Microsoft® Skype for Business® offers clear, crisp high-definition video calls an optimized architecture. Users can seamlessly participate in audio-video or audio-only calls to and from other Skype for Business users, Optimization Pack users and other standards-based video desktop and conference room systems.

This document is meant to guide administrators in evaluating the Skype for Business delivery solution in their Citrix environment. It contains best practices, tips and tricks to ensure that the deployment is the most robust.

Optimized versus Generic delivery of Microsoft Skype for Business

This is often what causes the most confusion about delivering a Microsoft Skype for Business experience in a Citrix environment. The main reason is that without optimization the media must "hairpin" from your client to the server in the data center and then back to the endpoint. This can put significant load on the server (especially for video) and can cause delay and an overall degraded experience, especially if the other party in a Skype for Business call is originating from a user in a similar virtualized experience. This method for delivering a Microsoft Skype for Business experience is referred to as "Generic" delivery.

The preferred method of delivery is the "Optimized" method. In this case, the architect and/or administrator must deploy the HDX RealTime Optimization Pack for Skype for Business. The "Optimized" method is like splitting the Skype for Business client in two, as illustrated in the following comparison diagram. The user interface lives inside the virtual host, and is seen completely in the virtual desktop or application display. However, the media rendering, or media engine is separated off to run on the endpoint. This allows for a very rich rendering of the audio and video experience.
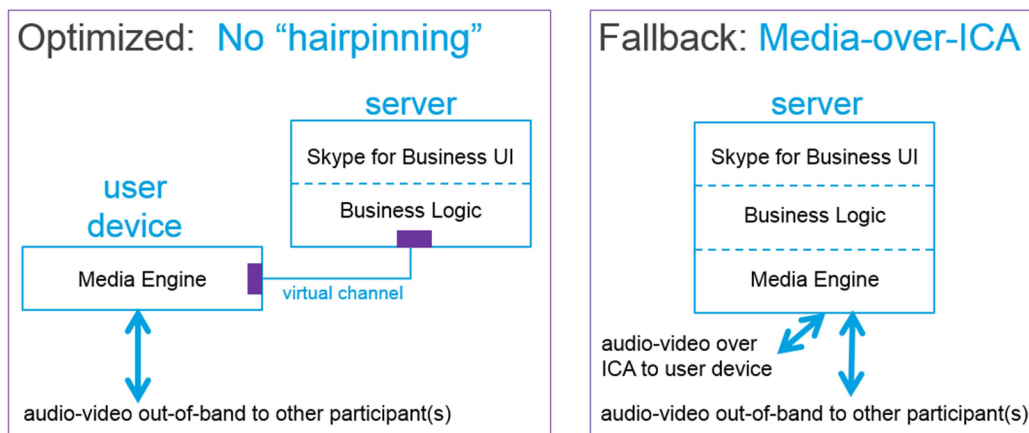
As of the 2.4 release, Citrix supports HDX RealTime Optimization Pack on Raspberry Pi platform. This is in addition to several thin and zero client devices that have been previously supported. To insure optimization, these devices rely on the latest firmware updates from respective manufacturers. Consult the device manufacturer to obtain a firmware that includes the latest HDX RealTime Media Engine. While firmware containing older 2.x versions of HDX RealTime Media Engine will provide an optimized experience, they will not deliver the latest new features and improvements in HDX RealTime Optimization Pack version 2.4.

Choosing the right Skype for Business optimization for your environment

Skype for Business (SfB) optimization is not a "one size fits all" technology. A recommended solution for each scenario is outlined in the following matrix.

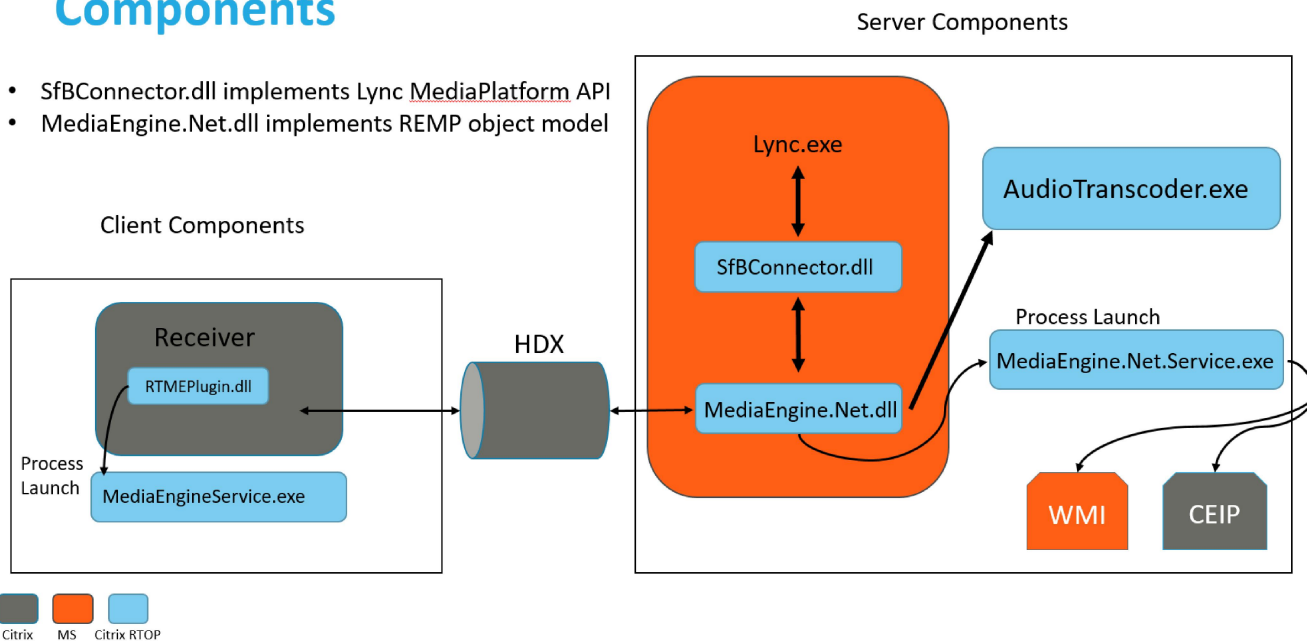|	Windows	Macintosh	Linux	Chrome/HTML5	Android	iOS
SfB 2015 Server / SfB 2015/16 client on host						
Lync 2013 Server/Lync 2013 client on host*						
Lync Online Office 365/Lync 2013 client on host						

Citrix HDX RealTime Optimization Pack, version 2.4
Generic ICA/HDX Delivery

Note that optimization packs have not been developed yet for mobile OS's. Typically, mobile users who desire access to Skype for Business on their devices will leverage Skype for Business native apps from the appropriate app store.

Citrix HDX RealTime Optimization Pack for Microsoft Skype for Business.

Components

Server Components

- SfBConnector.dll implements Lync MediaPlatform API
- MediaEngine.Net.dll implements REMP object model

Lync.exe

AudioTranscoder.exe

SfBConnector.dll

Process Launch

Client Components

Receiver

RTMEPlugin.dll

HDX

MediaEngine.Net.dll

MediaEngine.Net.Service.exe

Process Launch

MediaEngineService.exe

WMI

CEIP

Citrix   MS   Citrix RTOP

Delivering Microsoft Skype for Business to XenApp and XenDesktop Users

Pros of using HDX RealTime Optimization Pack for Skype for Business

- Richest experience, all media rendered on endpoint
- No hair-pinning effect, media communications go point to point between clients and the Skype for Business Audio-Video Conferencing Server (MCU)
- Less resource impact on the XenApp/XenDesktop hosts
- Less ICA bandwidth consumed over "generic" approach
- Allows for use of high tech Skype for Business optimized headsets and handsets
- Supports delivery with XenApp using Windows Server OS's
- Simple installation on client devices, minimal prerequisites.
- Can be used remotely from the enterprise network in conjunction with Skype for Business Edge Services (users making Citrix connections via NetScaler Gateway)
- Wide choice of supported HDX Premium thin client devices (see Citrix Ready list: https://citrixready.citrix.com/category-results.html?&f1=endpoints&f2=thin-clients&f3=hdx-levels/hdx-premium&compatibility=HDX%20RealTime%20Optimization%20Pack%202.4%20LTSR)
- Support provided by both Microsoft and Citrix support
- Supported method for delivering Skype for Business 2015/16 as seamless app from XenApp
- No requirement for both the sides of the optimized architecture to authenticate to the backend
- Requires no modification to the Skype for Business server back end

OS versions supported by the Optimization Pack 2.4
- RealTime Connector (installed on XenDesktop VDA / XenApp Farm): -
    - Desktop OS – Microsoft Windows 10, 8.1, 7
    - Server OS – Microsoft Windows Server 2016, 2012 R2, 2008 R2
- RealTime Media Engine/Client Device
    - Microsoft Windows 10 IOT Enterprise, 10, 8.1, 7
    - Microsoft Windows Server 2016, 2012 R2.
    - Microsoft Windows devices WES7, WES 2009. Windows Thin PC (TPC)
    - Macintosh client versions supported: OS X 10.10 through 10.13
    - Linux Client versions supported:
        - 32 Bit – Ubuntu 16.04, 15.10 and 14.04, Red Hat Enterprise 6.x, Red Hat 6.7, CentOS 7 and 6.x, Suse Enterprise Server 11 SP3,
        - 64 Bit – Ubuntu 16.04 and 15.10, Red Hat Enterprise 7 and 6.x, CentOS 7 and 6.x, SUSE Linux Enterprise Desktop 12 SP1
    - Unicon eLux - Contact Unicon for the version of eLux that they recommend for use by the RealTime Media Engine 2.4
    - Dell Wyse ThinOS 8.2 is supported by Dell and you can get more info about it from this link - https://www.dell.com/learn/us/en/vn/press-releases/2016-01-11-dell-cloud-client-computing

The Citrix HDX RealTime Optimization Pack 2.4 supports the following Citrix environments, read Release Notes (https://docs.citrix.com/en-us/hdx-optimization/2-4-ltsr.html) for more information:

Delivering Microsoft Skype for Business to XenApp and XenDesktop Users

- XenDesktop 7 Feature Pack 1, 7.5, 7.6, 7.6 Feature Packs 1, 2 and 3, 7.7 to 7.9, 7.11 to 7.16
- XenApp 6.0 Feature Pack 1, 6.5, 6.5 Feature Packs 1, 2 and 3, 7.5, 7.6, 7.6 Feature Packs 1, 2 and 3, 7.7 to 7.9, 7.11 to 7.16

Supported Skype for Business headsets and handsets:
The list of devices that are officially supported for Skype for Business RTOP can be found here:
https://citrixready.citrix.com/category-
results.html?&compatibility=HDX%20RealTime%20Optimization%20Pack%202.4%20LTSR

Note:
Microsoft native Skype does not support iPhone headsets.

The new release has the following key enhancements:

- Simulcast Video for improved video quality on conference calls, with support for Logitech H.264 encoding and FEC
- Audio call quality improved in fallback mode when CPU is busy
- Microphone icon changes to reflect who is speaking
- Compatibility with Receiver Auto-Update (Windows and Mac) and improved software version interop for easier upgrades
- Option to compress logging to reduce bandwidth requirements.
- Ability to disable logging on the user Device or RealTime Connector
- All UCCAPI files pulled into RTOP log file
- RTME compatibility with MAC OS 10.13 High Sierra
- More predictable selection of video resolution
- Improved Acoustic Echo Cancellation on Windows devices

Installation Guide

Prerequisites

Note - The version 2.4 applies to Windows, Mac and Linux Endpoints.
1. Download the HDX RealTime Optimization Pack 2.4 for Microsoft Skype for Business. On Citrix.com, select the Downloads Tab. Select XenApp or XenDesktop as the product and select Product Software as the download type. Select XenApp or XenDesktop 7.16, it will be under Components.
2. Ensure that the server backend is either
   a. Microsoft Skype for Business server 2015
   b. Microsoft Skype for Business Online (Office 365 hosted Skype for Business Server 2015)
   c. Any Lync 2013 servers are updated to February 2015 Cumulative Update. Citrix and Microsoft recommend updating to the latest Cumulative update.
3. Ensure Skype for Business client 2015/16 is installed in the Virtual Desktop Agent hosts or base image as well as XenApp servers, which may be used to deliver Microsoft Skype for Business.
   a. Microsoft Office Professional 2013 with Lync and at least the June 2016 Microsoft Office Public Updates. Latest updates recommended. The client must be configured in native Skype for Business UI mode.
   b. Microsoft Skype for Business 2015 stand-alone installer (which can be installed on top of Microsoft Office 2016) minimum version 15.0.4875.1001.
   c. Microsoft Skype for Business 2016 Click-to-Run minimum version 16.0.7571.2072.

        d. Microsoft Skype for Business 2016 MSI minimum version 16.0.4483.1000.
4. The client endpoint must have one of the following Receivers installed:
        a. Citrix Receiver for Windows 4.x

If windows receiver is not installed on the clients, you can install both the Citrix Receiver and the RealTime Media Engine using a single installer available from the download page:
https://www.citrix.com/downloads/citrix-receiver/additional-client-software/hdx-realtime-media-engine-latest.html

        b. Citrix Receiver for Mac 12.x
        c. Citrix Receiver for Linux 13.x

The installation procedures are simple:

Install the HDX RealTime Connector 2.4 on the Virtual Desktop

1. The HDX RealTime Connector must be **installed on VDAs** in XenDesktop, i.e. the hosts or base image of the catalog as well as XenApp servers which may be used to deliver Skype for Business. Link to the ver. 2.4 is here: https://www.citrix.com/downloads/xenapp-and-xendesktop/components/hdx-realtime-optimization-pack-24.html
Application Requirements: • Ensure Skype for Business client is installed and patched as specified above before installing the Connector • 2 vCPUs for Fallback mode if needed • Memory: minimum 4-GB RAM, 120-MB paging file • Disk space: minimum 100-MB available • Network interface: full-duplex Ethernet T CP/IP local network connection • Software: DirectX 9 (minimum) and Microsoft .NET 4.0 SP1 • Windows Defender, Trend Micro Deep Security, McAfee, etc. require addition of exceptions / exclusions for RTOP processes. This is essential to avoid performance degradation.
Note: On each of the VDA hosts, if a previous version of the Citrix HDX RealTime Connector is installed, please look into the Upgrade info here: https://docs.citrix.com/en-us/hdx-optimization/current-release/upgrade.html
Follow the instructions in this video.	https://citrix.sharefile.com/d-s41252182deb462aa

Using this image please create the appropriate machine catalogs and delivery groups in Citrix Studio before trying to establish sessions and accessing the Skype for Business client.

Windows client device - HDX RealTime Media Engine 2.4 install

1) If you have only Windows clients and you have already installed the RTME bundled with the Receiver you can skip directly to the next section. The LTSR bundled Receiver and RTME package can be auto updated, if autoupdate is enabled it. Else the RTME for Windows can be downloaded from here: https://www.citrix.com/downloads/citrix-receiver/additional-client-software/hdx-realtime-media-engine-24.html

|	
	If you have Mac or Linux clients in your environment, following sections contain steps to install RTME on them as well.
2)	Follow the below steps to get the HDX RealTime Media Engine 2.4- installed. From the components downloaded, on each endpoint client install the appropriate RealTime Media Engine. In this section, we install version 2.4 for Windows.
	Note: If you already have the Microsoft VDI Plugin or an older version of the Citrix RealTime media Engine installed on your endpoint, please look into the Upgrade info here: https://docs.citrix.com/en-us/hdx-optimization/current-release/upgrade.html
	If you have a Citrix session running in **Receiver** you will have to disconnect or close it in order to complete the following steps.
Follow the instructions in this video.	https://citrix.sharefile.com/d-sb1f751beeb641bab

Note: After connecting, one can quickly confirm that optimization is working. Open Skype for Business in the virtual desktop. Now that both the Skype application and the **HDX RealTime Optimization Pack for Skype for Business** are communicating over ICA virtual channels for command and control functions.
Look for the **RTOP** (bow-tie) icon in the systray.
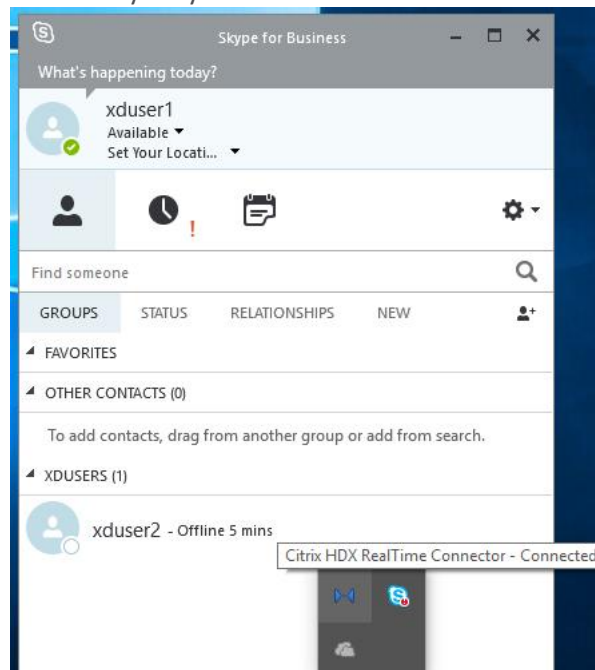
Select the "About" page and confirm connection attributes (versions of the components and OS this is deployed on). The following screenshot shows the correct connection values.

Delivering Microsoft Skype for Business to XenApp and XenDesktop Users
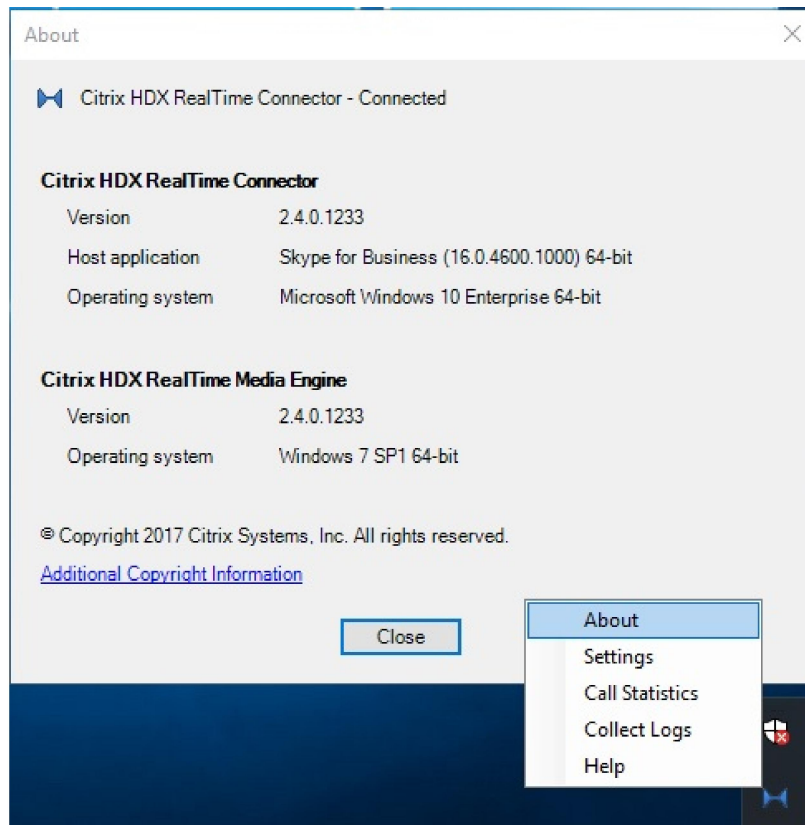
Additionally, a user can make changes to the settings available from the Settings panel.
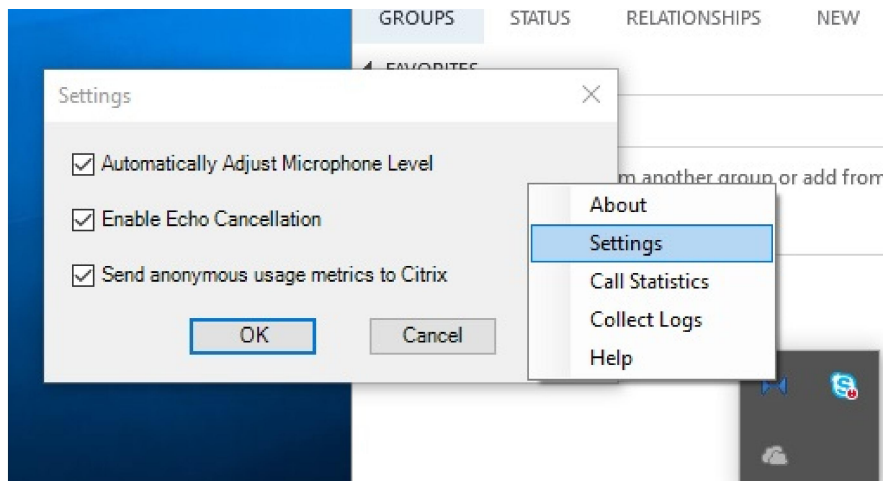
MAC OSX client device - HDX RealTime Media Engine 2.4 install

For Mac end points the procedure to follow is:
The installation procedures are simple:

> From the Citrix downloads page, search for XenApp and XenDesktop, under XenApp 7.16 / XenDesktop 7.16, select the Components drop down. (Direct link: https://www.citrix.com/downloads/citrix-receiver/additional-client-software/hdx-realtime-media-engine-24.html and jump to step 3)

|	

1) Select HDX RealTime Optimization Pack 2.4 for Microsoft Skype for Business.	**CITRIX** Products Downloads Support & Services Partners
	
	⌂ / Downloads / XenApp & XenDesktop
	
	Find Downloads
	XenApp & XenDesktop ⌄
	or
	Search Downloads 🔍
	
	XenApp & XenDesktop
	🔊 Subscribe to RSS notifications of new downloads
	
	⊙ XenApp 7.16 / XenDesktop 7.16
	
	Narrow Results
	By Type
	⦿ All Types
	○ Components (18)
	○ Edition Software (18)
	○ Product Software (15)
	○ Betas and Tech Previews (2)
	
	   ⊙ Product Software
	      XenApp 7.16.x / XenDesktop 7.16.x, All Editions
	      Dec 19, 2017 | NEW
	
	      XenApp 7.16 / XenDesktop 7.16, All Editions
	      Nov 28, 2017 | NEW
	
	   ⊙ Edition Software
	
	   ⊙ Components
	      HDX RealTime Optimization Pack 2.4 for Microsoft Skype® for Business
	      Dec 19, 2017 | NEW

2) At the bottom of the page, In the Real Time Media Engine section, click **Download File**.	**HDX RealTime Media Engine (Citrix Receiver plug-in)** Dec 19, 2017 (.htm) 🗗 Download File The HDX RealTime Media Engine is a plug-in to the Citrix Receiver to support clear, crisp high-definition audio-video calls, for Microsoft Skype® for Business.
3) Scroll to the bottom of the page and download the **HDX RealTime Media Engine 2.4 for MAC** file onto the Mac endpoint machine.	⌂ / Downloads / Receiver / Other Receiver Plug-ins / HDX RealTime Media Engine 2.4 for Microsoft Skype® for Business **Find Downloads** Citrix Receiver ⌄ or Search Downloads 🔍 **HDX RealTime Media Engine 2.4 for Microsoft Skype® for Business** Release Date: Dec 19, 2017 The HDX RealTime Media Engine is a plug-in to the Citrix Receiver to support clear, crisp high-definition audio-video calls, particularly with Microsoft Skype® for Business. Users can seamlessly participate in audio-video or audio-only calls to and from other HDX RealTime Media Engine users, native Skype® for Business and Lync® client users, and other standards-based desktop video and conference room systems. The HDX RealTime Media Engine is available for Windows, Mac and Linux devices. HDX RealTime Media Engine 2.x supports Microsoft Skype® for Business Server 2015, Microsoft Lync® Server 2013 and Office 365™ (Skype® for Business Online). HDX RealTime Media Engine 2.4 for Windows Dec 19, 2017 43.1 MB - (.exe) 🗗 Download File Checksums SHA-256 - 114a96af4f3367f691c7b04698cbf754f0089588c4e92ed5ef53325fd6e824cd HDX RealTime Media Engine 2.4 for Mac Dec 19, 2017 13.3 MB - (.dmg) 🗗 Download File Checksums SHA-256 - 773aaa4a803bcb585708a97d221faa1a204f2beb26fc9128121a36fa62e825b3
Follow the instructions from the video	https://citrix.sharefile.com/d-s7bb85a6ea64406db

Launch a Citrix session that has the Skype for Business Client and the RealTime Connector installed. Start the Skype for Business application. When everything is configured correctly, you will see the notification in the bottom left.	
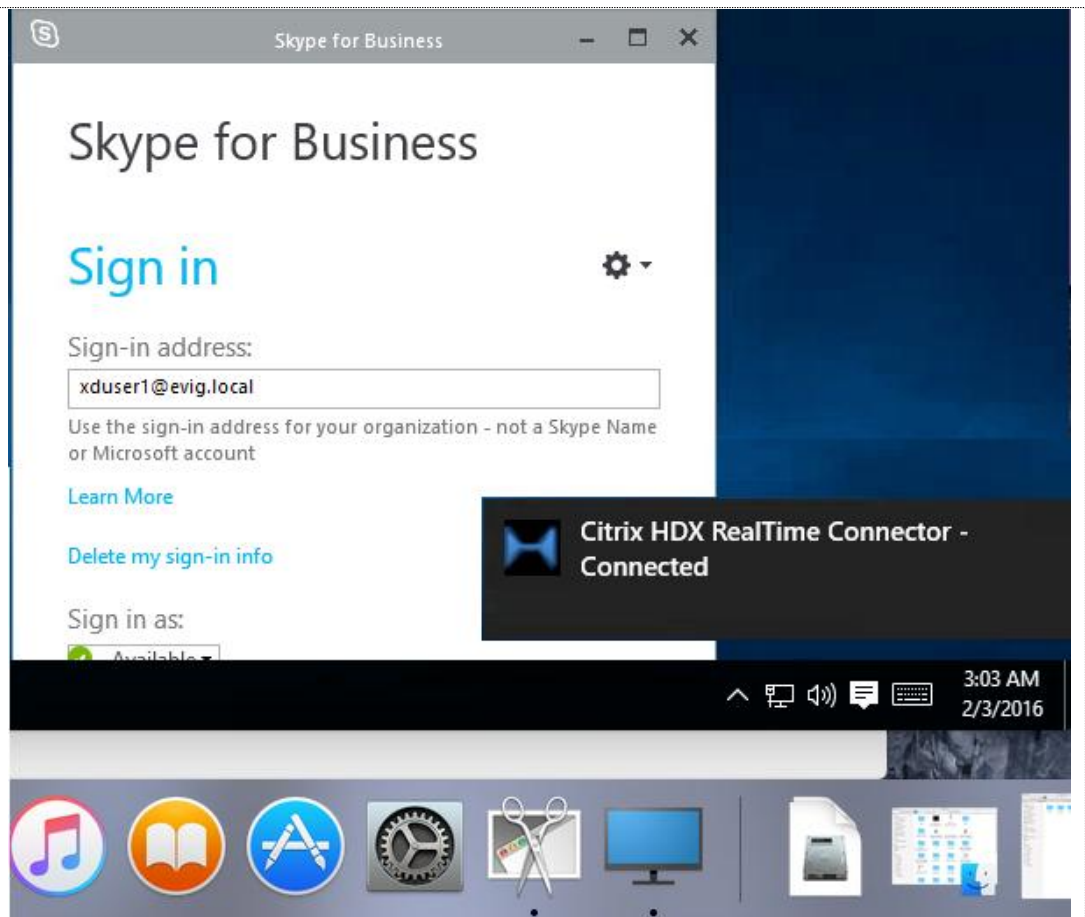
After connecting, one can quickly confirm that optimization is working. Look for the **RTOP** (bow-tie) icon in the systray. Select the "About" page and confirm connection attributes (versions of the components and OS this is deployed on). The following screenshot shows the correct connection values:
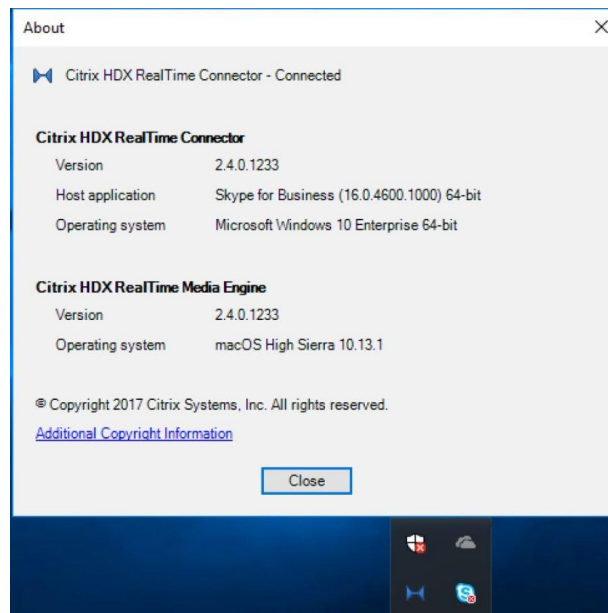
Linux client device - HDX RealTime Media Engine 2.4 install

For Linux endpoints the procedure to follow is:
The installation procedures are simple:

1)	From the XenDesktop 7.16 downloads page select HDX RealTime Optimization Pack 2.4. On this page click on the HDX RealTime Media Engine download link. Scroll to the bottom of the page and download the HDX RealTime Media Engine 2.4 for Linux zip file onto the Linux machine. (To see how to get to this page, please refer to the Mac client section at the bottom of page 10).
	Note: We recommend updating the Linux OS and applications, before you begin the installation of HDX RealTime Media Engine 2.4 for Linux.

Follow the instructions in the video.	https://citrix.sharefile.com/d-s796f39ec4df47ecb

Once the installation is complete then launch a Citrix session as you would normally and start Skype for Business within the Windows session and you should be able to use it just as you would on a Windows end point.
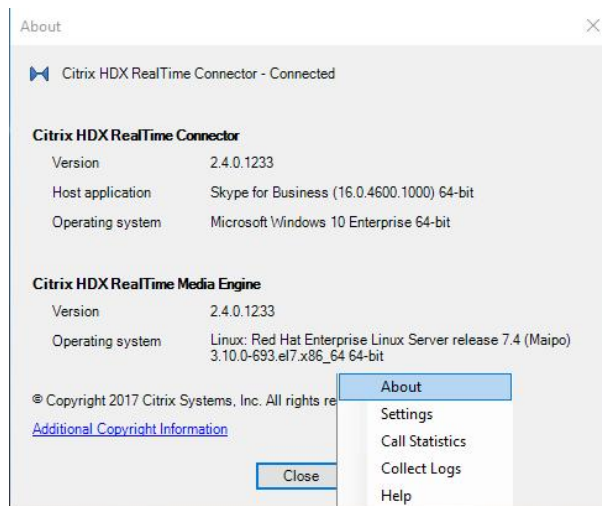
Upgrading to RealTime Optimization Pack 2.4

The update process is clearly defined in this page: https://docs.citrix.com/en-us/hdx-optimization/current-release/upgrade.html

Troubleshooting

Here are a few ways to resolve the issues users may face:

1. Audio/Video Performance Issues

    Resolution:
    a. A/V & Endpoint Protection software configuration is very, very important to avoid performance degradation! Set exclusions for RTOP processes to avoid certain anti-malware solutions incorrectly detecting RTOP as malware.
    b. Consider adding an exemption rule for the logging folder also as the text files generated by logging are constantly scanned by AV/endpoint security and this may reduce the performance of the endpoint. Without logging exclusions in place, users may notice a significant delay in webcam processing and display when initiating or accepting a video conference.
    c. In Citrix Policies Audio Quality is set to "High" for by Default. Set this to Medium or Low if RTOP in use. Setting of High will add latency and performance overhead while not improving call quality, as the call is medium or low quality 8GHz or 16GHz with RTOP. Also ensure that Audio over UDP is set to Allowed. Note: the audio policies suggested here do not directly affect the performance of RTOP. However, they are a best practice for providing "generic ICA" fallback methods in the event RTOP is not in place or optimization has not occurred.
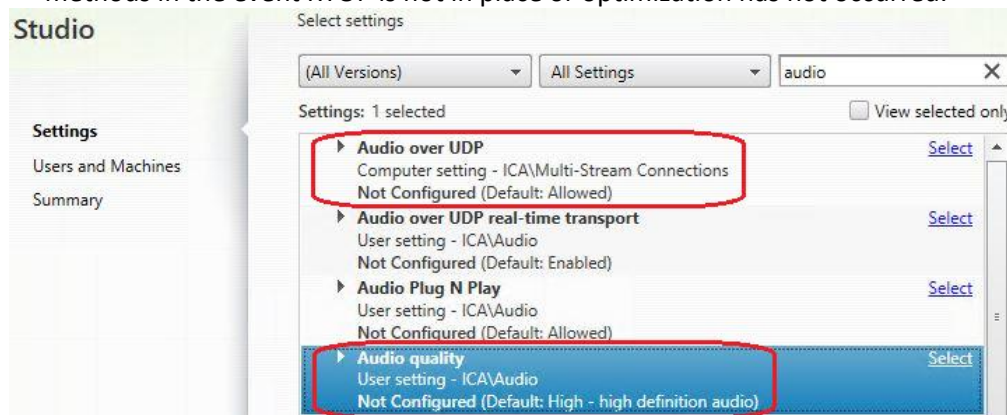

2. Upgrading Receiver requires RealTime Media Engine to be uninstalled from the client. This is a known issue, and will be corrected in future releases.

    Work Around: Due to some registry access conflict the upgrade will break the RTME. When upgrading Receiver on the Client machine, please ensure that you uninstall the RTME first before upgrading the Receiver.

3. Your users may sometimes arrive at a situation where they don't get the desired status, connection type and mode as shown above. Citrix HDX RealTime Connector systray (bow-tie) icon shows status other than Connected.

Resolution: Possible status messages are
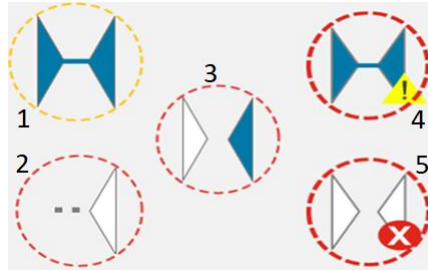
1) Connected - RTC has established a connection to RTME and we are ready to offload A/V.

2) Connecting – MediaEngine is attempting to connect to RTC.

3) UnOptimized / Fallback – RTME is not installed on the client and you have entered into fallback mode depending on configuration. This means you are connected to the local MediaEngine on the Client. Endpoint could be BYOD, iOS, Chromebook. It is discussed later in the document, here.

4) Connected with Warning symbol – Usually indicates a version mismatch. RTC could be a higher version of the RTME.

5) Not Connected – Unable to launch media engine on endpoint.

6) No bow-tie shown, either RTC isn't installed in the VDA or adequate Microsoft Skype for Business PU's are not installed on the VDA.

4. Skype for Business client throws a "Can't sign into Skype for Business" error message.
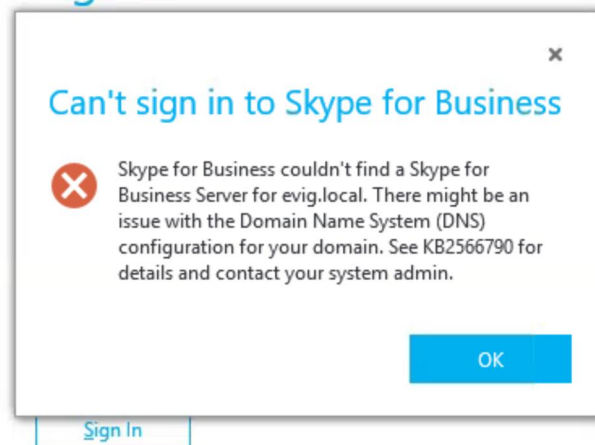
Resolution - There are multiple reasons for this, the Connection settings may need to be checked and changed from Automatic to Manual to verify the settings are correctly set in the VDA / base image. Click Settings and select Change Sign-In Address
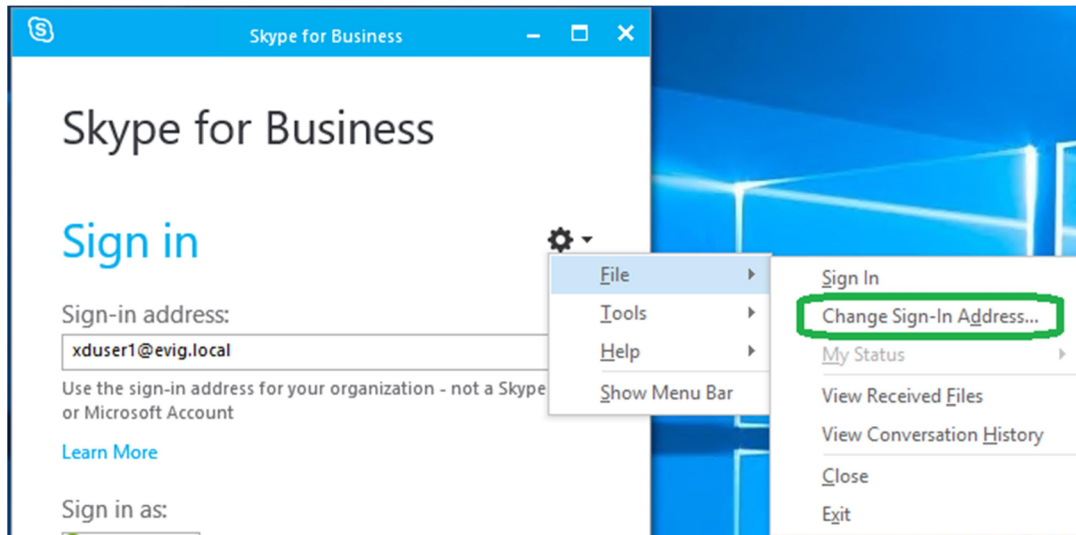
Click on Personal in the left pane and click Advanced
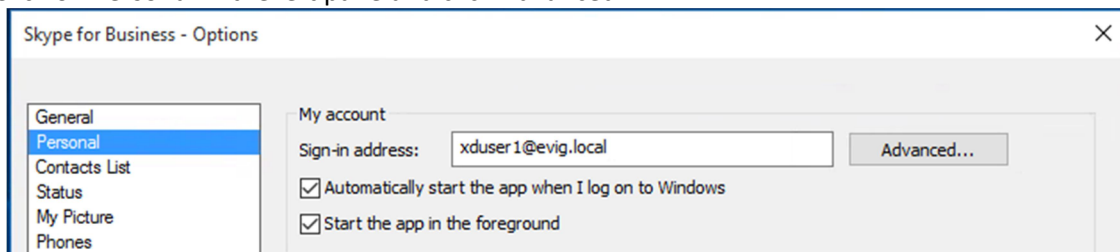
Select Manual Configuration and enter the Internal / External Server name correctly and check if the same error occurs.
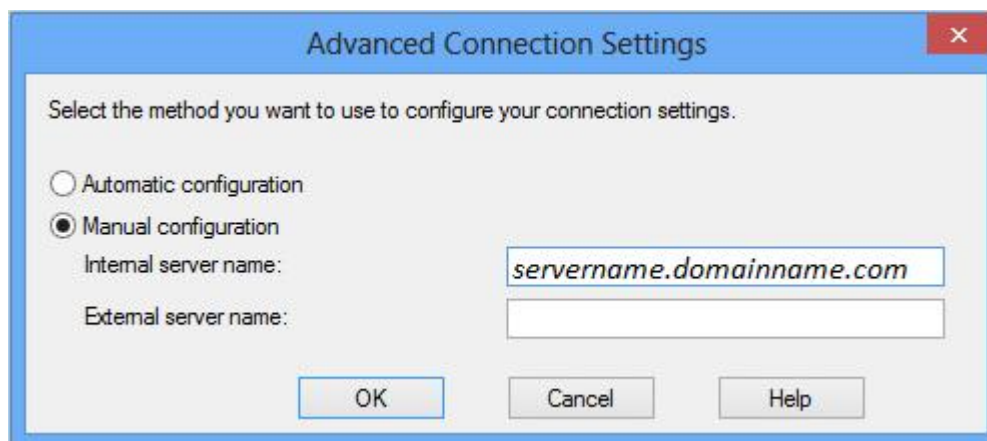
If this does not resolve the issue, follow the link to the Microsoft Skype for Business troubleshooting page: https://support.office.com/en-gb/article/Troubleshooting-Lync-Sign-in-Errors-Administrators-a0ca46f2-de15-4011-a82c-dbc7ffcfc7d3

5. If you are running a Lync 2013 server in your environment and using Skype for Business clients then the users may see the following pop up, stating their UI is going to be reverted.
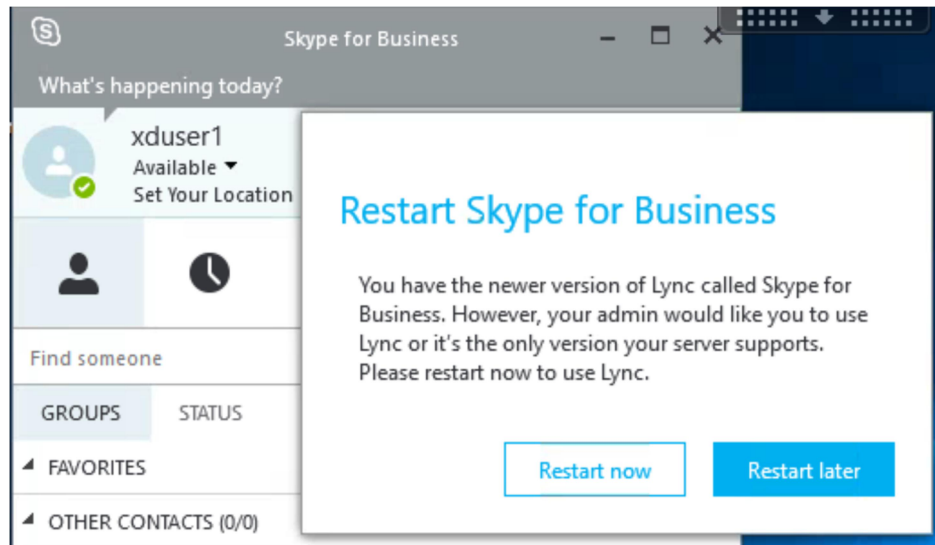
Resolution – It is strongly recommended that your users use the Skype for Business UI in conjunction with Citrix HDX RealTime Optimization Pack, as the UI integration and testing has been conducted with the latest version. The issue can be resolved by running the following command on your Lync 2013 server. For more information follow this link: https://technet.microsoft.com/en-us/library/dn954919(v=ocs.15).aspx

Set-CsClientPolicy -Identity Global -EnableSkypeUI $true

Then **restart** the **Lync Server Front-End** service on your Lync servers.

6. Echo or bad reception during the call.

Resolution – If call experience is not great and can hear echo or the remote party can't hear you clearly, always check the call settings by going to the same bow-tie icon and selecting Settings. Ensure that both check boxes are selected.

7. Citrix HDX RealTime Connector is not seen in the systray of the session, even after the Skype for Business Client has been launched within the VDA.

   Resolution – For Lync 2013 or Skype for Business 2015 clients This issue occurs if the VDA doesn't have the required Skype for Business update, as described in the **KB3114351** (https://support.microsoft.com/en-us/kb/3114351), installed in it. For Skype for Business 2016 clients ensure that the minimum version of the client installed on the VDA is 16.0.4483.1000, we suggest having the latest update of the client installed at all times.

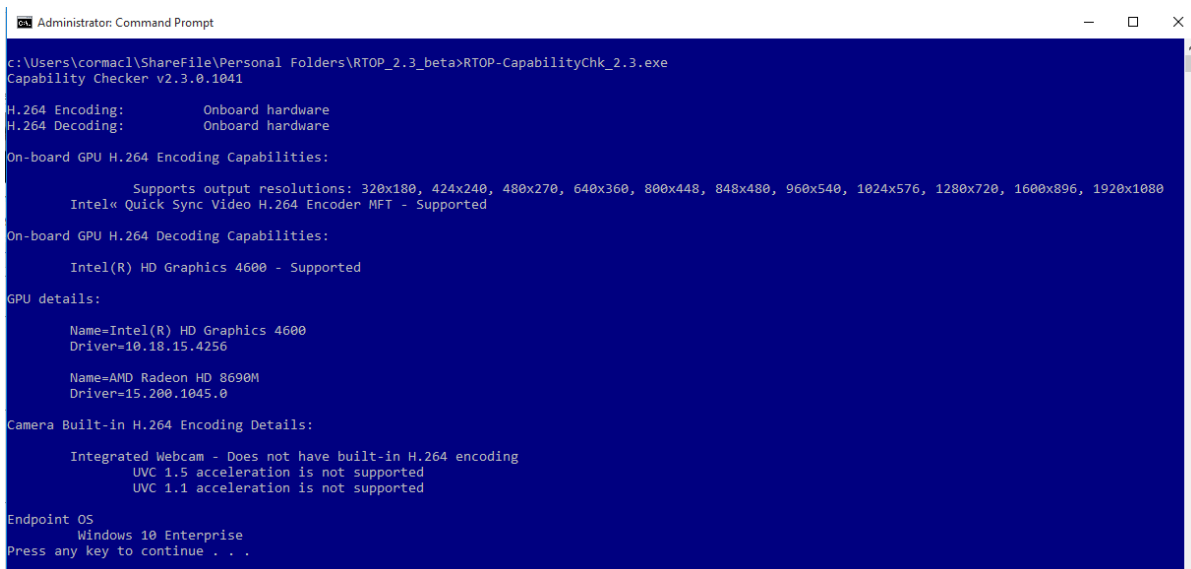For more information about Troubleshooting the Citrix RealTime Optimization pack, please visit: https://docs.citrix.com/en-us/hdx-optimization/current-release/troubleshooting.html

Note: When Media Bypass is enabled with HDX RealTime Optimization Pack 2.0.100 onwards, we automatically fall back to media streams sent through the Mediation Server.

Common deployment related tips and questions

Firewall settings: On premises they are same as for Skype for Business client: https://technet.microsoft.com/en-us/library/gg398833.aspx (Required Client Ports section)

RTOP Capability Checker:

The capability checker tool allows you to examine the capabilities of a customer's standard endpoint client where the majority of users are going to be offloading the media to. This could be a thin client that may not have a very high spec and could cause limitations in a call and affect performance of audio or video. It can also be used in troubleshooting a case where the customer is complaining about performance issues and you suspect the issue is with the endpoints resources. Run the capability checker and you can find exactly what you may be struggling with to support RTOP/Skype.

RTOP Connector Configuration settings:

The configuration settings for enabling and disabling – Fall back Mode, Notifications Balloons and Version Mismatch warnings and configuring WMI support can be found here - https://docs.citrix.com/en-us/hdx-optimization/current-release/configuration.html

Call Statistics:

During a call, users can view information about network health by selecting the Call statistics option in the connector systray. Values in red indicate potential problems with the network. To write the values to a text file whose default name is call_statistics_<date>.txt, click Save Statistics.

Check for
  - Dropped or Lost packets – Dropped packets are packets intentionally dropped by RTOP as they are out of order, lost packets are packets lost on the network.
  - Jitter/ skipped frames
  - A/V codecs in use.

The Call Statistics window appears, as shown in the following example.
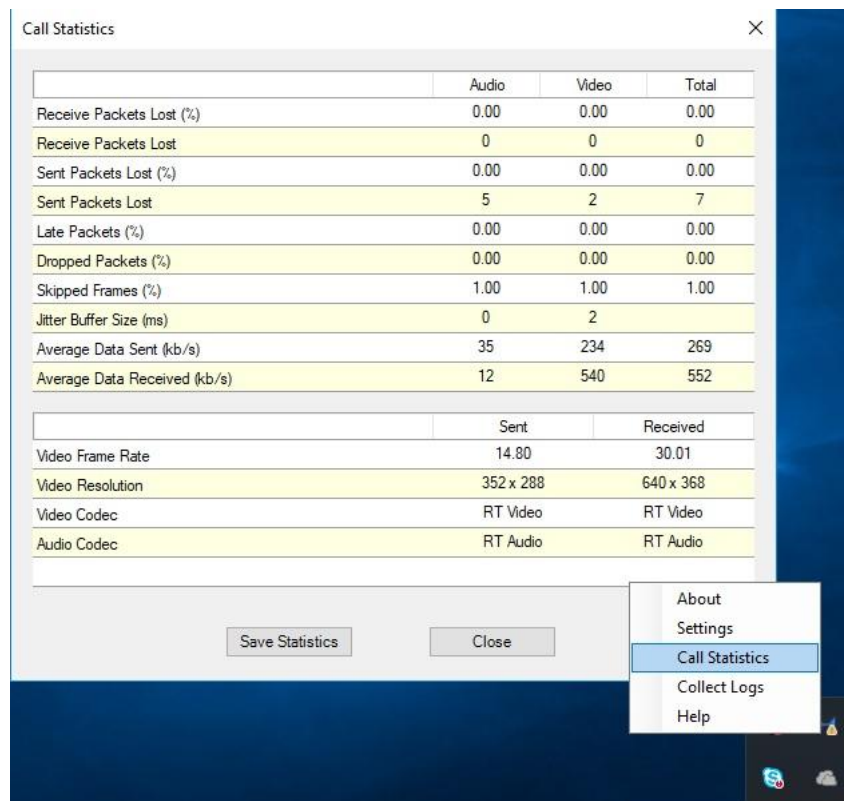
What are the bandwidth requirements for the RTOP? Does the RTOP observe the bandwidth policies set on the SfB/Lync server?

Bandwidth consumption with the HDX RealTime Optimization Pack is consistent with native Skype for Business. The HDX RealTime Media Engine will obey bandwidth restrictions configured on the SfB/Lync server, applying them to both RT Video and H.264. Bandwidth guidelines from Microsoft:

http://technet.microsoft.com/en-us/library/gg615029(v=ocs.14).aspx
http://technet.microsoft.com/en-us/library/jj688118.aspx

If the customer already provisioned their network for "fat desktop" Skype for Business / Lync users with voice and video conferencing, the Optimization Pack will work with that bandwidth as it adds very little network overhead; the only additional traffic is the low bandwidth virtual channel control interactions between the RTC on the VDA and the RTME on the user device.

One difference: RTOP does not support the Siren low bandwidth audio codec (approx. 60 Kbps). G.722 uses approximately 105 Kbps on a clean connection (no packet loss). If substantial packet loss is observed on the network, Forward Error Correction (FEC) increases overall bandwidth consumption for audio to approximately 170 Kbps. FEC is exclusive to Citrix RTOP.

For video, the minimum bandwidth depends on the desired resolution:
https://technet.microsoft.com/en-us/library/gg425841.aspx
For HD resolution (1280x720), we suggest 1 Mbps or more; for VGA resolution, 400 Kbps or more.

How does the HDX RTOP support Quality-of-Service (QoS)?

It is possible to configure alternate UDP ports for audio and video to manage QOS. Port ranges are configured with a server-side policy on the Lync server, using the Set-CsConferencingConfiguration cmdlet:

https://technet.microsoft.com/en-us/library/gg412969.aspx (reference)
https://technet.microsoft.com/en-us/library/jj204760%28v=ocs.15%29.aspx (examples of usage)

Is html5 browser supported or not - Example Windows Surface using Edge browser, Using Chrome books, Using Chrome browser?

Using the Skype for Business Web App (browser-based client) is totally independent of the HDX RT Optimization Pack, which can interoperate with any of the native Skype4B clients including the browser-based client. You might be able to use redirection to leverage the local browser on the user device; someone else on this thread should be able to comment on that. Otherwise, audio-video processing will be performed using whatever Generic HDX RealTime capabilities are available for the particular Receiver version being used (e.g. Chrome Receiver).

In order for Skype HDX to work properly – does Citrix have any driver requirements for BYOD?
Nothing special. Requirements for the HDX RT Media Engine are listed in the prerequisites section at the beginning of this guide.

To leverage onboard H.264 hardware encoding on Windows devices requires a driver for AMD VCE or Intel Quick Sync according to the chipset on the device. Use the RTOP Capability Checker if you want to determine whether a given device supports this technology; this new tool will be included in the Supportability Pack but meanwhile we can make it available via ShareFile.

Is desktop sharing inside Skype considered as a video or not?

Desktop sharing is performed using either RDP or VBSS (video-based), but this is determined by the Skype for Business client and is completely independent of the HDX RTOP. When VBSS is used, the video of the desktop or

shared app is rendered server-side and delivered over Thinwire, with Selective H.264 encoding (new feature of Adaptive Display introduced last year). According to Microsoft, the Skype4B 2016 client will use VBSS on incoming screen sharing calls from native clients and use RDP on outgoing screen sharing calls from clients running in a virtualized environment. From a functionality point of view, it makes no difference whether RDP or VBSS is used, however VBSS should deliver a better experience if there is considerable motion on the screen (e.g. when moving a 3D model). RDP and VBSS apparently use difference ports so make sure both protocols can be used since Microsoft's transition from RDP to VBSS is happening in phases and is not yet fully complete.

Is it possible to customize the UDP port ranges used by RTOP for audio and video?
Optimization Pack 2.4 supports the same parameters as native SfBClientAudioPort/ClientAudioPortRange/ClientVideoPort/ClientVideoPortRange.

The RTOP also supports DSCP marking for media packets. This provides another solution for QoS. For Windows this is possible by pushing out QoS policies to the endpoints. For Linux and Mac OS X, we provide registry settings that need to be applied in the user's profile on the server.

Remote Access

http://support.citrix.com/article/CTX201116

The HDX RTME uses Microsoft Edge servers only for media connectivity, i.e. to obtain ICE candidates using STUN and TURN protocols during call setup, and to relay media streams if direct connectivity is not possible. In the v2 architecture, SIP signaling is handled exclusively by the Skype for Business client on XenApp/XenDesktop.

Citrix HDX Generic Delivery

The Generic HDX RealTime technologies for media-over-ICA provide a valuable fallback when optimized delivery of the Skype for Business client is not possible. Over the years, Citrix has introduced numerous HDX technologies to deliver a good user experience when this approach is used, such as:

- Optimized-for-Speech audio codec (quick encode, 16-32 Kbps per channel)
- Webcam Video Compression
- UDP/RTP Audio transport (resilient to network congestion and packet loss)
- Adaptive Display (video quality and frame rate self-adjust to the network)
- Multi-stream ICA with packet tagging (DSCP and WMM) for QoS
- Jitter buffering and echo cancellation in Citrix Receiver for Windows
- Audio plug-n-play
- Audio device routing (e.g. ringtone to speakers, audio to headset)

Go through the following pages for more information:
http://support.citrix.com/article/CTX133024 and http://support.citrix.com/article/CTX132764.

Special Considerations for Remote Users with NetScaler Gateway

The information about the deployment best practices for Skype for Business in environments that have NetScaler present or where NetScaler is being introduced can be found here - https://www.citrix.com/products/netscaler-application-delivery-controller/tech-info/deploy.html.

Specifically the Microsoft Lync 2013 and Citrix NetScaler Deployment Guide - http://www.citrix.com/content/dam/citrix/en_us/documents/products-solutions/microsoft-lync-2013-and-citrix-netscaler-deployment-guide.pdf

and Deploying Citrix NetScaler for Global Server Load Balancing of Microsoft Lync 2013 documents - http://www.citrix.com/content/dam/citrix/en_us/documents/products-solutions/deploying-citrix-netscaler-for-global-server-load-balancing-of-microsoft-lync-2013.pdf.

Office 365 and Skype for Business

The Office 365 solution for Microsoft and Skype for Business Online in the office 365 suite is supported by the Citrix RTOP 2.4. The deployment method of the virtual desktop components described in this document is the same for O365 as it would do for on-premises Skype for Business deployment.

The O365 Deployment Guide can be found here - https://www.citrix.com/content/dam/citrix/en_us/documents/products-solutions/deployment-guide-office-365-for-xenapp-and-xendesktop.pdf

Note: that the guide is for an older version and will be updated shortly.
Please go through it for more information regarding setting up an Office 365 and Skype for Business setup with Citrix XenDesktop and XenApp.

Use remote administrative access to manage parameters:
ClientAudioPort / ClientAudioPortRange / ClientVideoPort / ClientVideoPortRange.
as described here:
http://blog.schertz.name/2015/04/managing-lync-online-with-powershell/ (high level overview)
https://technet.microsoft.com/ja-jp/library/dn362831%28v=ocs.15%29.aspx (detailed documentation)

Summary

We support all types of Skype for business infrastructures: on-site, hybrid or Office 365 (cloud) as long as configuration allows for successful internal and external client communication.

We have walked through the way to go about evaluating the Citrix RealTime Optimization Pack and pointed you to the resources for deploying the rest. The Citrix HDX RealTime Optimization Pack 2.4 for Microsoft Skype for Business greatly increases server scalability and offers zero degradation in audio-video quality and optimal network bandwidth efficiency. It is the Microsoft recommended solution for a VDI deployment. If there are Mac or Linux clients in your environment, then it's the only solution that is jointly supported by Microsoft and Citrix.

About the authors

Mayank Singh is a Citrix Certified Administrator and has been working with Citrix for 5+ years. He has been in the virtualization industry for over 11 years and is currently working as a Product Marketing Manager in the Technical Marketing team for Workspace Services.

Scott E. Lane is a Citrix Certified Integration Architect for Virtualization, and a Citrix Certified Enterprise Engineer. The author is a veteran of over a dozen years at Citrix, and currently Distinguished Engineer for Citrix US-Enterprise Sales.

Derek Thorslund is a Citrix veteran and Director of Product management for HDX and personally owns the Development of the RealTime Optimization Pack.

Daniel Szomboti is the Escalation Engineer who heads up the support for RTOP.

Cormac Long is another veteran Escalation Engineer who works on the RTOP.

Santhosh Kumar Bejjanki is Citrix developer who has been working closely with the support teams to help with solving customer issues as well as build tools that help troubleshoot issues encountered.

The concepts within have been validated through many field Proof of Concept trials by Scott and many other Systems/Sales Engineers in the Citrix Americas Geo.

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