HDX RealTime Optimization Pack 2.3

Aug 14, 2017

HDX RealTime Optimization Pack provides a scalable solution for delivering audio-video conferencing and voice over Internet Protocol enterprise telephony through Microsoft Skype for Business. The Optimization Pack supports XenDesktop and XenApp environments to users on Linux, Mac, Windows, and (through a partnership with Dell) Wyse ThinOS devices. The Optimization Pack uses your existing Microsoft Skype for Business infrastructure, on premises or in the cloud, and inter-operates with other Microsoft Skype for Business endpoints running natively on devices.

The Optimization Pack consists of both client and server components:

- **Client component.** Citrix HDX RealTime Media Engine and Citrix Receiver integrate on the endpoint device and performs media processing directly on the user device. It offloads the server for maximum scalability, minimizing network bandwidth consumption, and ensuring optimal audio-video quality.

For information about the RealTime Optimization Pack Capability Checker for Windows, which determines endpoint ability to support the Optimization Pack, see https://support.citrix.com/article/CTX222459.

- **Server-side (and virtual desktop) component.** Citrix HDX RealTime Connector is a connector to the virtualized Microsoft Skype for Business client running on the XenApp or XenDesktop server. It drives the RealTime Media Engine on the endpoint. RealTime Connector runs in the virtual server environment alongside Microsoft Skype for Business. It communicates signaling information over a Citrix ICA virtual channel to the RealTime Media Engine running on the user device.

The Optimization Pack supports users who are on the corporate network or working remotely. For information about configuring secure remote access to Skype for Business using the HDX RealTime Optimization Pack, see https://support.citrix.com/article/CTX201116.

Additional documentation

For information about earlier RealTime Optimization Pack releases, see the following sections:

- HDX RealTime Optimization Pack 2.2
- HDX RealTime Optimization Pack 2.1
- HDX RealTime Optimization Pack 2.0

What's new

Aug 14, 2017
What's new in 2.3

- **Improved video quality.** For information about factors that impact video quality,
  see https://support.citrix.com/article/CTX222553.
  - Implemented simulcast video transmission (multiple concurrent video streams) to improve video quality on conference calls and Skype Meetings. Each XenApp or XenDesktop user sees a single video stream because Gallery View is not available when the Skype for Business client is virtualized (see https://support.citrix.com/article/CTX200279). Simulcast allows endpoints to send more than one video stream at a time, if more than one resolution is requested for incoming Video Source Requests. There are many factors that determine how many streams and their resolution, frame rate, and bit rate. These factors include the endpoint capabilities, bandwidth availability, and decoding/encoding capabilities.
  - Supports the H.264 unified communications (UC) codec as the default for all calls. Also enables video forward error correction (FEC) to provide superior video quality on network connections that experience packet loss (for example, Wi-Fi).
- **Optimizing bandwidth usage.** RealTime Media Engine requests video resolution based on the size of the video window on the user screen. Transmitted resolutions are lower because endpoints aren't subscribing to video resolution higher than they can display. If other participants in the conference maximize their windows, the endpoint starts sending at a higher resolution, up to its limit. This update minimizes average network and CPU load without sacrificing quality.
- **Enhanced call statistics.** Added the Citrix_HDXRTConnector_Simulcast_Stream class to WMI and updated call statistics to include simulcast video statistics. These statistics include codec, resolution, frames per second, and bitrate for all streams being sent. Also, the statistics show how many viewers are receiving each of the streams. During the time active speakers change and participants join or leave the meeting, the statistics update to reflect the changes in the streams sent.

Codec	Resolution	FPS	Bitrate	FEC Level	Viewers
H.264-UC (HW)	848 x 480	30.00	1000	0	1
H.264-UC (HW)	424 x 240	15.00	240	0	1
RT Video (SW)	320 x 180	15.00	170	1	3

- **Quality of Experience statistics.** Added additional network connectivity parameters in Quality of Experience reports. We report the simulcast information in the outbound stream statistics:
  - Codecs/Codec Types: list all codecs used in all streams
  - Resolution: highest resolution being sent across all streams
  - FPS: highest frame rate being sent across all stream
  - Bitrate: sum of all streams
- **Call admission control.** Extended support for call admission control to include configurations without an Edge Server.
- **Citrix Receiver auto-update feature.** RealTime Media Engine is compatible with the Citrix Receiver for Windows minimum version 4.8 and Citrix Receiver for Mac minimum version 12.6 auto-update feature.

Fixed issues

Aug 14, 2017

- When using the unsupported combination of RealTime Media Engine version on a Windows, Linux, or Mac endpoint that is greater than the RealTime Connector version on the server, the RealTime Optimization Pack might take longer before going into fallback mode.

  [#LOP-1174]

- In multiparty conferences where some participants support only the real time video codec (for example, Lync 2010 or Lync for Mac), other participants might sometimes see a black rectangle instead of the incoming view

  [#LOP-1665]

- An Optimization Pack user having a UVC compatible camera starts a Meet Now call and starts video. An iPad user running Skype for Business who receives the call might not see the video.

  [#LOP-1935]

- Video from Windows 7 using hardware encoding might cause slow frame rates on thin clients that receive the video.

  [#LOP-1971]

- Maximizing the video window on low-end clients increases CPU usage, which might cause audio problems.

  [#LOP-2066]

- The Plantronics Savi 7*xx* base buttons might not answer or hang up calls.

  [#LOP-2213, #LOP-2334]

- On team calls with **Simultaneous Ringing** set, a call disconnect might occur when someone else picks up the call. If you observe this issue, supply log files to Citrix Technical Support.

  [#LC6548]

- When you establish a Skype for Business video call, the preview or self-view video might become unresponsive.

  [#LC6613]

- An interoperability issue with Cisco VCS gateways was observed when encryption is forced on, resulting in a black video region.

  [#LC6614]

- A runtime error can occur when reconnecting to session with the HDX RealTime Optimization Pack enabled.

[#LC6853]

- Intermittent call disconnections were observed with some combinations of Cisco Video Communication Server (VCS) gateway, ISP provided Network Address Translation (NAT), and Microsoft Edge Server. If you observe this issue, supply log files to Citrix Technical Support.

[#LC7527]

- With HDX RealTime Optimization Pack installed, disconnecting and reconnecting a headset while a Skype call is on hold might result in one-way audio after the call resumes.

[#LC7631]

- With HDX RealTime Optimization Pack installed on a MacBook Pro (2016), adding video to an existing conference call might disconnect you from the conference call.

[#LC7740]

- Call control buttons on headsets might not work as expected.

[#LC7873]

- A call between HDX RealTime Optimization Pack and Skype for Business might fail with a 488 error response generated by the non-published Skype for Business application.

[#LC8103]

Known issues

Oct 16, 2017
General known issues

> ## Warning
>
> Editing the registry incorrectly can cause serious problems that may 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.

- Simulcast does not support H.264 hardware encoding capabilities of UVC cameras.

  [#LOP-2320]

- When starting an audio point-to-point call and starting video at the same time, a **Cannot start video** message appears.

  Workaround: Do not start an audio point-to-point call and video at the same time.

  [#LOP-2356]

- When an external Optimization Pack client starts a point-to-point call to an internal Optimization Pack client, the video quality on the internal client might be poor.

  Workaround: Limit the size of your video window by keeping the requested resolution below 960 x 720.

  [LOP-2359]

- In point-to-point calls using a UVC camera, or in a Meet Now, before a user starts transmitting video, the aspect ratio of the picture-in-picture video window might not display in the correct aspect ratio. On point-to-point calls, the video you're sending might be wider and include more content than what is visible in the picture-in-picture window. In Meet Now, after each participant becomes an active speaker, the aspect ratio changes to 16:9.

  [LOP-2462]

- AMD hardware acceleration endpoints might fail to send and receive video in a Meet Now with a Lync online Office 365 user.

  [#LOP-2306]

- When endpoints are using AMD chipsets and hardware accelerated decoding, users might see short periods of black incoming video and accelerated incoming video playback after resizing the conversation window.

  [#LOP-2360]

- Audio might be distorted when CPU usage is high, especially in fallback mode.

  [#LOP-2368]

- Maximizing the video window on low-end clients increases CPU usage, which might cause audio problems.

  Workaround: Do not enlarge your video window.

  [#LOP-2066]

- We do not support two or more active network interfaces. For example, user1 has wired Ethernet and Wi-Fi enabled. User2 calls user 1 and connection problems occur causing the call to fail.

  [#LOP-1822]

- Optimization Pack 2.2.x is not compatible with the Polycom RealPresence Trio 8800. If you use the Skype for Business UI to accept a call, but use the Polycom RealPresence Trio 88 to hang up the call, the call doesn't end.

  [#LOP-1983]

- After the called party using a IP phone accepts a video call as audio-only, the caller cannot add a third participant to turn this into a conference call. Workaround: The called party can add the third participant, after which all conferencing capabilities are available.

  [LOP-1504]

- In some cases on Linux, the self-view picture might display only a corner portion of the full video.

  Workaround: Resize the video conversation window.

  [#LOP-1814]

- If a user on Mac OS X changes the dock UI setting while Skype for Business is running, current and future calls do not display local or remote video.

  Workaround: Restart Skype for Business.

  [#LOP-1062]

- On team calls with **Simultaneous Ringing** set, a call disconnect might occur when someone else picks up the call. If you observe this issue, supply log files to Citrix Technical Support.

  [#LC6548]

- If a caller plugs in another human interface device (HID) during an active call, the call might drop.

[#LOP-1377]

- Skype for Business might crash at startup after RealTime Connector is installed.

  Workaround: Restart Skype for Business.

  [#608171]

- Some headset devices (for example, Polycom and Plantronics) are mistaken for speaker phone or handset devices.

  Workaround: Restart Skype for Business

  [#605349]

- If Citrix Receiver for Mac 12.0 is on the endpoint device and a Human Interface Device (HID) is removed after Skype for Business and RealTime Optimization Pack are running, the RealTime Media Engine might crash.

  Workaround: Upgrade your version of Citrix Receiver for Mac to a more recent version.

  [#612448]

- Skype for Business might crash when exiting a video conference call or when exiting from the notification area.

  [#612444, #612115, #610894]

- Optimization Pack, does not appear in the Citrix Receiver for Windows Support Info generated from the Advanced Preferences menu.

  [#608200, LOP-650]

- When a public switched telephone network (PSTN) gateway is configured to generate custom ringback tones, the Skype for Business built-in ringback tone might be heard for a short period before the gateway ringback is heard.

  [# LOP-1243]

- When fallback mode is set to audio only, and the users in fallback mode participate in a video conference, they might see their own states in the participant list displayed incorrectly as **On Hold**. Other users are not affected.

  [#LOP-1175]

HDX RealTime Media Engine known issues

- The RealTime Media Engine v2.0.5 causes a slideshow effect in conference video calls when interoperating with 2.1.X through 2.3.X

  Workaround: Disable H264UC codec:
  Add DWORD DisableH264UC in the registry:

[HKEY_CURRENT_USER\Software\Citrix\HDXRTConnector\MediaEngine\CodecSettings]
"DisableH264UC=dword:000000001
The codec is enabled if the value is absent or set to 0, and is disabled if the value is present and set to 1.

[#LC6665]

- When a user (user2) on a Mac tries to use the RealTime Media Engine that another user (user1) installed, user2 might not receive an optimized experience.

  Workaround: On a Mac, install the RealTime Media Engine by using the actual user's logon.

[#LOP-2203]

- **For Citrix Receiver for Windows versions 4.2 and earlier** - Uninstalling the Citrix Receiver, uninstalls HDX Real Time Media Engine. You must reinstall HDX Real Time Media Engine after installing Receiver. For more information, see http://support.citrix.com/article/CTX200340.

[#484913]

- Sometimes, when attempting to install HDX RealTime Media Engine on Windows, a message indicates that there is no available disk space. However, limited space does exist on the Z:/ drive of the terminal. This is a known issue for Microsoft installers and applies to Citrix Receiver as well.

- During installation or un-installation, it is possible to encounter certain error conditions where the error message string is not localized.

  [#14530, #93]

- In Seamless mode, the following issues exist for Full Screen video:
  - Full Screen video appears in letterbox format with the Linux version of the RealTime Media Engine in Seamless mode.

    [#13564]

  - The Full Screen Control hides behind other apps in a Seamless session in XenApp Seamless mode.

    [#10731]

Third party issues

- The Windows 10 Anniversary Update has issues with web cameras and H.264 that might cause unnecessary bitrate adaption problems in RealTime Optimization Pack to RealTime Optimization Pack video calls. The problem is constant video resolution changes on your Windows 10 endpoints.

  Workaround: Add this registry key to the Windows 10 endpoint.

  [HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Windows Media Foundation\Platform]
  "EnableFrameServerMode"=dword:00000000

[#LOP-1985]

- RealTime Connector on 64-bit Windows might crash or become unstable if Microsoft .NET Framework 4.6 is installed with default configuration. For possible workarounds, see RyuJIT settings cause managed applications to crash after you install Microsoft .NET Framework 4.6.

[#LOP-1278]

- There might be problem dialing dual tone multi frequency (DTMF) digits using a Jabra Pro 9465 device on a Linux client.

  Workaround: Use the RealTime Optimization Pack interface to dial the DTMF digits.

[#547234]

- Citrix RealTime Optimization Pack does not support the Plantronics Clarity **P340** audio device but does support the **P340-M** (Skype for Business qualified device).

[#597048, 603639, 608218]

- On Mac OS X, Citrix RealTime Optimization Pack does not support Hewlett-Packard 4310, Hewlett-Packard 2300, and Microsoft LifeCam Studio webcams for point to point calls.

[#LOP-2371]

- Linux might mistake some audio devices containing buttons for a Human Interface Device (mouse) instead of an audio device. When a user presses a button, Linux interprets it as a mouse button press and prevents the regular mouse from working correctly until the call is terminated.

  Workaround: Configure the Linux X11 graphics subsystem to ignore the devices as sources of user input by creating or modifying a **.conf** file in the **/usr/share/X11/xorg.conf.d** directory with the following sections (for example, Jabra, Plantronics, or Sennheiser).

  ```
  Section "InputClass"
  Identifier "Jabra"
  MatchVendor "Jabra"
  Option "Ignore" "True"
  EndSection

  Section "InputClass"
  Identifier "Plantronics"
  MatchVendor "Plantronics"
  Option "Ignore" "true"
  EndSection

  Section "InputClass"
  Identifier "Sennheiser"
  MatchVendor "Sennheiser|1395"
  Option "Ignore" "true"
  EndSection
  ```

  [#521088]

- The microphone volume level of some Linux clients is low.

    Workaround: Increase the microphone level using the Linux system volume control.

- The microphone volume level of the Polycom CX100 speakerphone is very low even at its full level when used with the HP Thin Pro client.

    Workaround: You can modify the registry key that comes with the HP Thin Pro comes by using the regeditor program on the client, which can be run as root, or from the Registry Editor component of the Profile editor.

    These settings limit the range of available settings on the input volume slider. The RecordScale default value of 100 limits it to 25% of its maximum value for the microphone jack. Setting RecordScale to the maximum value of 400 allows the slider access to the entire scale.

    root>Audio>

    Value name: RecordScale
    Value data: 400 (Default is 100)

    Value name: RecordScaleAuto -
    Value data: 0 (Default is 1- sets to 100)

    1   Sets RecordScale value based on hardware type.

    2   Does not set RecordScale value based on hardware type.

    For playback, these controls work the same way as the input volume controls.

    root>

    Value name: OutputScale
    Value data: 400 (Default is 100)

    Value name: OutputScaleAuto
    Value data: 0 (Default is 1)

    [#604219]

- You might encounter errors with Skype (not Skype for Business) on iOS 9.2.

    Workaround: Upgrade to iOS 9.3.2

    [#LOP-1313]

- If you have more than one camera connected to an endpoint and you want to use the second camera for videos or video previews, open **Tools** > **Video Device Settings** and select the camera and click **OK**.

    [#LOP-1397]

- If Skype (not Skype for Business) fails to connect video from the RealTime Optimization Pack in a video call, you might see a black screen or a still video from the RealTime Optimization Pack user.

[#LOP-1295]

System requirements

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Environments

HDX RealTime Optimization Pack supports the following Microsoft Skype for Business configurations:

- **Server** (back end)
  - Microsoft Skype for Business server 2015
  - Microsoft Skype for Business Online (Microsoft Office 365 hosted Skype for Business Server)
  - Microsoft Lync 2013 server - Updated to at least the February 2015 Cumulative Update. Citrix and Microsoft recommend updating to the most recent Cumulative update.

- **Client** (the Skype for Business application installed on the XenApp or XenDesktop server). For information about configuring the Skype for Business 2015 client in native UI mode, see https://technet.microsoft.com/library/dn954919.aspx.
  - Microsoft Office Professional 2013 with Lync and at least the June 2016 Microsoft Office Public Updates. Citrix recommends having the latest updates. The client must be configured in native Skype for Business UI mode.
  - Microsoft Skype for Business 2015 stand-alone installer (which can be installed on top of Microsoft Office 2016) minimum version 15.0.4875.1001.
  - Microsoft Skype for Business 2016 Click-to-Run minimum version 16.0.7571.2072.
  - Microsoft Skype for Business 2016 MSI minimum version 16.0.4483.1000.

Important

Because Microsoft recently fixed the blue video region issue, we strongly recommend using the following (or the latest) Skype for Business client updates:

Skype for Business 2015 client

- Recommended minimum version: 15.0.4875.1001 November 1, 2016
- https://support.microsoft.com/en-us/kb/3127934

Skype for Business 2016 client

- Recommended minimum version: 1611 Build 7571.2072 December 6, 2016
- https://technet.microsoft.com/en-us/office/mt465751

The Optimization Pack supports the following Citrix environments:

- XenDesktop 7.9, 7.8, 7.7, 7.6 Feature Pack 1, Feature Pack 2, and Feature Pack 3
- XenDesktop 7.15, 7.14, 7.13, 7.12, 7.11, 7.6., 7.5, and 7
- XenApp 7.9, 7.8, 7.7, 7.6 Feature Pack 1, Feature Pack 2, and Feature Pack 3
- XenApp 7.15, 7.14, 7.13, 7.12, 7.11, 7.6 7.5, 6.5, and 6.0

For more information about XenDesktop and XenApp editions that include Skype for Business optimization, see XenApp and XenDesktop features.

The Optimization Pack supports the following Citrix Receivers:

- Receiver for Windows 4.x
- Receiver for Mac 12.x
- Receiver for Linux 13.x

HDX RealTime Connector

You install RealTime Connector on XenDesktop virtual desktops or on servers in your XenApp farm.

- Supported operating systems:
  - Desktops: Microsoft Windows 10, 8.1, 7
  - Servers:
    - Microsoft Windows Server 2016
    - Microsoft Windows Server 2012 R2
    - Microsoft Windows Server 2008 R2
- Memory: minimum 4-GB RAM, 120-MB paging file
- Disk space: minimum 100-MB available
- Network interface: full-duplex Ethernet TCP/IP local network connection
- Software:
  - DirectX 9 (minimum)
  - Microsoft .NET 4.0 SP1
  - Microsoft Skype for Business 2015 client - minimum Product Update 15.0.4833.1001 (32-bit or 64-bit)
  - Microsoft Skype for Business 2016 client - minimum Product Update 16.0.7341.2032 (32-bit or 64-bit)

Installation prerequisite

1. Right-click the Microsoft Skype for Business shortcut on your desktop or in the list of programs in the Start menu and choose **Properties**.
2. In the Properties dialog box, select the **Compatibility** tab.
3. On the Compatibility tab, ensure the **Run this program as an administrator** check box is cleared.

HDX RealTime Media Engine/Client Device

You install the RealTime Media Engine on the client device.

See citrixready.citrix.com for HDX Premium client devices verified for Optimization Pack.

Hardware guidelines when H.264 hardware acceleration is unavailable:

CPU:

Results vary based on processor architecture.

- For CIF (standard) video, 1.4 GHz
- For VGA, a minimum of 2 GHz.
- For 720p HD (high definition) video, 2.8 GHz dual core
- Support for SSE3 instruction set

Disk space and memory:

- 50 MB disk space

- 1 GB total RAM

Supported operating systems

You can install RealTime Media Engine on devices running any of the following operating systems:

- Microsoft Windows Server 2016, Microsoft Windows Server 2012 R2, Microsoft Windows 10 IoT Enterprise, Microsoft Windows 10, Microsoft Windows 8.1, Microsoft Windows 7
- Microsoft Windows devices: WES 7, WES 8, WES 2009, or Microsoft Windows Thin PC (TPC)
- Linux 32-bit
  - Ubuntu 16, 15, and 14.04
  - Red Hat Enterprise Linux 6.x
  - Red Hat 6.7
  - CentOS 7 and 6.x
  - SUSE Linux Enterprise Server 11 SP3 (Wyse Enhanced SUSE Linux)
  - HP ThinPro 5.x
- Linux 64-bit
  - Ubuntu 16.04 and 15.10
  - Red Hat Enterprise Linux 6.x
  - Red Hat Enterprise Linux 7
  - CentOS 7 and 6.x
  - SUSE Linux Enterprise Desktop 12 SP1
- Mac OS X 10.12.x, 10.11.x, and 10.10.x
- Unicon - Contact Unicon for the version of eLux that they recommend for use by the RealTime Media Engine 2.3

Important

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.

The Microsoft Windows 10 Anniversary Update released in August 2016 introduces a new feature called Windows Camera Frame Server. This feature might cause issues including disabling hardware encoding in webcams.

To avoid these issues, install Microsoft updates KB3176938 (Windows 10 CU released on August 31, 2016) and KB3194496 (Windows 10 CU September 29, 2016) for RealTime Media Engine on Windows 10. If you still see performance issues after installing the updates, make these registry changes:

HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows Media Foundation\Platform
EnableFrameServerMode=dword:00000000

HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Windows Media Foundation\Platform
EnableFrameServerMode=dword:00000000

Requirements for audio and video calling:

- RealTime Media Engine can support video calls in high-definition (HD) video. If the camera, host device, bandwidth setting, and remote endpoint support high-definition specifications, the RealTime Media Engine measures the speed of the user device. It then encodes HD video.

- Camera:
  - Most USB webcams are supported.
  - Minimum resolution: 320 x 240
  - Color space: 1420 or YUY2
  - Frame rate of at least 10 fps, 24 fps for HD video
  - Windows UVC driver
- Audio I/O must be DirectSound compatible and capable of 16-bit mono or stereo sound at 16,000, 32,000, or 44,100 samples per second. We recommend a USB headset.

Requirements for Skype for Business compatible audio devices:

RealTime Connector supports Skype for Business-compatible USB headsets, speaker phones, and phones. For full information about supported devices, see Skype for Business Solutions.

Third-party video drivers and the Optimization Pack

Windows USB video class (UVC) drivers for web cameras have been included in Microsoft Windows operating systems for many years. Microsoft Windows operating systems on some thin client terminals might not include those drivers. If you install a web camera on a terminal device, the installation program might report that it doesn't have the required files.

We recommend that you use the standard Windows device drivers for webcams. Vendor-supplied drivers can sometimes cause crashes and Blue Screen events on certain platforms (especially 64-bit Windows).

Technical overview

Aug 14, 2017

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HDX RealTime Optimization Pack offers clear, crisp high-definition audio/video calls with Microsoft Skype for Business in an optimized architecture. Users can seamlessly participate in audio-video or audio-only calls to and from other:

- Skype for Business users
- Microsoft Lync users
- Standards-based video desktop and conference room multipoint control unit (MCU) systems
- Standalone IP phones compatible with Skype for Business

All audio/video processing is offloaded from the Server to the end-user device or terminal, optimizing the quality of the call with minimal impact on server scalability.

Key features

The Optimization Pack provides XenApp and XenDesktop customers the following key features:

- Simulcast video transmission (multiple concurrent video streams) to improve video quality on conference calls and Skype Meetings.
- Optimizes Skype for Business audio and video calling on Windows, Mac, and Linux devices. Our partner, Dell, supports Wyse ThinOS.
- Compatible with Skype for Business Server 2015, Lync Server 2013, and Skype for Business Online (Office 365).
- Enables call initiation from the Skype for Business dialpad, dial-in bar, contacts list, Conversation window, and Outlook or other Office application.
- Supports both point-to-point and multi-party calling.
- Supports these audio codecs: SILK, G.771, G.722, G.722.1 and G.722c and RT-Audio. This enables voice communications over a wide range of network environments, including the public internet and mobile networks.

- Supports a wide range of video resolutions, from 320x180 to 1920x1080, at up to 30 frames per second.
- Supports Quality of Service (QoS) by observing the audio and video port ranges configured on the Skype for Business server (see https://technet.microsoft.com/en-us//library/jj204760(v=ocs.15).aspx andhttps://technet.microsoft.com/en-us/library/gg412969.aspx).
- Supports Differentiated Services Code Point (DSCP) marking for media packets. For Windows, push out QoS policies to the endpoints. For Linux and Mac OS X, there are Optimization Pack registry settings that must be applied in the user profile on the server. For more information, see https://support.citrix.com/article/CTX215691.
- Optimizes Quality-of-Experience (QoE) through adaptive jitter buffer, packet loss concealment, call rate adaptation, and other techniques.
- If there is no HDX RealTime Media Engine present on the user device, provides fallback to server-side media processing (Generic HDX RealTime).
- Supports most webcams including built-in webcams on Windows devices and built-in webcams (Facetime cameras) on Mac devices.
- Improves audio and video quality over lossy connections by enabling forward error correction (FEC).
- Call Admission Control on the Skype for Business server improves media quality in enterprise networks. It does so by tracking media bandwidth usage and denying calls that would overload the network by using too much bandwidth.
  - When enabled by administrators, all audio and video calls made with the Optimization Pack inform the Skype for Business server infrastructure about bandwidth usage. The calls follow all bandwidth policy constraints, including:
    - Limits audio and video bandwidth as required by the policies.
    - Downgrades video calls to audio only if bandwidth for video is not available. A generic message displays.
    - Reroutes the call through the internet when bandwidth on the corporate network is not available. A generic message displays.
    - Reroutes the call to voicemail when bandwidth is not available anywhere. A generic message displays.
    - Reports Call Admission Control bandwidth constraints to the Quality-of-Experience monitoring database.
  - Call Admission Control works in all network configurations supported by Microsoft. That is, multiple regions, sites, links, routes, policies, and so forth. It works as designed for both on-premises and remote endpoints. On remote endpoints, just as native Skype For Business clients running remotely, only internal portions of the media path are subject to Call Admission Control bandwidth policies.
- Supports RT-Video, H.264 UC, H.264 Scalable Video Coding (SVC), and H.264 Advanced Video Coding (AVC). Video call rates range from 128 kb/s to 2048 kb/s. All video is encoded at up to 30 fps (depending on the webcam used) and transmitted over RTP/UDP (preferred) or TCP.

Limitations

When you deliver the Skype for Business client in a virtualized environment, there are a few feature differences. For more information, see https://support.citrix.com/article/CTX200279.

Warning

Editing the registry incorrectly can cause serious problems that may 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.

- If Skype for Business is running locally on your device, right-click the Skype for Business icon in the system tray and Exit the application. Interaction issues are likely when running Skype for Business locally while it is also running in the data

center as a hosted application.

- Microsoft does not support the Lync and Skype for Business basic client with the Optimization Pack. Workaround: Use the full version of Skype for Business.
- The Optimization Pack does not support direct media connections to and from public switched telephone network (PSTN) gateways. There is an optional feature of Skype For Business, known as media bypass. For more information, see https://technet.microsoft.com/en-us/library/gg412740.aspx and https://support.citrix.com/article/CTX200279. If Skype For Business server administrators enable media bypass, PSTN calls involving Optimization Pack users automatically and transparently route media connections through the Mediation Server. This feature limitation doesn't cause user impact. Take this limitation in to account when planning network capacity.
- When the Skype for Business client is delivered as a published application rather than as part of a full Windows desktop, desktop sharing is not supported. If you use desktop sharing, the server desktop is shared rather that the local desktop. Application sharing can be used to share other hosted applications during a Skype for Business call. The virtualized Skype for Business client cannot share applications running locally on the user device.
- Client-side recording is not supported. Citrix recommends evaluating third-party server/network-based recording solutions.
- Gallery view is not supported in multiparty calls. Active speaker view is used in Skype for Business multiparty calls using the Optimization Pack.
- Panoramic webcams that deliver a 360-degree view of the meeting room are not supported.
- Optimized delivery (redirection of media processing to the user device) in a double-hop XenApp/XenDesktop-Receiver scenario is not supported.
- Web proxy limitations:
  - HTTP proxy authentication is not supported. Configure proxies using white lists to allow unauthenticated access to target Skype For Business servers (for example, Office 365 servers for cloud-based deployments).
  - Web Proxy Auto-Discovery Protocol (WPAD) and dynamic proxy detection are supported by using Windows endpoints only. Configure Linux and Mac endpoints using a static HTTP proxy address.
- On Linux terminals, the RealTime Media Engine installer disables multimedia redirection in Linux Receiver. Thus, avoiding the Optimization Pack and Linux/Unix Receiver getting into a conflict when accessing video devices. However, other unified communications applications cannot support Generic USB redirection when accessed on a Linux terminal that has RealTime Media Engine installed.
- The date and time strings on USB telephone devices that have display capabilities are not properly localized.
- The Plantronics Clarity P340 audio device is not supported.
- The Optimization Pack disables the use of hardware acceleration for the Logitech C920 camera on Windows. Support is provided for the C920 as a nonencoding camera. To enable hardware compression for the Logitech C920 on Windows, do the following:

    1. Replace the Logitech driver with the stock Microsoft driver.

    2. Create a registry setting that enables hardware acceleration with the C920.

    On 32-bit and 64-bit Windows:

    HKCU\Software\Citrix\HDXRTConnector\MediaEngine
    Name: EnableC920Compression
    Type: DWORD
    Data: 1 (enables the hardware acceleration)
    0 or missing (disables hardware acceleration)

Note: Logitech does not recommend the C920 for business use cases. We recommend the more modern Logitech cameras (C930E, C925E), which are compatible with standard Microsoft drivers.

Considerations and recommendations

- The inclusion of hardware acceleration for video increases the amount of data being sent if you deploy devices that support hardware acceleration for video. Ensure that you have sufficient bandwidth available among all endpoints or update your Skype for Business server media bandwidth policies accordingly.

- In Fallback mode, video quality might degrade to the point of failure on virtual desktops that have a single virtual CPU. Fallback mode is when RealTime Media Engine is not available on the endpoint and audio/video processing occurs on the server.

  We recommend that you change the VDA configuration to have a minimum of two CPUs for users who might need Fallback mode. For more information, see http://support.citrix.com/article/CTX133024 and http://support.citrix.com/article/CTX132764.

- Users might hear an echo or other artifacts when using any built-in microphone and speakers on endpoints.

  We recommend that you use a headset on an endpoint or a speakerphone that has hardware-based echo cancellation.

- When attempting to make high-definition video calls from a home office, consider your user network bandwidth and ISP routing policies. If you observe pixelation of the video or problems with lip sync, adjust the Maximum Packet Size (MTU) on the NIC properties. Specify a lower value such as 900 to avoid situations where ISPs perform traffic shaping based on packet size.

- Various scenarios (for example, combining content sharing and audio/video conferencing) might not work properly when some conversation participants run 1.x versions of the Optimization Pack.

  We recommend participants using older versions of the Optimization Pack upgrade to this version of the Optimization Pack.

- Users might see an error when making a call or joining a session when they have multiple sessions running.

  We recommend running only one session.

- Old versions of graphics card drivers might impact the stability of the Optimization Pack. H.264 hardware encoding and decoding on Intel and AMD chipsets works most reliably when using the latest versions of graphics drivers. The drivers are available from the endpoint or chipset vendors. If an unsupported driver version is detected, Optimization Pack might automatically disable these features.

Bandwidth management

- The Optimization Pack follows the bandwidth policies set on Skype for Business. For more information, see "Network bandwidth requirements for media traffic" at https://technet.microsoft.com/en-us/library/gg425841.aspx.
- RealTime Media Engine automatically detects and adapts to available bandwidth within the Skype for Business policy limits.
- Best practice - When using the Optimization Pack and low-end devices, start by using a bandwidth limit no greater than 500 Kbps and increase gradually to find the best balance.

Citrix Customer Experience Improvement Program (CEIP)

The Citrix CEIP usage and analytics program is a voluntary data collection program designed to improve your product experience. After installing this version of the Optimization Pack, you can participate in the programs anonymously.

You can change your participation in the program at any time. For more information, see https://www.citrix.com/community/cx/ceip.html.

CEIP is voluntary. When you opt-in, the CEIP services running in Citrix products gather anonymous configuration and usage data from your deployment, and automatically sends the data to Citrix. CEIP collects these classes of data:

- Configuration data
- All system and account identifiers are anonymized before being uploaded.

How your privacy is protected:

- Citrix does not collect any personally identifiable data.
- Random identifier is created at install time, which tracks data transfers over time.
- Citrix does not record information such as IP addresses, server names, or domain names.
- All data is sent using HTTPS directly to Citrix servers - no third-party data hosting services.
- All data is secured on Citrix servers and is accessible only by authorized individuals.

CEIP Opt-out policies and the user interface (UI)

The RealTime Connector defines the following registry entries controlling CEIP metrics:

HKEY_LOCAL_MACHINE\Software\Citrix\HDXRTConnector\
DWORD DisableCEIPMetrics

If absent or set to **0**, the user controls the CEIP metrics collection. If present and set to nonzero, metrics collection is disabled and the opt-out UI is hidden.

On 64-bit Windows, the RealTime Connector checks both HKEY_LOCAL_MACHINE\Software\Citrix and HKEY_LOCAL_MACHINE\Software\Wow6432Node\Citrix for this value.

HKEY_CURRENT_USER\Software\Citrix\ \
DWORD OptOutOfCEIPMetrics

If absent or set to **0**, the user did not opt out of CEIP metrics collection. If present and set to nonzero, the user opted out of CEIP metrics collection.

In the **Settings** dialog screen, the RealTime Connector adds a check box.

[] Send anonymous usage metrics to Citrix

The check box is hidden if the administrator disables CEIP metrics collection by setting **DisableCEIPMetrics**. Otherwise, it appears. The check box is checked if the **OptOutOfCEIPMetrics** registry value is absent or set to zero. The check box is clear if **OptOutOfCEIPMetrics** is present and set to nonzero. When the user changes the state of the check box, the RealTime Connector updates the registry setting and enables or disables CEIP metrics submission accordingly.

Download

Citrix recommends that you install this version of HDX RealTime Optimization Pack.

- Upgrading from version 1.8 to this version:
  You must install HDX RealTime Connector as a new installation - uninstall 1.8 version of the RealTime Connector before installing this version. You can install or upgrade RealTime Media Engine.

- Upgrading from an earlier 2.*x* version to this version:
  You do not need to uninstall the earlier version and can upgrade RealTime Connector and RealTime Media Engine to this version.

You can download this version by logging on using your My Account credentials and going to the following download pages:

For XenDesktop and for XenApp

RealTime Media Engine

After downloading, unzip the package and place the following installation files on an available network drive or a local device, such as a USB flash drive.

For Windows:

The package includes HDX RealTime Connector for the XenApp or XenDesktop server, and the Windows version of the HDX RealTime Media Engine for user devices.

- HDX_RealTime_Media_Engine_2.3_for_Windows.msi - client running Receiver
- HDX_RealTime_Connector_2.3_for_Skype_for_Business - server-side (and virtual desktop) - choose the 32-bit or 64-bit version to match your operating system. The Skype for Business client bitness doesn't matter.

For more information, see Deploy HDX RealTime Media Engine to Windows devices.

For Linux:

- HDX_RealTime_Media_Engine_2.3_for_Linux.zip
- HDX_RealTime_Media_Engine_2.3_for_Linux_x64.zip

For more information, see Deploy HDX RealTime Media Engine to Linux terminal devices.

For Mac:

- HDX_RealTime_Media_Engine_2.3_for_OSX.dmg

For more information, see Deploy HDX RealTime Media Engine to Mac devices.

Now you can make Optimization Pack available to your users. Before installing the RealTime Media Engine or RealTime Connector, be sure that your environment meets the minimum software hardware and software requirements.

Install HDX RealTime Optimization Pack

Aug 14, 2017

If you have not downloaded the installation files for the Optimization Pack, see How to download HDX RealTime Optimization Pack.

The order of the Optimization Pack new installation (not an upgrade) is important:

1. If Receiver is running, close it.
2. Install RealTime Media Engine on your user devices.
3. Start XenDesktop.
4. Install RealTime Connector on your XenDesktop virtual desktops and XenApp servers.

Important

Configure any anti-virus/security software on XenApp or XenDesktop to allow the Optimization Pack and Skype for Business client to run without unnecessary performance degradation.

Bundled RealTime Media Engine installation with the Citrix Receiver for Windows

As a convenience for new bring-your-own and at-home device users, the Citrix Receiver for Windows and the HDX RealTime Media Engine are available as a single-download bundle with a single installer. When installing the latest version of Citrix Receiver for Windows, the RealTime Media Engine is included in the executable file (.exe). See the Citrix Receiver for Windows installation article for more information.

If the RealTime Media Engine is installed when you uninstall and then reinstall Citrix Receiver for Windows, use the same mode that you used to install the RealTime Media Engine.

Important

RealTime Connector versions 2.x cannot be used with the RealTime Media Engine version 1.8. You can use any combination of versions 2.x RealTime Connector and RealTime Media Engine, if the RealTime Connector version is newer, or the same, than the RealTime Media Engine.

Deploy RealTime Media Engine to your users

You install RealTime Media Engine on client devices. The media engine provides local media processing of audio/video calls and peer-to-peer communication with other callers using Microsoft Skype for Business.

Your method for deploying RealTime Media Engine to a user device depends on the operating system of the device.

Download the RealTime Media Engine files from HDX RealTime Media Engine 2.3 for Microsoft Skype® for Business.

Deploy RealTime Media Engine to Windows devices

RealTime Connector requires the installation of RealTime Media Engine on the host terminal device. This topic describes the

steps for deploying RealTime Media Engine to thin client terminals running Windows operating systems.

Prerequisites

Before deploying RealTime Media Engine to a Windows client device:

- Ensure that Citrix Receiver is installed on the user device and is able to connect through XenDesktop or to XenApp.
- If the device is using RAM disk, increase it to its maximum size.

To maximize RAM disk space

1. Log on to the device.
   - If there is a red ball (labeled FBWF) in the Windows notification area, skip to the next step. The write filter is disabled.
   - If there is a green ball in the Windows notification area, click the green ball and choose DISABLE so that the ball turns red.
2. Restart your device and log on.
3. Open Control Panel > Ramdisk.
4. In the Ramdisk Configuration dialog box, increase the size of the RAM disk to the maximum amount.
5. Restart your device.

Deploy RealTime Media Engine

Ensure system requirements and prerequisites are met. You can then deploy the media engine to your users by making the installer available from a flash drive, webpage, or network drive.

1. Log on to the terminal or computer.
2. Run **HDX_RealTime_Media_Engine_2.3_for_Windows.msi**. After accepting the terms of use, the installer runs silently.
3. Install a web camera on the device, using the built-in Windows drivers.

Deploy RealTime Media Engine to Mac devices

RealTime Connector requires the installation of RealTime Media Engine on the client device. This section describes how to install the RealTime Media Engine on supported Mac OS devices.

Before running RealTime Media Engine installation script, ensure that you have Citrix Receiver for Mac 12.0 or later installed on the device.

The installation package for RealTime Media Engine includes the following components:

- Install HDXRealTimeMediaEngine.pkg
- Uninstall HDXRealTimeMediaEngine

1. Log on to the Mac as an administrator.
2. Double-click the downloaded file, **HDX_RealTime_Media_Engine_2.3_for_OSX.dmg**. The disk image mounts.
3. To start the installation, double-click **HDX_RealTime_Media_Engine_2.3_for_OSX.dmg**.
4. Follow the instructions provided by the script.
5. After the installation completes, confirm the installation: In the Mac System Preferences under **Other**, select **Citrix HDX RealTime Media Engine** to view the installed version.
6. If you have Microsoft Skype for Business running as a published application, restart it (Microsoft Skype for Business).

Deploy RealTime Media Engine to Linux terminal devices

The Optimization Pack requires the installation of RealTime Media Engine on the terminal device. This section describes

how to install the RealTime Media Engine for all supported platforms.

Prerequisites

Before deploying RealTime Media Engine to a Linux terminal device, you must install the Citrix Receiver for Linux. Go to the download page for Citrix Receiver for Linux and follow the instructions on that page for the system you are installing on.

- RealTime Media Engine 64-bit requires Citrix Receiver for Linux 13.2 x64 or greater
- RealTime Media Engine 32-bit requires Citrix Receiver for Linux 13.0 x86 or greater

To run RealTime Media Engine installation script

The installation package for RealTime Media Engine includes the following components. Use this package for Ubuntu, and RedHat. The software detects the type of Linux and installs the appropriate package.

Components for the 32-bit package:

- EULA.rtf
- HDXRTME_install.sh
- /i386 subdirectory containing the Debian and RPM packages:
    - citrix-hdx-realtime-media-engine-2.3.0-XXX_i386.deb
    - citrix-hdx-realtime-media-engine-2.3.0-XXX_i386.rpm

Components for the 64-bit package:

- EULA.rtf
- HDXRTME_install.sh
- /x86_64 subdirectory containing the Debian and RPM packages:
    - citrix-hdx-realtime-media-engine-2.3.0-XXX_amd64.deb
    - citrix-hdx-realtime-media-engine-2.3.0-XXX_x86_64.rpm

1. Place the entire installation package in the directory from which you are running commands.
2. Use **chmod** to make **./HDXRTME_install.sh** executable.
3. At the prompt of the directory in which the software resides, type **./HDXRTME_install.sh**, and then follow the instructions provided by the script.
4. If you have Microsoft Skype for Business running as a published application, restart it (Microsoft Skype for Business).

Upgrade the existing RealTime Media Engine installation

Use the same **./HDXRTME_install.sh** script for upgrading the previous version of the RealTime Media Engine package.

Install RealTime Connector on your servers and VDAs

RealTime Connector enables optimized audio and video conferences. To make RealTime Connector available to your users in XenApp and XenDesktop environments, you install RealTime Connector on your XenApp servers and XenDesktop virtual desktops.

Important

Before deploying RealTime Connector on your servers and VDAs, ensure that you have Skype for Business installed.

Install into a XenDesktop environment

Install RealTime Connector onto a XenDesktop virtual desktop you want to make available to your users. Before installation, ensure that Microsoft Skype for Business is not running on the XenDesktop virtual desktop.

Important

Uninstall older versions of the RealTime Connector before installing this version.

Depending on your VDA/Server operating system, use the 32-bit or 64-bit version of the RealTime Connector.

To install RealTime Connector:

1. Start a XenDesktop virtual desktop and log on as administrator.
2. On the virtual desktop, run the installation file HDX_RealTime_Connector_2.3_for_Skype_For_Business.msi **or** HDX_RealTime_Connector_2.3_for_Skype_For_Business_32.msi and follow the instructions.

Install into a XenApp environment

Install RealTime Connector on each server in a XenApp farm where you want to make RealTime Connector available. Before installation, ensure that the Microsoft Skype for Business is not running in any sessions on the servers.

Important

Uninstall older versions of the RealTime Connector before installing this version.

1. Log on to a XenApp server as administrator.
2. Run the installation file HDX_RealTime_Connector_2.3_for_Skype_For_Business.msi **or** HDX_RealTime_Connector_2.3_for_Skype_For_Business_32.msi and follow the instructions.

Exclude lync.exe from anti-virus software scanning

Your anti-virus and anti-malware software might cause sound issues. To avoid issues like those in the following list, update your anti-virus and anti-malware software, including network-offloaded anti-virus scanners, to exclude scanning of Lync.exe.

- Call arrives and the ring tone plays incorrectly and has interruptions at irregular intervals.
- Dual Tone Multiple Frequencies (DTMF) playback is erratic making it difficult to tell which digit was typed.
- Discontinuous ("stutter") ringing and Ringback tones.

Disable Optimization Pack

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.

To disable and then reenable Optimization Pack, do the following:

Back up and remove or rename the following registry keys (for example, VdiMediaProviderDisabled). When you restart Skype for Business, the Optimization Pack is disabled.

To reenable the Optimization Pack, restore or rename the key back to VdiMediaProvider.

For 64-bit Skype for Business or 32-bit Skype for Business on 32-bit Windows:
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Office\Lync\VdiMediaProvider

For 32-bit Skype for Business on 64-bit Windows:
HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Office\Lync\VdiMediaProvider

Upgrade

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For access to this version of the RealTime Optimization Pack features, upgrade your Skype for Business 2015 to the June 2016 PU (15.0.4833.1001) or subsequent PU or your Optimization Pack 1.x to this version.

Optimization Pack 2.x to this version

Optimization Pack supports flexible upgrade from earlier 2.*x* Optimization Pack versions to this version. To upgrade from previous Optimization Pack 2.x versions to this version, be aware of the following considerations:

- To upgrade the Optimization Pack to this version, upgrade Skype for Business 2015 to minimum Product Update 15.0.4833.1001 or Skype for Business 2016 to minimum Product Update 16.0.7341.2032 (for Click-to-Run).
- You can upgrade RealTime Connector from a previous 2.x to this version without immediately upgrading the RealTime Media Engine 2.x on the endpoints. You must update the RealTime Media Engine eventually to receive all the new features and fixes to known issues. This information applies to major, minor, and patch releases.
- You can upgrade the RealTime Connector and Skype for Business independently:
  - Upgrade the previous RealTime Connector 2.x to this version, and then upgrade Skype for Business 2015 to at least June 2016 Product Update 15.0.4833.1001. For Skype for Business 2016, you must upgrade to minimum Product Update 16.0.7341.2032.

    OR

  - Upgrade Skype for Business 2015 to the June 2016 Product Update or subsequent Product Update. Then upgrade the RealTime Connector 2.0.x or 2.1 to this version. For Skype for Business 2016, you must upgrade to minimum Product Update 16.0.7341.2032.
- When doing a staged upgrade for a minor or major release (for example, from 2.0 to this version), upgrade RealTime Connector first, before RealTime Media Engine. Otherwise, you get fallback behavior rather than optimized behavior.
- Upgrades to a patch release (for example, 2.x to 2.x.100) can be done in either order.

> ## Important
>
> If you are upgrading from 1.*x*, you must upgrade both RealTime Connector and RealTime Media Engine to retain optimized operation.

Upgrade requirement for Linux

If you are running the 32-bit Citrix Receiver for Linux and 32-bit RealTime Media Engine on 64-bit systems, you can use the 32-bit RealTime Media Engine package to upgrade.

If you want a 64-bit RealTime Media Engine, first uninstall both 32-bit Citrix Receiver for Linux and 32-bit RealTime Media Engine. Then install the 64-bit Citrix Receiver for Linux, version 13.2 or later and 64-bit RealTime Media Engine

Optimization Pack 1.x to 2.x

During 2015, Citrix and Microsoft co-developed a new architecture for delivering Skype for Business in virtualized environments. This new architecture provides smooth upgrades from one 2.x release to the next. It does so by allowing

customers to upgrade the RealTime Connector on the XenApp and XenDesktop servers before upgrading the RealTime Media Engine on all user devices. But upgrading from the original 1.x to 2.x is more challenging because 1.x versions of the RealTime Media Engine aren't compatible with the RealTime Connector 2.x. Therefore, during the interval between upgrading the RealTime Connector and upgrading the RealTime Media Engine on user devices, optimized delivery of the Skype for Business client isn't possible.

For the smoothest possible upgrade, we recommend using Electronic Software Delivery mechanisms to update the RealTime Connector and the RealTime Media Engine on user devices. Execute the upgrades as close to simultaneously as possible. To manage server load if some users require Skype for Business audio-video services while a major version mismatch exists between RealTime Connector and RealTime Media Engine, the RealTime Connector provides fallback controls (introduced in the 2.1 release). These controls enable administrators to configure whether to deny audio-video service totally until the RealTime Media Engine is upgraded to 2.x, permit only audio, or permit both audio and video. Server-side video processing has the greatest impact on CPU usage and server scalability.

Microsoft Lync VDI plug-in migration to Optimization Pack

Citrix and Microsoft collaborated on a "version 2" architecture for delivering the Skype for Business client from XenApp and XenDesktop. This collaboration culminated in the HDX RealTime Optimization Pack 2.0 release in December 2015 and a corresponding update to the Skype for Business client. Previously, Microsoft promoted a "version 1" solution consisting of a Citrix Receiver for Windows plug-in called the VDI plug-in.

The Lync 2013 client version 15.0.4859.1002 (released in September 2016) includes an enhancement to support co-residency of the Lync VDI plug-in with HDX RealTime Media Engine 2.2. This enhancement assists migration. The migration procedure:

1. Apply all the latest updates for the Lync/Skype for Business client on the XenDesktop server and for the Lync VDI plug-in on the users Windows devices. Migration support is available only with the latest updates for both components. Ensure that the client is running in Skype for Business UI mode. This version of the Optimization Pack supports only this mode.
2. Deploy this version of the RealTime Media Engine on the endpoints in parallel with the Lync VDI plug-in. At this point, the Lync VDI plug-in is still used for audio/video calls.
3. Deploy the RealTime Connector for Skype for Business on the XenDesktop server. At this point, the system switches to using the Optimization Pack for audio/video calls.
4. Uninstall the Lync VDI plug-in from the Windows devices.

Configure RealTime Connector features

Aug 14, 2017

You can enable or disable fallback mode and the system notification balloons by changing registry settings in HKLM\Software\Citrix\HDXRTConnector or HKCU\Software\Citrix\HDXRTConnector.

> ## 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.

Fallback mode

Control fallback mode by changing the following registry setting:

Key: HKLM\Software\Citrix\HDXRTConnector or HKCU\Software\Citrix\HDXRTConnector

Value: DWORD DisableFallback
0 or missing value - fallback mode enabled
1 - fallback mode disabled
2 - video in the fallback mode disabled

Notification balloons

Enable or disable the system notification balloons by changing the following registry setting:

Key: HKLM\Software\Citrix\HDXRTConnector or HKCU\Software\Citrix\HDXRTConnector

Value: DWORD DisableStatusBalloons

0 or missing value - all status balloons enabled
1 - Connected balloon disabled. Fallback and Disconnected balloons enabled.
2 - all status notification balloons disabled.

Disable or enable version mismatch warning

Enable or disable the version mismatch warning by changing the following registry setting:

Key: HKLM\Software\Citrix\HDXRTConnector or HKCU\Software\Citrix\HDXRTConnector

Value: DWORD DisableVersionWarning

0 or missing value - Warning icon and text are enabled
1 - Warning icon and text are disabled in both the status notification icon and the About dialog.

Windows Management Instrumentation (WMI) support

We've added WMI support to the RealTime Connector, which provides connection, call, and device status for all

Optimization Pack connections.

The following are the namespace and classes. There is an example PowerShell script at **C:\Program Files (x86)\Citrix\HDX RealTime Connector\wmirtc.ps1** for retrieving all object data.

Namespace:

ROOT\Citrix\hdx\RTOptPack

Classes:

Citrix_HDXRTConnector
Citrix_HDXRTConnector_Call
Citrix_HDXRTConnector_Device

WMI calls:

Run these calls from an account that has administrative privileges.

get-wmiobject -namespace root\citrix\hdx\RTOptPack -class Citrix_HDXRTConnector_Call
get-wmiobject -namespace root\citrix\hdx\RTOptPack -class Citrix_HDXRTConnector_Device
get-wmiobject -namespace root\citrix\hdx\RTOptPack -class Citrix_HDXRTConnector

Or use this example powershell script:

Example PowerShell script at C:\Program Files (x86)\Citrix\HDX RealTime Connector\wmirtc.ps1:

Syntax:
wmirtc.ps1 [*Skype for Business Login name*]

- If no name is supplied, it returns objects for all classes for all users.
- If a name is supplied, it returns objects only for that user.

Configure firewalls

Aug 14, 2017

When using the HDX RealTime Optimization Pack, the HDX RealTime Media Engine runs on the user device. The RealTime Media Engine performs signaling and media transmission. There is an easy way to understand which ports are used by the RealTime Media Engine for supporting external users. Equate running the RealTime Media Engine with running the Microsoft Skype for Business client locally on the user device. The difference is XenApp and XenDesktop host the UI and business logic layers. Understanding that the media engine is running on the remote endpoint clarifies the port requirements.

External users outside of the corporate firewall connect to the Skype for Business Edge Server or Lync Edge Server. The Edge Server is a component of Skype for Business or Lync Server infrastructure. Install it on a dual-homed server in the DMZ having connections to both the internet and to the intranet. For more information, see https://support.citrix.com/article/CTX201116, https://technet.microsoft.com/en-us/library/mt346415.aspx, and https://technet.microsoft.com/EN-US/library/mt346416.aspx.

To find the Lync Edge Server, the RealTime Media Engine follows the same procedures as the Skype for Business client. See "How Skype for Business Clients Locate Services" at https://technet.microsoft.com/en-us/library/dn951397.aspx.

Internal users inside the corporate firewall connect directly to the Lync Server that runs inside the firewall. They also communicate point-to-point among other Lync clients during calls. For internal firewalls, ensure that the proper ports are open to connect to the Lync Server and to transmit and receive media during calls. The port requirements are listed at: https://technet.microsoft.com/EN-US/library/gg398833.aspx.

Troubleshoot HDX RealTime Optimization Pack

Aug 17, 2017

Verify your installation and collect troubleshooting information

Determine whether your connection problems are related to DNS issues

Resolve poor performance

Save crash logs for Dell Wyse terminals

Resolve poor video quality

Resolve video quality issues when using a wireless network connection

Resolve poor quality or failed call connections on laptops running Windows

Determine whether your firewall is blocking the HDX RealTime Connector

Resolve installation issues

Notification area icon displays an unoptimized operation

Notification area icon is not displayed

Notification balloons do not display

Sound issues and slow call establishment

Skype for Business does not recognize the webcam

For more information about technical support on Microsoft Skype for Business on XenApp and XenDesktop, see https://support.citrix.com/article/CTX132979.

> ## 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.

Verify your installation and collect troubleshooting information

Open the **About** page and confirm the attributes (connection type, RealTime Connector and RealTime Media Engine versions, Skype for Business version, and operating system).
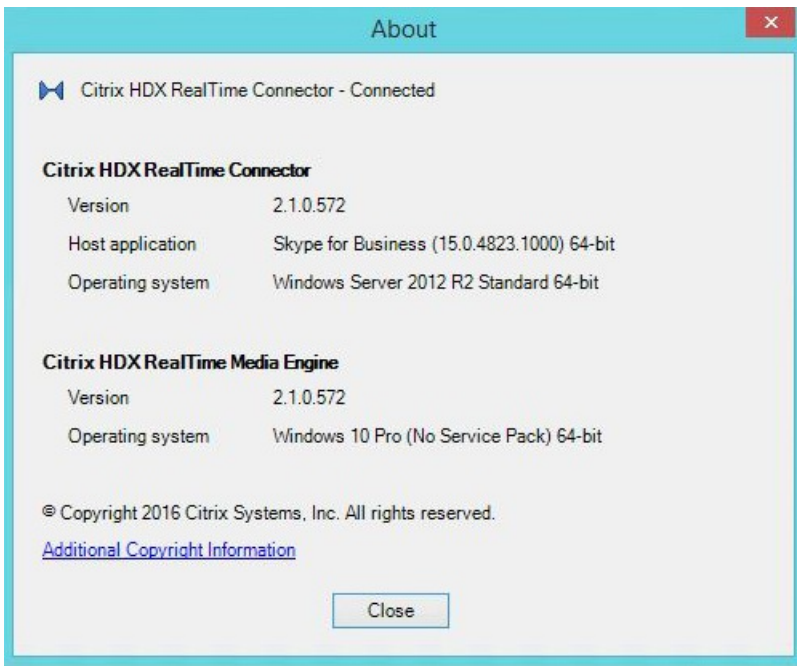
Open the Optimization Pack icon in the navigation area and confirm connection attributes. The following screenshots show the possible connection values.

Connected - There is a RealTime Connector connection over a virtual channel and the version of remote RealTime Media Engine matches the version of mediaEngine.Net.
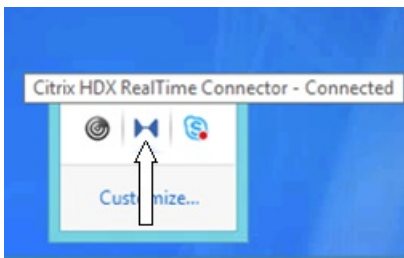
Connecting - MediaEngine.Net is trying to establish a RealTime Connector connection.
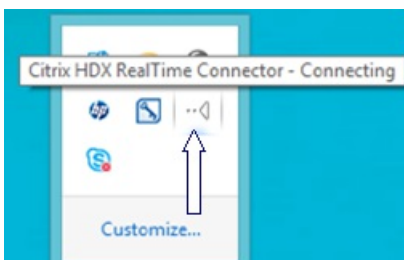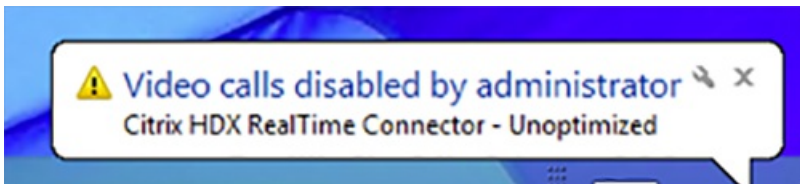

Fallback or unoptimized mode - There is a RealTime Connector connection to a local RealTime Media Engine process.
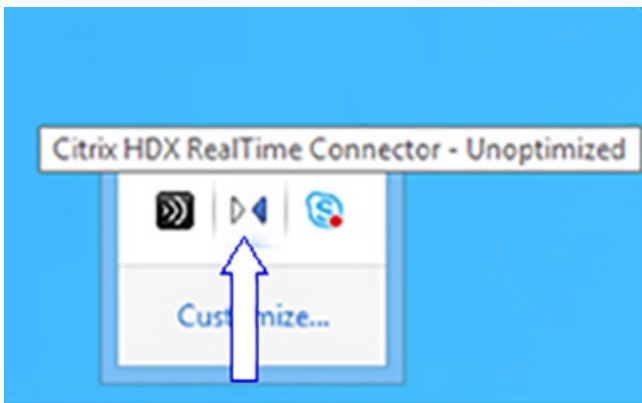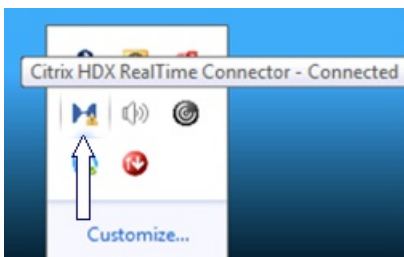
Disable Fallback set to audio only

When DisableFallback is set to audio only, the icon displays this popup. For more information about controlling fallback mode, see Fallback mode.

Version mismatch - Same as Connected but the version match is not exact (different major or minor numbers)

Not connected - A registry setting (policy) preventing MediaEngine.Net from running RealTime Media Engine locally.
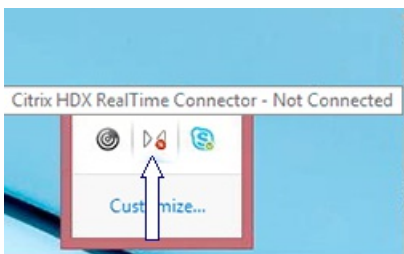
You can verify your installation and collect troubleshooting information by right-clicking the Optimization icon and making selections from the menu.

- About - Specifies the version of the RealTime Connector and RealTime Media Engine
- Settings - Contains check boxes for **Automatically Adjust Microphone Level** (Automatic Gain Control (AGC)) and

Enable Echo Cancellation, which are on by default. Disable these options only when users experience issues using either function.

- Call Statistics - During a call, you can view information about your network health by selecting **Call Statistics**. The Network Health window appears, as shown in the following example. To write the values to a text file whose default name is call_statistics_<date>.txt, select **Save Statistics**. Note: Other menu items are disabled when the Call Statistics window is open.

- Collect Logs - When you select **Collect Logs**, a **Save as** dialog box appears and you can save the log file. We offer a Log parser tool (LOPper). The tool displays the following information:
    - Call details like caller, callee, call duration, and so forth.
    - Detail description of the call and any issues encountered.
    - Session Description Protocol (SDP) payload Flow among endpoints.
    - Call statistics.
    - Any errors or warnings during the call.
    - Session Description Protocol (SDP) messages.

    For information about the Log Parser tool (LOPper), see https://support.citrix.com/article/CTX214237.

- Help - Takes you to the Skype for Business Help.

Call statistics - Displays audio and video statistics, including simulcast video information.

Call Statistics			
	Audio	Video	Total
Receive Packets Lost (%)	0.00	1.00	1.00
Receive Packets Lost	0	92	92
Sent Packets Lost (%)	0.00	0.00	0.00
Sent Packets Lost	0	0	0
Late Packets (%)	0.00	1.00	0.00
Dropped Packets (%)	0.00	1.21	1.00
Skipped Frames (%)	0.00	0.00	0.00
Jitter Buffer Size (ms)	0	5	
Average Data Sent (kb/s)	67	1366	1433
Average Data Received (kb/s)	62	209	271

	Sent	Received
Video Frame Rate		29.61
Video Resolution	Multiple	640 x 360
Video Codec		H.264-UC (HW)
Audio Codec	G.722	G.722

Codec	Resolution	FPS	Bitrate	FEC Level	Viewers
H.264-UC (HW)	848 x 480	30.00	1000	0	1
H.264-UC (HW)	424 x 240	15.00	240	0	1
RT Video (SW)	320 x 180	15.00	170	1	3

Save Statistics   Close

Resolve poor performance

If the performance and stability of Optimization Pack are poor, a likely cause is interaction with an anti-virus or security

application. Resolve this issue by correctly configuring the anti-virus or security application.

Correct configuration includes the following software exclusions:

- Optimization Pack process
- Log file location of Optimization Pack
- Log file location of the Skype for Business client
- Disable Network Directory Scan in the real-time settings (Scan files and folder in network shares and mapped network drive)

For information about sound issues, see Windows Defender.

Save crash logs for Dell Wyse terminals

On Dell Wyse terminals, the log file of an application crash is not saved when the user works in User mode. To save crash logs, the user must work in Administrator mode. You can find crash logs in MS-RAMDRIVE, which is drive Z by default on Wyse terminals.

Resolve poor video quality

One of the following issues often causes poor video quality:

- When the user device is capable and sufficient bandwidth is available, the HDX RealTime Media Engine can deliver high-definition (HD) video calls. Some devices can deliver only low-resolution video, unless using a webcam that offers H.264 hardware encoding.
- Inadequate CPU capabilities often cause poor quality video. Check your CPU performance by right-clicking the Optimization Pack icon and selecting **Call Statistics**.
- Out-of-date Windows 7 hardware and software can cause error messages during video rendering. Ensure that your hardware and software have the latest updates.
- Logitech RightLight technology can cause video problems because it lowers the frame rate produced by the camera. Edit the Logitech camera settings to ensure the RightLight check box is unselected so that the camera captures more frames per second.
- Wireless network connections might cause poor video quality. To ensure reliable transmission of video packets, if a wired connection is available, disable the wireless adapter and connect to a wired network.

Other options for improving video quality include:

- Improving lighting.
- Creating a darker background in the room from which the image is transmitted.
- Adjusting the anti-flicker setting of the transmitting camera.

For more information about factors impacting video quality with Skype for Business, see https://support.citrix.com/article/CTX222553.

Resolve poor quality or failed call connections on laptops running Windows

Intel processors include SpeedStep technology, which lowers the clock speed of the processor when the machine runs on battery. Because desktop video applications require normal processor speeds to run, SpeedStep can cause poor visual and audio quality and failed call connections.

SpeedStep is enabled when the Windows power scheme is set to Portable/Laptop. To resolve poor call connections, change the power scheme to Home Office/Desk or Always On. Connecting the laptop to a regular power source is also

recommended for call quality.

Determine whether your firewall is blocking the RealTime Connector

If a personal firewall blocks the network initialization for too long, the RealTime Connector can fail to initialize. This condition resolves itself the next time the program is run after you unblock the application.

When the firewall is blocked, an error message such as the following can appear:

- RealTime Connector is waiting for the connection from the RealTime Media Engine.
- Failed to maintain RealTime Connector on this device. Communication to the RealTime Media Engine was disrupted. Contact your system administrator.

In such cases, create an exception in the Windows firewall.

Resolve video quality issues when using a wireless network connection

If you experience issues with video quality when using a wireless network connection, try moving closer to the wireless access point. If that does not resolve the issue, try a wired network connection instead. When using a wired network connection, disable the wireless network adapter to avoid transmission issues.

Resolve installation issues

For software in general, the most common installation problems are related to corrupt system files needed for installation. These errors are rare, but difficult to troubleshoot.

The RealTime Media Engine installer requires Microsoft .NET 4.0. If it is missing from the computer, install it to resolve the problem. If it is already installed, run a repair installation on .NET.

On some Windows machines, customers encounter errors during software installation when embedded custom-action VB scripts run. Common errors presented to the user or captured in install logs are 2738 and 1720. Some customers have encountered these errors when an antivirus program places the vbscript.dll ClassID under the HKEY_CURRENT_USER registry hive instead of under HKEY_LOCAL_MACHINE. The HKEY_LOCAL_MACHINE hive is where it is needed for the proper elevated run level.

Run the following registry queries to determine if the vbscript.dll ClassID is installed for the current user, system wide, or both:

- % reg query HKEY_CURRENT_USER\SOFTWARE\Classes\CLSID{B54F3741-5B07-11CF-A4B0-00AA004A55E8}
- % reg query HKEY_LOCAL_MACHINE\SOFTWARE\Classes\CLSID{B54F3741-5B07-11CF-A4B0-00AA004A55E8}

The ClassID appears only for HKEY_LOCAL_MACHINE. If it is under HKEY_CURRENT_USER, follow these steps. If ClassID is under HKEY_LOCAL_MACHINE and not HKEY_CURRENT_USER, start at step 2.

1. Run an anti-virus clean-up utility:
   1. If the terminal has an anti-virus program installed and the vendor has a clean-up utility, run the clean-up utility.
   2. Rerun the RealTime Media Engine installer MSI.
   3. If the issue persists, go to the next step.
2. Register vbscript.dll:
   The vbscript.dll file or registry reference to its ClassID can become unregistered or corrupted. Follow these steps to register or repair it.

1. Run CMD.exe as an administrator: Click Start, type cmd, right-click cmd, and click **Run as administrator**.
   2. Type in the Command window:
      - For the 32-bit version of Windows: **cd %windir%\system32**
      - For the 64-bit version of Windows: **cd %windir%\syswow64**
   3. Type in the Command window: **regsvr32 vbscript.dll**
   4. Rerun the RealTime Media Engine installer MSI.
   5. If the issue persists, go to the next step.
3. Remove the vbscript.dll ClassID:
   1. In the Registry Editor, locate and remove registry keyHKEY_Current_User\SOFTWARE\Classes\CLSID{ B54F3741-5B07-11CF-A4B0-00AA004A55E8}.
   2. Click **Start > Control Panel**, navigate to the User Account Control Settings, and then move the slider to **Never notify.**
      After you complete the troubleshooting, you can revert this change if needed.

   3. Rerun the RealTime Media Engine installer MSI.
   4. If the issue persists, go to the next step.
4. Repair corrupt system files by using System File Checker:
   1. Run CMD.exe as an administrator: Click Start, type cmd, right-click cmd, and click **Run as administrator.**
   2. In the Command window, type: **sfc /scannow**
   3. Rerun the RealTime Media Engine installer MSI.
   4. If the issue persists, go to the next step.
5. Restore corrupt registry entries to their original state:
   1. Restart the Windows terminal and during the restart, insert the OS installation DVD to start from it.
      The OS installation DVD must match the Windows service pack installed on the terminal.

   2. Follow the installation steps, selecting the option to repair the OS.
   3. Rerun the RealTime Media Engine installer MSI.

Notification area icon displays an unoptimized fallback operation

An unoptimized session in fallback mode is when RealTime Connector is not able to connect to RealTime Media Engine, and audio and video processing occurs on the server. When the notification area icon indicates an unoptimized fallback session, try these troubleshooting tips:

- If the RealTime Media Engine isn't installed on the client device, install it.
- A version of the RealTime Media Engine that is newer than the RealTime Connector is installed on the user device. Reinstall the correct version of RealTime Media Engine or upgrade your RealTime Connector. You can use a combination of versions 2.x RealTime Connector and RealTime Media Engine. The RealTime Connector version must be newer than, or the same as, the RealTime Media Engine.
- The RealTime Media Engine might be failing to start. To obtain the logs, click on the RealTime Optimization Pack icon and select **Logs**. If you can't determine the cause of the issue, contact Citrix Technical Support.

Notification area icon is not displayed

After you install the Optimization Pack on both the endpoint and server and start Skype for Business, the Optimization Pack icon appears in the notification area. If not, ensure that the Skype for Business version is Public Update (PU) 15.0.4779.1001 or later.

Notification balloons do not display

If the notification balloons do not display, ensure that they were not disabled. You can enable or disable them. For more information, see Notification balloons.

Sound issues and slow call establishment

If calls take a long time to establish or established calls have sound issues, check your anti-virus software and ensure **lync.exe** is excluded from scanning. For example:

- Call arrives and the ring tone plays incorrectly and there are interruptions at irregular intervals.
- Dual Tone Multiple Frequencies (DTMF) playback is erratic making it difficult to tell which digit was entered.
- Discontinuous (stutter) ringing and Ringback tones.

Windows Defender

Sound issues might occur because of Windows Defender. We recommend that you do the following proactively for all for Windows 8.1 and Windows 10 VDAs:

1. Click **Start** and type **Defender**.
2. Choose the Windows Defender settings option.
3. Scroll down to Exclusions and choose **Add an exclusion**.
4. Choose Exclude a .exe, .com or .scr process.
5. Navigate to where Skype For Business is installed (C:\Program Files\Microsoft Office\Office15).
6. Choose Lync.exe and choose **Exclude this file**.

Skype for Business does not recognize the webcam

If Skype for Business doesn't recognize the webcam of the user, edit the system registry and add DevicePath:

HKEY_CLASSES_ROOT\CLSID\{860BB310-5D01-11d0-BD3B-00A0C911CE86}\Instance\Citrix HDX Web Camera. (32-bit devices)

HKEY_CLASSES_ROOT\Wow6432Node\CLSID\{860BB310-5D01-11d0-BD3B-00A0C911CE86}\Instance\Citrix HDX Web Camera (64-bit devices)

Name: DevicePath

Type: REG_SZ

Value: Citrix Client