

Lync and Skype Audio Offloading of Digital Signal Processing (DSP) Effects in Windows 8.1

Introduction

In Windows 8.1, applications can open an audio stream in either “*raw mode*” or “*default mode*”. In raw mode, any custom digital signal processing (DSP) effects, such as acoustic echo cancellation (AEC) and noise suppression (NS), that are provided by an audio processing object (APO) or audio driver are disabled, except for always-on endpoint effects. In raw mode, Microsoft Skype (Skype) and Microsoft Lync (Lync) apply their internal DSP effects, such as AEC and NS algorithms, and are not impacted by APO, driver-provided, or firmware-provided processing. For audio streams opened in default mode, DSP effects that are enabled by an APO or the driver apply, and Skype and Lync disable their internal processing. In this case, the DSP effects are offloaded by Skype and Lync to the APO, driver, or firmware.

The goals of this white paper are to clarify the use of the raw and default modes in Skype and Lync and to compare the differences in behavior between versions that support the raw and default modes with earlier Skype and Lync versions that do not include this support. This white paper also outlines the steps to be followed by providers of APO, driver-level, or firmware-level effects who would like Skype and Lync to use their processing by opening the audio stream in default mode.

Skype and Lync behavior before Windows 8.1

Before the introduction of raw and default modes in Windows 8.1, the audio stream opened by Skype and Lync was subject to all enabled DSP effects provided by an APO or the driver. Prior to Windows 8.1, an app could not discover the enabled DSP effects. Consequently, Skype and Lync applied internal AEC and NS processing to the audio stream regardless of whether such effects were applied—for example, by an APO. Consequently, the effects provided by the APO or driver were cascaded with internal DSP effects of Skype or Lync.

Skype and Lync behavior in Windows 8.1

Skype and Lync maintain a list of certified devices and their DSP effects that meet the requirements outlined in the unified Skype and Lync audio offload specification. For such devices, the audio stream is opened in default mode. Skype and Lync disable their internal processing for the certified audio effects that are discoverable and enabled. For devices not on the list, the audio stream is opened in raw mode, which bypasses all on-board processing and returns an unprocessed stream to Skype and Lync.

Note that it is important for an APO or driver to correctly expose all of the effects that are provided in the default mode as effects that are discoverable by a communications category app. For example, if an APO provides both AEC and NS but exposes only AEC as a discoverable effect, Skype or Lync will discover only AEC and will disable its internal AEC; however, it will continue to run its internal NS, which can result in cascaded NS processing. The effects to be certified must be discoverable by a communications category

app; this is a prerequisite for a device to be added to the list of certified devices and is part of the certification tests. It can be noted that only those certified effects that are also enabled will be offloaded. For example, AEC and NS can be certified effects on a device, but if a user disables these effects through Control Panel, these effects will not be offloaded.

Raw and default mode support is implemented in the Lync and Skype Windows Store app for Windows 8.1.

In Windows 8.1, a render audio stream opened in communications category is always opened in raw mode. Any must-have effect, such as speaker protection, must be implemented as an endpoint effect (EFX), which is an always-on effect. Effects such as dynamic range compression (DRC) that can potentially affect capture-side processing, such as AEC, should not be implemented as EFX effects.

Advantages of offloading audio DSP effects

Although capture-side effects provided by Skype and Lync, such as AEC and NS, are tuned to work well on a variety of devices, AEC quality can be further improved by tuning the algorithm to a particular device form factor. Offloading effects, such as AEC, to an APO, a driver, or firmware allows such device-specific tuning. When tuned appropriately, this is expected to result in significantly improved voice quality (for example, during doubletalk) on the device as compared to an AEC algorithm with a generic tuning.

Similarly, if a device supports multiple microphones, audio offloading allows beamforming algorithms tailored to the microphone geometry on a particular device to be employed. This can result in improved nonstationary noise suppression.

In addition, the hardware-optimized implementation of DSP effects, such as AEC and NS, can result in savings in battery life.

Thus, the audio offloading program provides an avenue for original equipment manufacturers or independent hardware vendors who pass the offload certification tests to differentiate their offerings and help provide a great communications experience for their users.

Feature categories

Table 1 shows the different feature categories associated with the Skype and Lync audio offload program. If nonstationary NS is included, support for switching between front and omnidirectional modes must be provided. This is to help ensure that the application can use nonstationary NS where beneficial (for example, to suppress nonstationary noises from the rear and sides when the front camera is active) and switch to omnidirectional capture when necessary (for example, when the rear camera is active, the user might prefer to capture sounds from all directions).

Windows APIs and sample code

The relevant Kernel Streaming properties are:

- KSPROPERTY_AUDIOSIGNALPROCESSING_MODES (<http://go.microsoft.com/fwlink/?LinkId=393789>)
- KSPROPERTY_AUDIOEFFECTSDISCOVERY_EFFECTSLIST (<http://go.microsoft.com/fwlink/?LinkId=393790>)

The Microsoft Slate Virtual Audio Device Driver sample shows how to register a stream effect, mode effect, and endpoint effect and is available at <http://go.microsoft.com/fwlink/?LinkId=393791>.

The audio effects discovery sample shows how an application can query audio effects and is available at <http://go.microsoft.com/fwlink/?LinkId=393792>.

Certification process

For details on the certification process, please refer to the [Program overview specification](#) or contact the Lync logo team at lynclogo@microsoft.com.

Feature	Required	Optional	Comments
AEC	X	N/A	
Omnidirectional audio capture	X	N/A	
Stationary NS (omni)	X		
Nonstationary NS (front)	N/A	X	If nonstationary NS is supported, tablets must support switching between front and omni modes.

Table 1: Feature categories for Skype and Lync audio offload

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