Music on Hold

Prerequisites for Music on Hold

- For Unified CME Release 11.6 and previous releases, phones receiving Music on Hold (MOH) in a system using G.729 require transcoding between G.711 and G.729. From Unified CME Release 11.7 onwards, transcoding is not required if G.729 codec format MOH file is configured on Unfiied CME. For information about transcoding, see Configure Transcoding Resources.
- Transcoding for MOH is supported on Cisco 4000 Series Integrated Services Router from Unified CME Release 11.7 onwards.

Restrictions for Music on Hold

- IP phones do not support multicast at 224.x.x.x addresses.
- Cisco Unified CME 3.3 and earlier versions do not support MOH for local Cisco Unified CME phones that are on hold with other Cisco Unified CME phones; these parties hear a periodic repeating tone instead.
- Cisco Unified CME 4.0 and later versions support MOH for internal calls on SCCP Phones only if the **multicast moh** command is used to enable the flow of packets to the subnet on which the phones are located.
- Internal extensions that are connected through a Cisco VG224 Analog Voice Gateway or through a WAN (remote extensions) do not hear MOH on internal calls.
- Multicast MOH is not supported on a phone if the phone is configured with the **mtp** command or the **paging-dn** command with the **unicast** keyword.
- For calls from SCCP to SCCP phones, Unicast MoH is not supported. Multicast MoH is supported if it is enabled. If Multicast MoH is not enabled, Tone on Hold is supported.

- Multicast MOH is not supported on SIP Phones.
- Multicast MOH does not support co-location of tunnels on the same device.

Restrictions for Music on Hold from a Live Feed on Cisco 4000 Series Integrated Services Routers

- MOH from a live feed supports only G.711 codec. Transcoding is required if the MOH playback party is on a codec other than g711ulaw or g711alaw.
- E&M is not supported on Cisco 4000 Series Integrated Services Routers. Only an FXO based live feed is supported.

Note Unified CME 12.6 on Cisco IOS XE Gibraltar 16.11.1a Release is not a recommended release for call flows that include Multicast Music On Hold.

Information About Music on Hold

Music on Hold Summary

MOH is an audio stream that is played to PSTN and VoIP G.711 or G.729 callers who are placed on hold by phones in a Cisco Unified CME system. This audio stream is intended to reassure callers that they are still connected to their calls.

Table 1: Music on Hold (MOH) provides a summary of options for MOH for PSTN and multicast MOH for local IP phones.

Table 1: Music on Hold (MOH)

Audio Source	Description	How to Configure
Flash memory	No external audio input is required.	Configure Music on Hold from an Audio File to Supply Audio Stream
Live feed	The multicast audio stream has minimal delay for local IP phones. The MOH stream for PSTN callers is delayed by a few seconds. If the live feed audio input fails, callers on hold hear silence.	Configure Music on Hold from a Live Feed
Live feed and flash memory	The live feed stream has a few seconds of delay for both PSTN and local IP phone callers. The flash MOH acts as backup for the live-feed MoH. If MOH from a live feed is not found or fails, Unified CME swtiches to playback of MOH from the flash memory.	Configure Music on Hold from an Audio File to Supply Audio Stream and Configure Music on Hold from a Live Feed

Music on Hold

MOH is an audio stream that is played to PSTN and VoIP G.711 or G.729 callers who are placed on hold by phones in a Cisco Unified CME system. This audio stream is intended to reassure callers that they are still connected to their calls.

For Unified CME Release 11.6 and previous releases, when the phone receiving MOH is part of a system that uses a G.729 codec, transcoding is required between G.711 and G.729. The G.711 MOH must be translated to G.729. Note that because of compression, MOH using G.729 is of significantly lower fidelity than MOH using G.711. From Unified CME Release 11.7 onwards, transcoding is not required if G.711 and G.729 codec format MOH files are configured on Unified CME. For information about transcoding, see Transcoding Resources.

The audio stream that is used for MOH can derive from one of two sources:

- Audio file—A MOH audio stream from an audio file is supplied from a .au or .wav file held in router flash memory. For configuration information, see Configure Music on Hold from an Audio File to Supply Audio Stream.
- Live feed—A MOH audio stream from a live feed is supplied from a standard line-level audio connection that is directly connected to the router through an FXO or “ear and mouth” (E&M) analog voice port. For configuration information, see Configure Music on Hold from a Live Feed.

Note E&M is not supported on Cisco 4000 Series Integrated Services Routers for Unified CME.

Music on Hold from a Live Feed

The live-feed feature is typically used to connect to a CD jukebox player. To configure MOH from a live feed, you establish a voice port and dial peer for the call and also create a “dummy” ephone-dn. The ephone-dn must have a phone or extension number assigned to it so that it can make and receive calls, but the number is never assigned to a physical phone. Only one live MOH feed is supported per system.

Using an analog E&M port as the live-feed MOH interface requires the minimum number of external components. You connect a line-level audio feed (standard audio jack) directly to pins 3 and 6 of an E&M RJ-45 connector. The E&M voice interface card (VIC) has a built-in audio transformer that provides appropriate electrical isolation for the external audio source. An audio connection on an E&M port does not require loop-current. The **signal immediate** and **auto-cut-through** commands disable E&M signaling on this voice port. A G.711 audio packet stream is generated by a digital signal processor (DSP) on the E&M port.

Note E&M is not supported for MOH from a live feed on the Cisco 4000 Series Integrated Services Routers. Only an FXO based live MOH feed is supported.

If you use an FXO port as the live-feed MOH interface, connect the MOH source to the FXO port using a MOD-SC cable if the MOH source has a different connector than the FXO RJ-11 connector. MOH from a live feed is supported on the VIC2-2FXO, VIC2-4FXO, EM-HDA-3FXS/4FXO, EM-HDA-6FXO, and EM2-HDA-4FXO.

For Cisco 4000 Series Integrated Services Routers, MOH from a live feed is supported on the following Cisco network interface modules (NIMs):

- NIM-2FXO
- NIM-4FXO
- NIM-2FXS/4FXO
- NIM-2FXS/4FXOP

You can directly connect a live-feed source to an FXO port if the **signal loop-start live-feed** command is configured on the voice port; otherwise, the port must connect through an external third-party adapter to provide a battery feed. An external adapter must supply normal telephone company (telco) battery voltage with the correct polarity to the tip and ring leads of the FXO port and it must provide transformer-based isolation between the external audio source and the tip and ring leads of the FXO port.

Music from a live feed is continuously fed into the MOH playout buffer instead of being read from a flash file, so there is typically a 2-second delay. An outbound call to a MOH live-feed source is attempted (or reattempted) every 30 seconds until the connection is made by the directory number that has been configured for MOH. If the live-feed source is shut down for any reason, the flash memory source will be automatically activated.

A live-feed MOH connection is established as an automatically connected voice call that is made by the Unified CME MOH system or by an external source directly calling in to the live-feed MOH port. An MOH call can be from or to the PSTN or can proceed via VoIP with voice activity detection (VAD) disabled. The call is assumed to be an incoming call unless the optional **out-call** keyword is used with the **moh** command during configuration.

The Unified CME router uses the audio stream from the call as the source for the MOH stream, displacing any audio stream that is available from a flash file. An example of an MOH stream received over an incoming call is an external H.323-based server device that calls the ephone-dn to deliver an audio stream to the Cisco Unified CME router.

For configuration information, see Configure Music on Hold from a Live Feed.

For configuration example, see Examples.

Music on Hold from a Live Feed on Cisco 4000 Series Integrated Services Routers

From Unified CME Release 12.2 onwards, MOH from a live feed is supported on the Cisco 4000 Series Integrated Services Routers for all phone types (SIP, SCCP, PSTN, SIP Trunk) . As part of the feature support introduced in Unified CME Release 12.2, only FXO based live feed is supported. If the FXO based live feed is not available, Unified CME switches to flash based MOH playback. If the MOH options are disabled, the caller does not hear either the tone on hold or the MOH playback.

If you configure both live feed and flash-based audio file as the source for MOH, the router seeks the live feed first. If the live feed is found, it displaces the audio file source. If the live feed is not found or fails at any time, the router falls back to the audio file source specified in the MOH audio file configuration. This is the recommended configuration.

MOH from a live feed supports only G.711 codec. If the MOH live feed over a SIP trunk has a codec other than G.711, transcoder insertion is required to play MOH from the live feed. TDM trunks support G.711 codecs. Hence, no transcoder insertion is required to play MOH for calls from a TDM trunk.

For an MOH from a live feed supported on the Cisco 4000 Series Integrated Services Routers:

- When the SIP trunk or line side has G.729 codec and a DSP resource is not available for transcoding, MOH is played from the G.729 codec format file in the router flash memory.
- When the SIP trunk or line side has G.729 codec and a DSP resource is available for transcoding, MOH from a live feed is played. If the MOH from live feed fails, MOH is played from the G.711 codec format file in the router flash memory using the DSP resource.
- When the SIP trunk or line side has a codec other than G.729 or G.711 and a DSP resource is not available for transcoding, MOH is not played (dead air).

Multicast MOH

In Cisco CME 3.0 and later versions, you can configure the MOH audio stream as a multicast source. A Cisco Unified CME router that is configured for multicast MOH also transmits the audio stream on the physical IP interfaces of the specified router to permit access to the stream by external devices.

From Unified CME Release 12.2 (Cisco IOS XE Fuji 16.8.1 Release), you can configure MOH audio stream from a live feed as the multicast source. The live feed MoH is supported when a SCCP phone puts any remote party (SCCP phone, SIP phone, TDM trunk or SIP trunk) on hold. The MoH is sourced on multicast address, only if the remote party is SCCP phone. For other parties, it would be unicast address. The support is introduced on the Cisco 4000 Series Integrated Services Routers.

Certain IP phones do not support multicast MOH because they do not support IP multicast. In Cisco Unified CME 4.0 and later versions, you can disable multicast MOH to individual phones that do not support multicast. Callers hear a repeating tone when they are placed on hold.

Music on Hold for SIP Phones

In Cisco Unified CME 4.1 and later versions, the MOH feature is supported when a call is put on hold from a SIP phone and when the user of a SIP phone is put on hold by a SIP, SCCP, or POTS endpoint. The holder (party that pressed the hold key) or holdee (party who is put on hold) can be on the same Cisco Unified CME or a different Cisco Unified CME connected through a SIP trunk. MOH is also supported for call transfers and conferencing, with or without a transcoding device.

Configuring MOH for SIP phones is the same as configuring MOH for SCCP phones. For configuration information, see Configure Music on Hold.

Music On Hold Enhancement

Cisco Unified CME 8.0 and later versions enhance the MOH feature by playing different media streams to PSTN and VoIP callers who are placed on hold. The MOH enhancement allows you to configure up to five additional media streams supplied from multiple media files stored in a router's flash memory and eliminates the need for separate routers for streaming MOH media files.

Cisco Unified CME 8.0 MOH enhancement allows you to create MOH groups and assign ephone extension numbers to these MOH groups to receive different media streams. Callers to the extension numbers configured under the MOH groups can listen to different MOH media streams when they are placed on hold.

You can configure up to five MOH groups. The size of each media source file can range between 64KB to 10MB long on the Cisco Unified CME router for ephones in different departments in a branch. A MOH group is linked to an ephone using the extension number of that ephone. For configuration information, see Configure Music on Hold Groups to Support Different Media Sources.

You can also configure individual directory numbers to select any MOH group as a MOH source on the Cisco Unified CME router. The extension number of a directory associates an ephone to a specific MOH group and callers to these extension numbers can listen to different media streams when placed on hold. For configuration information, see Assign a MOH Group to a Directory Number.

Similarly, callers from internal directory numbers can listen to different media streams when a MOH group is assigned for an internal call. For configuration information, see Assign a MOH Group to all Internal Calls Only to SCCP Phones.

Following precedence rules are applicable when an ephone caller is placed on hold:

- **MOH group** defined for internal calls takes highest precedence.
- **MOH group** defined in ephone-dn takes the second highest precedence.
- **MOH group** defined in ephone-dn-template takes precedence if MOH group is not defined in ephone-dn or internal call.
- Extension numbers defined in a **MOH-group** has the least precedence.
- Phones not associated with any MOH groups default to the MOH parameters defined in the **moh** command under telephony-service configuration mode.

Note If a selected MOH group does not exist, the caller will hear tone on hold.

Note We recommend that departments in a branch must have mutually exclusive extension numbers and multicast destinations for configuring MOH groups.

Caching MOH Files for Enhanced System Performance

Caching MOH files helps enhance the system performance by reducing the CPU usage. However, caching requires memory buffer to store a large MOH file. You can set up a buffer file size for caching MOH files that you might use in the future. The default MOH file buffer size is 64 KB (8 seconds). The maximum buffer size (per file) can be configured anywhere between 64 KB (8 seconds) to 10000 KB (approximately 20 minutes), You can use the **moh-file-buffer** command to allocate MOH file buffer for future MOH files, see Configure Buffer Size for MOH Files. To verify if a file is being cached and to update a cached moh-file, see Verify MOH File Caching.

Note If the file size is too large, buffer size falls back to 64 KB.

Configure G.711 and G.729 Files for Music on Hold

From Cisco Unified CME 11.7 Release onwards, G.711 and G.729 codec format MOH files can be configured on Unified CME. For calls (line or trunk calls) that need to be placed on hold and MOH needs to be played, transcode insertion is not required if the codec used is G.729 or G.711. The new feature dynamically selects

the matching codec (either G.729 or G.711) based on the codec used on phones or trunk. Transcode insertion is required only if the codec on the phone playing Music on Hold is neither G.729 nor G.711. For more information on configuration of MOH, see Configure Music on Hold, on page 7.

If G.711 and G.729 codec format MOH files are configured on Unified CME, you will need transcoding only to support other codec format MOH files, such as iLBC. You need the G.711 codec format MOH file to be configured under telephony-service for MOH to be supported on Unified CME.

Note You have to configure the primary G.711 codec format MOH file before configuring the G.729 or G.729A codec format MOH file.

We recommend that G.711 and G.729 codec format MOH files are available on the flash memory of Unified CME router.

Note In a scenario where a call between an SCCP line and SIP trunk has a codec other than G.729 or G.711, then MOH is not played when the SCCP line places the SIP phone on hold.

In a scenario where a call is placed between an SCCP line and a SIP line, and the call is placed on hold from the SIP end, MOH is played only from the G.711 codec format MOH file.

Configure Music on Hold

Configure Music on Hold from an Audio File to Supply Audio Stream

Note If you configure MOH from an audio file and from a live feed, the router seeks the live feed first. If a live feed is found, it displaces an audio file source. If the live feed is not found or fails at any time, the router falls back to the audio file source.

Note The MOH file packaged with the CME software is completely royalty free.

Restriction

- To change the audio file to a different file, you must remove the first file using the **no moh** command before specifying a second file. If you configure a second file without removing the first file, the MOH mechanism stops working and may require a router reboot to clear the problem.
- The volume level of a MOH file cannot be adjusted through Cisco IOS software, so it cannot be changed when the file is loaded into the flash memory of the router. To adjust the volume level of a MOH file, edit the file in an audio editor before downloading the file to router flash memory.

Before you begin

- SIP phones require Cisco Unified CME 4.1 or a later version.
- A music file must be in stored in the router's flash memory. This file should be in G.711 format. The file can be in .au or .wav file format, but the file format must contain 8-bit 8-kHz data; for example, ITU-T A-law or mu-law data format.
- From Cisco Unified CME Release 11.7 onwards, you can configure and store an MOH file in G.729 codec format in the router's flash memory. The G.729 file can be used as MOH source.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **telephony-service**
4. **moh** *filename*
5. **multicast moh** *ip-address* **port** *port-number* [**route** *ip-address-list*]
6. **exit**
7. **ephone** *phone-tag*
8. **multicast-moh**
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**telephony-service** **Example:** `Router(config)# telephony-service`	Enters telephony-service configuration mode.

Step 4	**moh** *filename*
	Example:
	`Router(config-telephony)# moh minuet.au`
	OR
	`Router(config-telephony)# moh flash:moh_g711u_music.wav`
	`Router(config-telephony)# moh g729 flash:SampleAudioSource.g729.wav`
		Enables music on hold using the specified file.
		• If you specify a file with this command and later want to use a different file, you must disable use of the first file with the **no moh** command before configuring the second file.
		• G.729 MOH file can be configured along with the G.711 MOH file. Unified CME would pick the MOH file to be played based on the negotiated codec on line or trunk.

	Command or Action	Purpose
Step 5	**multicast moh** *ip-address* **port** *port-number* [**route** *ip-address-list*] **Example:** `Router(config-telephony)# multicast moh 239.10.16.4 port 16384 route 10.10.29.17 10.10.29.33`	Specifies that this audio stream is to be used for multicast and also for MOH. **Note** This command is required to use MOH for internal calls and it must be configured after MOH is enabled with the **moh** command. • *ip-address*—Destination IP address for multicast. • **port** *port-number*—Media port for multicast. Range is 2000 to 65535. We recommend port 2000 because it is already used for normal RTP media transmissions between IP phones and the router. **Note** Valid port numbers for multicast include even numbers that range from 16384 to 32767. (The system reserves odd values.) • **route**—(Optional) List of explicit router interfaces for the IP multicast packets. • *ip-address-list*—(Optional) List of up to four explicit routes for multicast MOH. The default is that the MOH multicast stream is automatically output on the interfaces that correspond to the address that was configured with the **ip source-address** command. **Note** For MOH on internal calls, packet flow must be enabled to the subnet on which the phones are located.
Step 6	**exit** **Example:** `Router(config-telephony)# exit`	Exits telephony-service configuration mode.
Step 7	**ephone** *phone-tag* **Example:** `Router(config)# ephone 28`	Enters ephone configuration mode.
Step 8	**multicast-moh** **Example:** `Router(config-ephone)# no multicast-moh`	(Optional) Enables multicast MOH on a phone. This is the default. • This command is supported in Cisco Unified CME 4.0 and later versions. • The **no** form of this command disables MOH for phones that do not support multicast. Callers hear a repeating tone when they are placed on hold. • This command can also be configured in ephone-template configuration mode. The value set in

	Command or Action	Purpose
		ephone configuration mode has priority over the value set in ephone-template mode.
Step 9	**end** **Example:** `Router(config-ephone)# end`	Returns to privileged EXEC mode.

Examples

The following example enables music on hold and specifies the music file to use:

```
telephony-service
   moh minuet.wav
```

The following example enables MOH and specifies a multicast address for the audio stream:

```
telephony-service
   moh minuet.wav
   multicast moh 239.23.4.10 port 2000
```

Configure Music on Hold from a Live Feed

To configure music on hold from a live feed, perform the following steps.

Note If you configure MOH from an audio file and from a live feed, the router seeks the live feed first. If a live feed is found, it displaces an audio file source. If the live feed is not found or fails at any time, the router falls back to the audio file source.

Restriction

- A foreign exchange station (FXS) port cannot be used for a live feed.

Before you begin

- SIP phones require Cisco Unified CME 4.1 or a later version.
- VIC2-2FXO, VIC2-4FXO, EM-HDA-3FXS/4FXO, EM-HDA-6FXO, or EM2-HDA-4FXO on Cisco Integrated Services Routers Generation 2 (ISR G2) family of routers.

  NIM-2FXO, NIM-4FXO, NIM-2FXS/4FXO, and NIM-2FXS/4FXOP are the Cisco network interface modules (NIMs) supported on Cisco 4000 Series Integrated Services Routers.
- For a live feed from VoIP (over a SIP trunk), VAD must be disabled.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **voice-port** *port*
4. **input gain** *decibels*
5. **auto-cut-through**
6. **operation 4-wire**
7. **signal immediate**
8. **signal loop-start live-feed**
9. **no shutdown**
10. **exit**
11. **dial peer voice** *tag* **pots**
12. **destination-pattern** *string*
13. **port** *port*
14. **exit**
15. **ephone-dn** *dn-tag*
16. **number** *number*
17. **moh** [**out-call** *outcall-number*] [**ip** *ip-address* **port** *port-number* [**route** *ip-address-list*]]
18. **exit**
19. **ephone** *phone-tag*
20. **multicast-moh**
21. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**voice-port** *port* **Example:** `Router(config)# voice-port 1/1/0`	Enters voice-port configuration mode. • *Port* argument is platform-dependent; type **?** to display syntax.
Step 4	**input gain** *decibels* **Example:** `Router(config-voice-port)# input gain 0`	Specifies, in decibels, the amount of gain to be inserted at the receiver side of the interface. • *decibels*—Acceptable values are integers –6 to 14.
Step 5	**auto-cut-through** **Example:**	(E&M ports only) Enables call completion when a PBX does not provide an M-lead response.

	Command or Action	Purpose
	`Router(config-voice-port)# auto-cut-through`	• MOH requires that you use this command with E&M ports.
Step 6	**operation 4-wire** **Example:** `Router(config-voice-port)# operation 4-wire`	(E&M ports only) Selects the 4-wire cabling scheme. • MOH requires that you specify 4-wire operation with this command for E&M ports.
Step 7	**signal immediate** **Example:** `Router(config-voice-port)# signal immediate`	(E&M ports only) For E&M tie trunk interfaces, directs the calling side to seize a line by going off-hook on its E-lead and to send address information as dual tone multifrequency (DTMF) digits.
Step 8	**signal loop-start live-feed** **Example:** `Router(config-voice-port)# signal loop-start live-feed`	(FXO ports only) Enables an MOH audio stream from a live feed to be directly connected to the router through an FXO port. • This command is supported in Cisco IOS Release 12.4(15)T and later releases.
Step 9	**no shutdown** **Example:** `Router(config-voice-port)# no shutdown`	Activates the voice port. • To shut the voice port down and disable MOH from a live feed, use the **shutdown** command.
Step 10	**exit** **Example:** `Router(config-voice-port)# exit`	Exits voice-port configuration mode.
Step 11	**dial peer voice** *tag* **pots** **Example:** `Router(config)# dial peer voice 7777 pots`	Enters dial-peer configuration mode.
Step 12	**destination-pattern** *string* **Example:** `Router(config-dial-peer)# destination-pattern 7777`	Specifies either the prefix or the full E.164 telephone number to be used for a dial peer.
Step 13	**port** *port* **Example:** `Router(config-dial-peer)# port 1/1/0`	Associates the dial peer with the voice port that was specified in Step 3.
Step 14	**exit** **Example:** `Router(config-dial-peer)# exit`	Exits dial-peer configuration mode.
Step 15	**ephone-dn** *dn-tag* **Example:**	Enters ephone-dn configuration mode.

	Command or Action	Purpose
	`Router(config)# ephone-dn 55`	• *dn-tag*—Unique sequence number that identifies this ephone-dn during configuration tasks. Range is 1 to 288.
Step 16	**number** *number* **Example:** `Router(config-ephone-dn)# number 5555`	Configures a valid extension number for this ephone-dn. • This number is not assigned to any phone; it is only used to make and receive calls that contain an audio stream to be used for MOH. • *number*—String of up to 16 digits that represents a telephone or extension number to be associated with this ephone-dn.

Step 17	**moh** [**out-call** *outcall-number*] [**ip** *ip-address* **port** *port-number* [**route** *ip-address-list*]]
	Example:
	`Router(config-ephone-dn)# moh out-call 7777 ip 239.10.16.8 port 2311 route 10.10.29.3 10.10.29.45`
	or
	`Router(config-ephone-dn)# moh out-call 7777`
		Specifies that this ephone-dn is to be used for an incoming or outgoing call that is the source for an MOH stream.
		• (Optional) **out-call** *outcall-number*—Indicates that the router is calling out for a live feed for MOH and specifies the number to be called. Forces a connection to the local voice port that was specified in Step 3. If this command is used without this keyword, the MOH stream is received from an incoming call.
		• (Optional) **ip** *ip-address*—Destination IP address for multicast.
		If you are configuring MOH from a live feed and from an audio file for backup, do not configure a multicast IP address for this command. If the live feed fails or is not found, MOH will fall back to the ip address that you configured using the **multicast moh** command in telephony-service configuration mode. See Configure Music on Hold from an Audio File to Supply Audio Stream.
		If you specify an address for multicast with this command and a different address with the **multicast moh** command in telephony-service configuration mode, you can send the MOH audio stream to two multicast addresses.
		• (Optional) **port** *port-number*—Media port for multicast. Range is 2000 to 65535. We recommend port 2000 because it is already used for RTP media transmissions between IP phones and the router.
		• (Optional) **route** *ip-address*-list—Indicates specific router interfaces on which to transmit the IP multicast packets. Up to four IP addresses can be listed. Default: The MOH multicast stream is automatically output on the interfaces that correspond to the address that was configured with the **ip source-address** command.

	Command or Action	Purpose
Step 18	**exit** **Example:** `Router(config-ephone-dn)# exit`	Exits ephone-dn configuration mode.
Step 19	**ephone** *phone-tag* **Example:** `Router(config)# ephone 28`	Enters ephone configuration mode.
Step 20	**multicast-moh** **Example:** `Router(config-ephone)# no multicast-moh`	(Optional) Enables multicast MOH on a phone. This is the default. • This command is supported in Cisco Unified CME 4.0 and later versions. • The **no** form of this command disables MOH for phones that do not support multicast. Callers hear a repeating tone when they are placed on hold. • This command can also be configured in ephone-template configuration mode. The value set in ephone configuration mode has priority over the value set in ephone-template mode.
Step 21	**end** **Example:** `Router(config-ephone)# end`	Returns to privileged EXEC mode.

Examples

The following example enables MOH from an outgoing call on voice port 1/1/0 and dial peer 7777:

```
voice-port 1/1/0
 auto-cut-through
 operation 4-wire
 signal immediate
!
dial-peer voice 7777 pots
 destination-pattern 7777
 port 1/1/0
!
ephone-dn 55
 number 5555
 moh out-call 7777
```

The following example enables MOH from a live feed and if the live feed is not found or fails at any time, the router falls back to the music file (music-on-hold.au) and multicast address for the audio stream specified in the telephony-service configuration:

```
voice-port 0/1/0
 auto-cut-through
 operation 4-wire
 signal immediate
```

```
 timeouts call-disconnect 1
 description MOH Live Feed
!
dial-peer voice 7777 pots
 destination-pattern 7777
 port 0/1/0
!
telephony-service
 max-ephones 24
 max-dn 192
 ip source-address 10.232.222.30 port 2000
 moh music-on-hold.au
 multicast moh 239.1.1.1 port 2000
!
ephone-dn  52
   number 1
 moh out-call 7777
```

Configure Music on Hold Groups to Support Different Media Sources

Restriction

- Media files from live-feed source are not supported.
- Each MOH group must contain a unique flash media file name, extension numbers, and multicast destination. If you enter any extension ranges, MOH filenames, and multicast IP addresses that already exist in another MOH-group, an error message is issued and the new input in the current voice MOH-group is discarded.
- Media file CODEC format is limited to G.711 and G.729.

Before you begin

- Cisco Unified CME 8.0 or a later version.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **voice moh-group** *moh-group-tag*
4. **description** *string*
5. **moh** *filename*
6. **multicast moh** *ip-address* **port** *port-number* **route** *ip-address-list*
7. **extension-range** *starting-extension to ending-extension*
8. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Router> enable`	
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**voice moh-group** *moh-group-tag* **Example:** `Router(config-telephony)# voice moh-group 1`	Enters the voice moh-group configuration mode. You can create up to five voice moh-groups for ephones receiving music on hold audio files when placed on hold. Range for the voice moh-groups is 1 to 5.
Step 4	**description** *string* **Example:** `Router(config-voice-moh-group)# description moh group for sales`	(Optional) Allows you to add a brief description specific to a voice MOH group. You can use up to 80 characters to describe the voice MOH group.
Step 5	**moh** *filename* **Example:** `Router(config-voice-moh-group)# moh flash:/minuet.au`	Enables music on hold using the specified MOH source file. The MOH file must be in .au and .wav format. MOH filename length should not exceed 128 characters. You must provide the directory and filename of the MOH file in URL format. For example: **moh flash:/minuet.au** • If you specify a file with this command and later want to use a different file, you must disable use of the first file with the **no moh** command before configuring the second file.
Step 6	**multicast moh** *ip-address* **port** *port-number* **route** *ip-address-list* **Example:** `Router((config-voice-moh-group)# multicast moh 239.10.16.4 port 16384 route 10.10.29.17 10.10.29.33`	Specifies that this audio stream is to be used for multicast and also for MOH. **Note** This command is required to use MOH for internal calls and it must be configured after MOH is enabled with the **moh** command. • *ip-address*—Destination IP address for multicast. • **port** *port-number*—Media port for multicast. Range is 2000 to 65535. We recommend port 2000 because it is already used for normal RTP media transmissions between IP phones and the router. **Note** Valid port numbers for multicast include even numbers that range from 16384 to 32767. (The system reserves odd values.) • **route**—(Optional) List of explicit router interfaces for the IP multicast packets. • *ip-address-list*—(Optional) List of up to four explicit routes for multicast MOH. The default is that the MOH multicast stream is automatically output on the

	Command or Action	Purpose
		interfaces that correspond to the address that was configured with the **ip source-address** command. **Note** For MOH on internal calls, packet flow must be enabled to the subnet on which the phones are located.

Step 7	**extension-range** *starting-extension to ending-extension*
	
	Example:
	`Router(config-voice-moh-group)#extension-range 1000 to 1999`
	`Router(config-voice-moh-group)#extension-range 2000 to 2999`
		(Optional) identifies MOH callers calling the extension numbers specified in a MOH group. Extension number must be in hexadecimal digits (0-9) or (A-F). Both extension numbers (starting extension and ending extension) must contain equal number of digits. Repeat this command to add additional extension ranges.
		• *starting-extension*—(Optional) Lists the starting extension number for a moh-group.
		• *ending-extension*—(Optional) Lists the ending extension number for a moh-group.
		
		Note The ending extension number must be greater than or equal to the starting extension number. Extension-ranges must not overlap with any other extension-range configured in any other MOH group.
		
		Note If extension range is defined and a moh-group is also defined in an **ephone-dn**, the **ephone-dn** parameters takes precedence.

Step 8	**end** **Example:** `Router(config-voice-moh-group)# end`	Returns to privileged EXEC mode.

Examples

In the following example, total six MOH groups are configured. MOH group 1 through 5 are configured under voice-moh-group configuration mode and MOH group 0 is the MOH source file configured under telephony-services.

```
router# show voice moh-group
telephony-service
moh alaska.wav
Moh multicast 239.1.1.1 port 16384 route 10.1.4.31 10.1.1.2

voice moh-group 1
 description this moh group is for sales
 moh flash:/hello.au
 multicast moh 239.1.1.1 port 16386 route 239.1.1.3 239.1.1.3
 extension-range 1000 to 1999
 extension-range 2000 to 2999
 extension-range 3000 to 3999
 extension-range A1000 to A1999
```

```
voice moh-group 2
 description (not configured)
 moh flash1:/minuet.au
 multicast moh 239.23.4.10 port 2000
 extension-range 7000 to 7999
 extension-range 8000 to 8999

voice moh-group 3
 description This is for marketing
 moh flash2:/happy.au
 multicast moh 239.15.10.1 port 3000
 extension-range 9000 to 9999

voice moh-group 4
 description (not configured)
 moh flash:/audio/sun.au
 multicast moh 239.16.12.1 port 4000
 extension-range 10000 to 19999

voice moh-group 5
 description (not configured)
 moh flash:/flower.wav
 multicast moh 239.12.1.2 port 5000
 extension-range 0012 to 0024
 extension-range 0934 to 0964

=== Total of 6 voice moh-groups ===
```

Assign a MOH Group to a Directory Number

Restriction

- Do not use same extension number for different MOH groups.

Before you begin

- Cisco Unified CME 8.0 or a later version.
- MOH groups must be configured under global configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ephone-dn** tag
4. **number**
5. **moh-group** *tag*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**ephone-dn** tag **Example:** `Router(config)# ephone-dn 1`	Enters **ephone-dn** configuration mode. In ephone-dn configuration mode, you assign an extension number using the number command. You can also configure a MOH group to an ephone-dn-template for use across a range of ephone-dns. If two different MOH groups are configured as a result of this command, the MOH group configured under the ephone-dn configuration takes precedence. **Note** MOH group configuration for ephone-template-dn configuration command is temporarily prohibited when any directory number using that template is on hold.

Step 4	**number**
	Example:
	`Router(config)# ephone-dn 1`
	`Router(config-ephone-dn)# number 1001`
		Allows you to define an extension number and associate this number to a telephone.

Step 5	**moh-group** *tag*
	Example:
	`Router(config-telephony)#voice moh-group 1`
	`Router(config-voice-moh-group)#`
		Allows you to assign a MOH group to a directory number.
		• MOH group *tag*— identifies the unique number assigned to a MOH group for configuration tasks.

Step 6	**end** **Example:** `Router(config-ephone)# end`	Returns to privileged EXEC mode.

Examples

In the following example different moh groups are assigned to different directory numbers (ephone-dn) moh group1 is assigned to ephone-dn 1, moh-group 4 is assigned to ephone-dn 4, and moh-group 5 is assigned to ephone-dn 5.

```
ephone-dn  1  octo-line
 number 7001
```

```
 name DN7001
 moh-group 1
!
ephone-dn  2  dual-line
 number 7002
 name DN7002
 call-forward noan 6001 timeout 4
!
ephone-dn  3
 number 7003
 name DN7003
 snr 7005 delay 3 timeout 10
 allow watch
 call-forward noan 8000 timeout 30
!
!
ephone-dn  4  dual-line
 number 7004
 allow watch
 call-forward noan 7001 timeout 10
 moh-group 4
 !
ephone-dn  5
 number 7005
 name DN7005
 moh-group 5
 !
```

Assign a MOH Group to all Internal Calls Only to SCCP Phones

Restriction

- Do not use same extension number for different MOH groups.

Before you begin

- Cisco Unified CME 8.0 or a later version.
- MOH groups must be configured under global configuration mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **telephony-service**
4. **internal-call moh-group** *tag*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:**	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
	`Router> enable`	
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**telephony-service** **Example:** `Router(config-telephony)# ephone-dn 1`	Enters telephony-service configuration mode. In ephone-dn configuration mode, you assign an extension number using the number command.

Step 4	**internal-call moh-group** *tag*
	Example:
	`Router(config)#`
	`Router(config-telephony)# internal call moh-group 4`
		Allows to assign a MOH-group for all internal directory numbers.
		• Moh group *tag*— identifies the unique number assigned to a MOH group for configuration tasks, Range for the tag is from 0 to 5, where 0 represents MOH configuration in telephony service.

Step 5	**end** **Example:** `Router(config-ephone)# end`	Returns to privileged EXEC mode.

Examples

The following examples shows moh-group 4 configured for internal directory calls.

```
telephony-service
  sdspfarm conference mute-on *6 mute-off *8
  sdspfarm units 4
  sdspfarm transcode sessions 2
  sdspfarm tag 1 moto-HW-Conf
  moh flash1:/minuet.au
  Moh multicast 239.1.1.1 port 16384 route 10.1.4.31 10.1.1.2
  internal-call moh-group 4
  em logout 0:0 0:0 0:0
  max-ephones 110
  max-dn 288
  ip source-address 15.2.0.5 port 2000
  auto assign 1 to 1
  caller-id block code *9999
  service phone settingsAccess 1
  service phone spanTOPCPort 0
  service dss
  timeouts transfer-recall 12
```

Configure Buffer Size for MOH Files

Restriction

- MOH file caching is prohibited if live-feed is enabled for MOH-group 0.
- MOH file buffer size must be larger than the MOH file (size) that needs to be cached.
- Sufficient system memory must be available for MOH file caching.

Before you begin

- Cisco Unified CME 8.0 or a later version.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **telephony-service**
4. **moh-file-buffer** *file size*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**telephony-service** **Example:** `Router(config-telephony)# ephone-dn 1`	Enters telephony-service configuration mode. In ephone-dn configuration mode, you assign an extension number using the number command.
Step 4	**moh-file-buffer** *file size* **Example:** `Router(config-telephony)# moh-file-buffer 2000`	(Optional) Allows to set a buffer for the MOH file size. You can configure a max file buffer size (per file) anywhere between 64 KB (8 seconds) to 10000 KB (approximately 20 minutes), Default **moh-file-buffer** size is 64 KB (8 seconds). **Note** A large buffer size is desirable to cache the largest MOH file and a better system performance.

	Command or Action	Purpose
Step 5	**end** **Example:** `Router(config-ephone)# end`	Returns to privileged EXEC mode.

Examples

The following examples shows 90 KB as the configured moh-file-buffer size.

```
telephony-service
 sdspfarm conference mute-on *6 mute-off *8
 sdspfarm units 4
 sdspfarm transcode sessions 2
 sdspfarm tag 1 moto-HW-Conf
 moh flash1:/minuet.au
 Moh multicast 239.1.1.1 port 16384 route 10.1.4.31 10.1.1.2
 moh-file-buffer 90
 em logout 0:0 0:0 0:0
 max-ephones 110
 max-dn 288
 ip source-address 15.2.0.5 port 2000
 auto assign 1 to 1
 caller-id block code *9999
 service phone settingsAccess 1
 service phone spanTOPCPort 0
 service dss
 timeouts transfer-recall 12
```

Verify MOH File Caching

Use the **show ephone moh** command to verify if the MOH file is being cached.

The following examples shows that the minuet.au music file in MOH group 1 is not cached. Follow steps a through d to verify the MOH file is being cached.

Example:

```
Router #show ephone moh
Skinny Music On Hold Status (moh-group 1)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/minuet.au (not cached) type AU Media_Payload_G711Ulaw64k 160 bytes
Moh multicast 239.10.16.6 port 2000
```

a) If the file is not cached as in MOH group 1 in the above example, then check file size in the flash.

Example:

```
Router#dir flash:/minuet.au
Directory of flash:/minuet.au 32  -rw- 1865696  Apr 25 2009 00:47:12 +00:00  moh1.au
```

b) Under telephony-service, configure “moh-file-buffer <file size>”. Default file size is 64 KB (8 seconds). Make sure you enter a larger file size to cache large MOH files that you may use in future.

Example:

```
Router(config)# telephony-service
Router(config-telephony)# moh-file-buffer 2000
```

c) Under voice moh-group <group tag>, configure “no moh”, and immediately configure “moh <filename>”. This allows the MOH server to read the file immediately from flash again.

Example:

```
Router(config-telephony)#voice moh-group 1
Router(config-voice-moh-group)#no moh
Router(config-voice-moh-group)#moh flash:/minuet.au
```

d) Depending on the size of the file, you should see the MOH file caching after a few minutes (approximately, 2 minutes).

Example:

```
Router #show ephone moh
Skinny Music On Hold Status - group 1
Active MOH clients 0 (max 830), Media Clients 0
File flash:/moh1.au (cached) type AU Media_Payload_G711Ulaw64k 160 bytes
Moh multicast 239.10.16.6 port 2000
```

Note MOH file caching is prohibited under the following conditions: if live feed is configured in moh-group 0, If file buffer size smaller than file size, or insufficient system memory.

Verify Music on Hold Group Configuration

Step 1 Use the **show voice moh-group** command to display one or the entire moh-group configuration.

The following example shows all six MOH groups with extension ranges, MOH files, and multicast destination addresses.

```
router# show voice moh-group
 telephony-service
 moh alaska.wav
 Moh multicast 239.1.1.1 port 16384 route 10.1.4.31 10.1.1.2

voice moh-group 1
 description this moh group is for sales
 moh flash:/audio?minuet.au
 multicast moh 239.1.1.1 port 16386 route 239.1.1.2 239.1.1.3
 extension-range 1000 to 1999
 extension-range 2000 to 2999
 extension-range 3000 to 3999
 extension-range 20000 to 22000
 extension-range A1000 to A1999

voice moh-group 2
 description (not configured)
 moh flash:/audio/hello.au
 multicast moh 239.23.4.10 port 2000
 extension-range 7000 to 7999
 extension-range 8000 to 8999
```

```
voice moh-group 3
 description This is for marketing
 moh flash:/happy.au
 multicast moh 239.15.10.1 port 3000
 extension-range 9000 to 9999

voice moh-group 4
 description (not configured)
 moh flash:/audio/sun.au
 multicast moh 239.16.12.1 port 4000
 extension-range 10000 to 19999

voice moh-group 5
 description (not configured)
 moh flash:/flower.wav
 multicast moh 239.12.1.2 port 5000
 extension-range 0012 to 0024
 extension-range 0934 to 0964

=== Total of 6 voice moh-groups ===
```

Step 2 Use the **show ephone moh** to display information about the different MOH group configured.

The following example displays information about five different MOH groups.

```
Router # show ephone moh
Skinny Music On Hold Status (moh-group 1)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/minuet.au (not cached) type AU Media_Payload_G711Ulaw64k 160 bytes
Moh multicast 239.10.16.6 port 2000

Skinny Music On Hold Status (moh-group 2)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/audio/hello.au type AU Media_Payload_G711Ulaw64k  160 bytes
Moh multicast on 239.10.16.6 port 2000 via 0.0.0.0

Skinny Music On Hold Status (moh-group 3)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/bells.au type AU Media_Payload_G711Ulaw64k  160 bytes
Moh multicast on 239.10.16.5 port 2000 via 0.0.0.0

Skinny Music On Hold Status (moh-group 4)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/3003.au type AU Media_Payload_G711Ulaw64k  160 bytes
Moh multicast on 239.10.16.7 port 2000 via 0.0.0.0

Skinny Music On Hold Status (moh-group 5)
Active MOH clients 0 (max 830), Media Clients 0
File flash:/4004.au type AU Media_Payload_G711Ulaw64k  160 bytes
Moh multicast on 239.10.16.8 port 2000 via 0.0.0.0
```

Step 3 Use the **show voice moh-group statistics** command to display the MOH subsystem statistics information.

In the following example, the MOH Group Streaming Interval Timing Statistics shows the media packet counts during streaming intervals. Each packet counter is of 32 bit size and holds a count limit of 4294967296. This means that with 20 milliseconds packet interval (for G.711), the counters will restart from 0 any time after 2.72 years (2 years 8 months). Use the clear voice moh-group statistics once in every two years to reset the packet counters.

MOH Group Packet Transmission Timing Statistics shows the maximum and minimum amount of time (in microseconds) taken by the MOH groups to send out media packets. The MOH Group Loopback Interval Timing Statistics is available when loopback interface is configured as part of the multicast MOH routes as in the case of SRST. These counts are loopback packet counts within certain streaming timing intervals.

```
router# show voice moh-group statistics

MOH Group Streaming Interval Timing Statistics:
Grp#  ~19 msec     20~39      40~59      60~99     100~199   200+ msec
==== ========== ========== ========== ========== ========== ==========
 0:       25835   17559966      45148          0          0          1
 1:       19766   17572103      39079          0          0          1
 2:       32374   17546886      51687          0          0          1
 3:       27976   17555681      47289          0          0          1
 4:       34346   17542940      53659          0          0          1
 5:       14971   17581689      34284          0          0          1

MOH Group Packet Transmission Timing Statistics:
Grp#  max(usec)  min(usec)
==== ========== ==========
 0:          97          7.
 1:          95          7.
 2:          97          7.
 3:          96          7.
 4:          94          7.
 5:          67          7.

 MOH Group Loopback Interval Timing Statistics:
 loopback event array: svc_index=1542, free_index=1549, max_q_depth=31
 Grp#  ~19 msec     20~39      40~59      60~99     100~199   200+ msec
 ==== ========== ========== ========== ========== ========== ==========
 0:     8918821    8721527      10023          0          1          1
 1:     9007373    8635813       7184          0          1          1
 2:     8864760    8772851      12758          0          1          1
 3:     8924447    8715457      10464          0          1          1
 4:     8858393    8778957      13017          0          1          1
 5:     9005511    8639936       4919          0          1          1

Statistics collect time: 4 days 2 hours 5 minutes 39 seconds.
```

Step 4 Use the **clear voice moh-group statistics** command to clear the display of MOH subsystem statistics information.

For Example:

```
router# clear voice moh-group statistics
All moh group stats are cleared
```

Feature Information for Music on Hold

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 2: Feature Information for Music on Hold

Feature Name	Cisco Unified CME Version	Feature Information
Music on Hold	12.2	Support for Music on Hold from a live feed on Unified CME is introduced on the Cisco 4000 Series Integrated Services Routers.
	12.2	Support for Multicast Music on Hold from a live feed is introduced for SCCP to SCCP calls on the Cisco 4000 Series Integrated Services Routers.
	11.7	Support for configuration of G.711 and G.729 codec format MOH file on Unified CME is added.
	8.0	Music on hold from different media sources is added.
	4.1	Music on hold for SIP phones is supported.
	4.0	• Music on hold is introduced for internal calls. • The ability to disable multicast MOH per phone is introduced.
	3.0	The ability to use a live audio feed as a multicast source is introduced.
	2.1	Music on hold from a live audio feed is introduced for external calls.
	2.0	Music on hold from an audio file is introduced for external calls.