Music On Hold

The integrated Music On Hold (MOH) feature allows users to place on-net and off-net users on hold with music that is streamed from a streaming source. The Music On Hold feature allows two types of hold:

- End-user hold
- Network hold, which includes transfer hold, conference hold, and call park hold

Music On Hold also supports other scenarios where recorded or live audio is needed.

This chapter covers the following topics:

Understanding Music On Hold

The following sections explain the Music On Hold feature by providing definitions, service characteristics, feature functionality with examples, and supported features.

Additional Information

See the “Related Topics” section on page 6-28.

Music On Hold Definitions

In the simplest instance, music on hold takes effect when phone A is talking to phone B, and phone A places phone B on hold. If Music On Hold (MOH) resource is available, phone B listens to music that is streamed from a music on hold server.

The following definitions provide important information for the discussion that follows:

- MOH server—A software application that provides music on hold audio sources and connects a music on hold audio source to a number of streams.
- Media resource group—A logical grouping of media servers. You may associate a media resource group with a geographical location or a site as desired. You can also form media resource groups to control server usage or desired service type (unicast or multicast).
- Media resource group list—A list that comprises prioritized media resource groups. An application can select required media resources from among ones that are available according to the priority order that is defined in a media resource group list.
- Audio source ID—An ID that represents an audio source in the music on hold server. The audio source can be either a file on a disk or a fixed device from which a source stream music on hold server obtains the streaming data. One cluster can support up to 51 audio source IDs (1 to 51). Each audio source (represented by an audio source ID) can stream as unicast and multicast mode, if needed.
- Holding party—In an active, two-party call, the party that initiates a hold action (either user hold or network hold). Example: if party A is talking to party B, and party A presses the Hold softkey to initiate a hold action, party A is the holding party.
- Held party—In an active, two-party call, the party that does not initiate a hold action but is involved. Example: if party A is talking to party B, and party A presses the Hold softkey to initiate a hold action, party B is the held party.

The following audio source ID selection rules apply for selecting audio source IDs and media resource group lists:

- The system administrator, not the end user, defines (configures) audio source IDs.
- The system administrator chooses (configures) audio source IDs for device(s) or device pool(s).
- Holding parties define which audio source ID applies to held parties.
- Cisco CallManager implements four levels of prioritized audio source ID selection with level four as highest priority and level one as lowest priority.
  - The system selects audio source IDs at level four, which is directory/line-based, if defined. (Devices with no line definition, such as gateways, do not have this level.)
  - If no audio source ID is defined in level four, the system searches any selected audio source IDs in level three, which is device based.
  - If no level four nor level three audio source IDs are selected, the system selects audio source IDs that are defined in level two, which is DevicePool-based.
  - If all higher levels have no audio source IDs selected, the system searches level one for audio source IDs, which are clusterwide parameters.

The following media resource group list selection rules apply:

- Held parties determine the media resource group list that a Cisco CallManager uses to allocate a music on hold resource.
- Two levels of prioritized media resource group list selection exist:
  - Level two media resource group list provides the higher priority level, which is device based. Cisco CallManager uses the media resource group list at the device level if such a media resource group list is defined.
  - Level one media resource group list provides the lower priority level, which is an optional DevicePool parameter. Cisco CallManager uses the DevicePool level media resource group list only if no media resource group list is defined in the device level for that device.
- If no media resource group lists are defined, Cisco CallManager uses the system default resources. System default resources comprise resources that are not assigned to any existing media resource group. System default resources are always unicast.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Characteristics

The integrated Music On Hold feature allows users to place on-net and off-net users on hold with music that is streamed from a streaming source. This source makes music available to any possible on-net or off-net device that is placed on hold. On-net devices include station devices and applications that are placed on hold, consult hold, or park hold by an interactive voice response (IVR) or call distributor. Off-net users include those who are connected through Media Gateway Control Protocol (MGCP)/skinny gateways, IOS H.323 gateways and IOS Media Gateway Control Protocol gateways. The Music On Hold feature is also available for Cisco IP POTS phones that are connected to the Cisco IP network through FXS ports on IOS H.323/Media Gateway Control Protocol and for Cisco Media Gateway Control Protocol/skinny gateways.

The integrated Music On Hold feature covers media server, data base administration, call control, media resource manager, and media control functional areas.

The music on hold server provides the music resources/streams. These resources register with the Cisco CallManager during the initialization/recovery period.

Database administration provides a user interface to allow the Cisco CallManager administrator to configure the Music On Hold feature for the device(s). Database administration also provides Cisco CallManager call control with configuration information.

Call control controls the music on hold scenario logic.

The media resource manager processes the registration request from the music on hold server and allocates/deallocates the music on hold resources under the request of call control.

Media control controls the establishment of media stream connections, which can be one-way or two-way connections.

You must ensure that an end device is provisioned with music on hold-related information before music on hold functions for that device. Initializing a Cisco CallManager creates a media resource manager. The music on hold server(s) registers to the media resource manager with its music on hold resources.

When an end device or feature places a call on hold, Cisco CallManager connects the held device to a music resource. When the held device is retrieved, it disconnects from the music on hold resource and resumes normal activity.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Functionality

For music on hold to function, you must perform the actions in the following list:

- Configure music on hold servers.
- Configure audio sources. For the examples that follow, configure and provision the following audio sources: *Thank you for holding* and *Pop Music 1*.

Note Define audio sources first and then set up the music on hold servers, especially when multicast will be used. The user interface allows either step to take place first.

Note If an audio source is configured for multicast, the MOH server always transmits the audio stream, regardless of whether devices are held.

- Configure media resource groups. If multicast is desired, check the Use Multicast for MOH Audio check box.
- Configure media resource group lists.
- Assign media resource group lists and audio sources to device pools.
- Assign media resource group lists and audio sources to devices (to override assignments made to device pools).
- Assign audio sources to lines (to override device settings).

Using the preceding configuration actions, if you define music on hold functionality as follows, the examples that follow demonstrate music on hold functionality for user hold, transfer hold, and call park.

Media Resource Groups

MOH designates a music on hold server. MRG designates a media resource group.

- MRG_D comprises MOH_D.
- MRG_S_D comprises MOH_S and MOH_D.

Media Resource Group Lists

MRGL designates a media resource group list.

- MRGL_D comprises MRG_D.
- MRGL_S_D comprise MRG_S_D and MRG_D (prioritized order).

Nodes

- Dallas node comprises phone D and MOH_D.
- San Jose node comprises phone S and MOH_S.
- Assign phone D audio source ID 5, *Thank you for holding* or plain music (for both user and network hold), and MRGL_D.
- Assign phone S audio source ID 1, *Pop Music 1* (for both user and network hold), and MRGL_S_D.

User Hold Example

Phone D calls phone S, and phone S answers. Phone D presses the Hold softkey. Result: Phone S receives *Thank you for holding* announcement or plain music that is streaming from MOH_S. (MOH_S has available streams.) When phone D presses the Resume softkey, phone S disconnects from the music stream and reconnects to phone D.

Transfer Hold Example

Transfer hold serves as an example of network hold.

Phone D calls phone S, and phone S answers. Phone D presses the Transfer softkey. Phone S receives *Thank you for holding* announcement or plain music that is streaming from MOH_D. (MOH_S has no available streams, while MOH_D does.) After phone D completes the transfer action, phone S disconnects from the music stream and gets redirected to phone X, the transfer destination.

Call Park Example

Call park serves as an example of network hold.

Phone D calls phone S, and phone S answers. Phone S presses the CallPark softkey. Phone D receives a beep tone. (MOH_D has no available streams.) Phone X picks up the parked call. Phone S gets redirected to phone X (phone D and phone X are conversing).

Additional Information

See the "Related Topics" section on page 6-28.

Supported Music On Hold Features

Music on hold supports the following features, which are listed by category. Feature categories include music on hold server characteristics, server scalability, server manageability, server redundancy, database scalability, and manageability.

Music On Hold Server Characteristics

- Servers stream music on hold from music on hold data source files that are stored on their disks.
- Servers stream music on hold from an external audio source (for example, looping tape recorder, radio, or CD).
- Music on hold servers can use a single music on hold data source for all source streams and, hence, all connected streams. When multiple music on hold servers are involved, the local server of each music on hold server always stores the music on hold data source files. Cisco CallManager does not support distribution of fixed-device (hardware) audio sources across music on hold servers within a media resource group.
- Music on hold data source files have a common filename across all music on hold servers.
- Music on hold data source files must be uploaded to each server in the cluster.
- Each audio source receives a feed from either a designated file or a designated fixed source (for example, radio or CD).
- A designated fixed source comprises a single device, which is either enabled or disabled.

- The audio driver on the local machine makes a single fixed source available to the music on hold server.
- Music on hold servers support the G.711 (a-law and mu-law), G.729a, and wideband codecs.
- Music on hold servers register with one primary Cisco CallManager server.

Server Scalability

- Music on hold supports from 1 to 500 simplex unicast streams per music on hold server.
- Music on hold supports multiple Cisco-developed media-processing applications, including Interactive Voice Response (IVR) and AutoAttendant (AA). Cisco CallManager facilitates this support.
- Music on hold server simultaneously supports up to 50 music on hold data source files as sources.
- Music on hold server supports one fixed-device stream source in addition to the file stream sources. This source is the fixed audio source, which is configured on the Music On Hold (MOH) Fixed Audio Source Configuration page. This source requires the additional Cisco USB Music-On-Hold-capable adaptor.

Server Manageability

- From Cisco CallManager Serviceability windows, you can activate the music on hold server application, Cisco IP Media Streaming Application, on any standard media convergence server (MCS) as a service.
- You can activate music on hold application on the same media convergence server (MCS) as other media applications, so music on hold and the other media application(s) co-reside on the MCS.
- You can install music on hold server application on multiple media convergence servers (MCS) in a cluster.
- The administrator can specify the source for each source stream that is provided by the server.
- Administration of stream sources takes place through a browser.

Server Redundancy

- Music on hold servers support Cisco CallManager lists. The first entry on the list serves as the primary server, and subsequent Cisco CallManagers on the list serve as backup Cisco CallManagers in prioritized order.
- Music on hold servers can maintain a primary and backup connection to Cisco CallManagers from their Cisco CallManager list.
- Music on hold servers can re-home to backup Cisco CallManagers by following the standard procedures that are used by other servers and phones on the cluster.
- Music on hold servers can re-home to their primary server by following standard procedures for other media servers on the cluster.

Cisco CallManager/Database Requirements

- When a Cisco CallManager is handling a call and places either endpoint in the call on hold, the Cisco CallManager can connect the held endpoint to music on hold. This feature holds true for both network hold and user hold. Network hold includes transfer, conference, call park, and so forth.
- A media resource group for music on hold supports having a single music source stream for all connected streams.

- The system supports having music on hold server(s) at a central site without music on hold server(s) at remote sites. Remote site devices that require music on hold service can obtain service from a media resource group across the WAN when service is not available locally.
- You can distribute music on hold servers to any site within a cluster.
- A music on hold server can use a single music on hold data source for all source streams and, hence, all connected streams. When multiple music on hold servers are involved, the music on hold data source may be a file stored locally on each server.
- The system can detect when the primary media resource group that supplies music on hold for a device is out of streams and can select a stream from the secondary or tertiary media resource group that is specified for that device.
- When connecting a device to music on hold, the system can insert a transcoder when needed to support low-bandwidth codecs.

Database Scalability

- Cisco CallManager can support from 1 to 500 unicast sessions per music on hold server.
- A cluster can support from 1 to more than 20 music on hold servers.
- A cluster can support from 1 to more than 10,000 simultaneous music on hold streams across the cluster.
- A cluster can support from 1 to 500 or more media resource groups for music on hold.
- A media resource group for music on hold can support from 1 to 20 or more music on hold servers.

Manageability

- The administrator can select media resource group list per device.
- The administrator can select music on hold source stream per device/DN.
- The administrator can select music on consult (network hold) source stream per device/DN.
- The administrator can configure which music on hold servers are part of a specified media resource group.
- The administrator can designate a primary, secondary, and tertiary music on hold/consult servers for each device by configuring media resource groups and media resource group lists.
- The administrator can provision multiple music on hold servers.
- The administrator can provision any device registered with the system such that any music on hold server can service it in the system.
- All music on hold configuration and administration take place through a browser.
- The administrator specifies the user hold and network hold audio sources for each device pool. These default audio sources may be either file-based or fixed device-based.
- The administrator can designate a music on hold server as either unicast or multicast, provided that resources exist to support multicast.
- The administrator can reset all music on hold servers.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Server

The music on hold server uses the Station Stimulus (Skinny Client) messaging protocol for communication with Cisco CallManager. A music on hold server registers with the Cisco CallManager as a single device and reports the number of simplex, unicast audio streams that it can support. The music on hold server advertises its media type capabilities to the Cisco CallManager as G.711 mu-law and a-law, G.729a, and wideband. Cisco CallManager starts and stops music on hold unicast streams by sending skinny client messages to the music on hold server.

A music on hold server handles up to 500 simplex, unicast audio streams. A media resource group includes one or more music on hold servers. A music on hold server supports 51 audio sources, with one audio source that is sourced from a fixed device that uses the local computer audio driver, and the rest that are sourced from files on the local music on hold server.

You may use a single file for multiple music on hold servers, but the fixed device may be used as a source for only one music on hold server. The music on hold audio source files get stored in the proper format for streaming. Cisco CallManager allocates the simplex unicast streams among the music on hold servers within a cluster.

The music on hold server uses the media convergence server series hardware platform. A Cisco USB sound adaptor that is installed on the same computer as the music on hold server application provides the external fixed audio source, which can be a looping tape recorder, radio, or CD.

The music on hold server, which is actually a component of the Cisco IP Voice Media Streaming application, supports standard device recovery and database change notification.

Each music on hold server uses the local hard disk to store copies of the Music On Hold audio source files. Each audio source file gets distributed to the server(s) when the file is added through the Cisco CallManager Administration interface.

Note The administrator must upload Music On Hold audio source files to each MOH server.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Audio Sources

When the administrator imports an audio source file, the Cisco CallManager Administration window interface processes the file and converts the file to the proper format(s) for use by the music on hold server.

The recommended format for audio source files specifies the following:

- 16-bit PCM wav file
- Stereo or mono
- Sample rates of 48kHz, 32kHz, 16kYz, or 8kHz

Additional Information

See the "Related Topics" section on page 6-28.

Default Music On Hold Sample

Cisco CallManager includes a default music on hold sample that automatically downloads with Cisco CallManager software for customer use.

Additional Information

See the "Related Topics" section on page 6-28.

Creating Audio Sources

Most standard wav files serve as valid input audio source files, including the following file types:

- 16-bit PCM (stereo/mono)
- 8-bit CCITT a-law or mu-law (stereo/mono)

Note The Music On Hold feature does not support the MP3 format.

In creating an audio source, the following sequence takes place:

- The administrator imports the audio source file into the Cisco CallManager cluster. This step may take some time to transfer the file and convert the file to the proper format(s) for the music on hold server to use.
- The administrator must import the audio source file to the MOH server in each cluster prior to assigning an audio source number to the audio source file.
- The music on hold server uses the local audio source file(s).
- The music on hold server streams the files by using a kernel mode RTP driver as Cisco CallManager needs or requests.

Additional Information

See the "Related Topics" section on page 6-28.

Storing Audio Source Files

In previous releases, Cisco CallManager did not limit the amount of space that MOH files used. The MOH upload tool does not limit the number of uploaded files or the file size. The modified upload JSP pages check the disk usage of existing MOH files and only permit uploads if sufficient space is found.

The following considerations also apply:

- Release 5.0 of Cisco CallManager supports up to five MOH audio sources on 36- or 40-gigabyte disk-based systems. Systems with 72- or 80-gigabyte disks support the entire 50 audio streams.
- To increase the number of audio sources that Cisco CallManager supports, install a larger disk during upgrade.

Note The smallest node on the cluster controls MOH capacity.

Additional Information

See the "Related Topics" section on page 6-28.

Managing Audio Sources

After music on hold audio sources are created, their management occurs entirely through the Cisco CallManager Administration web interface. Choose **Media Resources > Music On Hold Audio Source** to display the Music On Hold (MOH) Audio Source Configuration window. For a given audio source, use this window to add, update, or delete a music on hold audio source. For each audio source file, assign a music on hold audio source number and music on hold audio source name and decide whether this audio source will play continuously and allow multicasting. For an audio source, this window also displays the music on hold audio source file status. Refer to the "Finding a Music On Hold Audio Source" section on page 6-17 for details.

Note Beginning with Release 5.0 of Cisco CallManager, the Music On Hold Audio Source Configuration window uploads audio source files only to a particular server. The window does not provide for automatic copying of audio source files to any other servers. You must manually upload audio source files to subscriber servers by accessing the Cisco CallManager application on each server.

Additional Information

See the "Related Topics" section on page 6-28.

Multicast and Unicast Audio Sources

Multicast music on hold conserves system resources. Multicast allows multiple users to use the same audio source stream to provide music on hold. Multicast audio sources associate with an IP address.

Unicast music on hold, the system default, uses a separate source stream for each user or connection. Users connect to a specific device or stream.

For administrators, multicast entails managing devices, IP addresses, and ports. In contrast, unicast entails managing devices only.

For multicast, administrators must define at least one audio source to allow multicasting. To define music on hold servers for multicast, first define the server to allow multicasting.

For multicast, an address comprises a combination of an IP address and a port number. Each audio source for multicast requires a set of addresses: one for each format on each MOH server. When configuring the MOH server for multicast, specify whether addresses should be assigned by incrementing the port or the IP address.

Caution Cisco strongly recommends incrementing multicast on IP address instead of port number to avoid network saturation in firewall situations. This results in each multicast audio source having a unique IP address and helps to avoid network saturation.

The Max Hops field in the Music On Hold (MOH) Server Configuration window indicates the maximum number of routers that an audio source is allowed to cross. If max hops is set to zero, the audio source must remain in its own subnet. If max hops is set to one, the audio source can cross up to one router to the next subnet. Cisco recommends setting max hops to two.

A standards body reserves IP addresses. Addresses for IP multicast range from 224.0.1.0 to 239.255.255.255. The standards body, however, assigns addresses in the range 224.0.1.0 to 238.255.255.255 for public multicast applications. Cisco strongly discourages using public multicast addresses for music on hold multicast. Instead, Cisco recommends using an IP address in the range that is reserved for administratively controlled applications on private networks (239.0.0.0 to 239.255.255.255).

Valid port numbers for multicast include even numbers that range from 16384 to 32767. (The system reserves odd values.)

Multicast functions only if both media resource groups and media resource group lists are defined to include a multicast music on hold server. For media resource groups, you must include a music on hold server that is set up for multicast. Such servers are labeled as *(MOH)[Multicast]*. Also, check the Use Multicast for MOH Audio check box when defining a media resource group for multicast.

For media resource group lists, which are associated with device pools and devices, define the media resource group list, so the media resource group set up for multicast is the first group in the list. This recommended practice facilitates the device efforts to find the multicast audio source first.

In music on hold processing, the held device (the device placed on hold) determines the media resource to use, but the holding device (the device that initiates the hold action) determines the audio source to use.

Additional Information

See the "Related Topics" section on page 6-28.

Multicast Configuration Checklist

Table 6-1 provides a checklist for configuring various Cisco Call Manager services to allow multicasting. You must perform all steps for multicast to be available.

Table 6-1 Multicast Configuration Checklist

Configuration Steps		Procedures and Related Topics
Step 1	Configure a music on hold server to enable multicast audio sources. **Caution** Cisco strongly recommends incrementing multicast on IP address in firewall situations. This results in each multicast audio source having a unique IP address and helps to avoid network saturation.	Music On Hold Server Configuration Settings, page 6-26
Step 2	Configure an audio source to allow multicasting.	Music On Hold Audio Source Configuration Settings, page 6-19
Step 3	Create a media resource group and configure it to use multicast for MOH audio.	Media Resource Group Configuration Settings, *Cisco CallManager Administration Guide*

Table 6-1 Multicast Configuration Checklist (continued)

Configuration Steps		Procedures and Related Topics
Step 4	Create a media resource group list with a multicast media resource group as the primary media resource group.	Media Resource Group List Configuration Settings, *Cisco CallManager Administration Guide*
Step 5	Choose the media resource group list that was created in Step 4 for either a device pool or for specific devices.	Related Topics, *Cisco CallManager Administration Guide*

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold System Requirements and Limits

The following system requirements and limits apply to the Music On Hold feature:

- All audio streaming devices that are using the Music On Hold feature support simplex streams. The music on hold server supports up to 500 simplex streams.
- The music on hold (MOH) server, a part of the Cisco IP Voice Media Streaming application, gets installed with Cisco CallManager. Use the Cisco CallManager Serviceability application to activate the MOH server. Only one Cisco IP Voice Media Streaming application may be activated on a media convergence server, and therefore only one MOH server can be enabled per server. The Cisco IP Voice Media Streaming application, however, can be activated on multiple servers to provide multiple MOH servers for the cluster.
- For a Cisco CallManager cluster, you may define up to 50 audio sources. A Cisco CallManager Administration window supports import, addition, update, and deletion of each audio source. The music on hold server also supports one fixed input source. The system supports the following codecs: G.711 a-law/mu-law, G.729a, and wideband.

  Note Because the G.729a codec is designed for human speech, using it with music on hold for music may not provide acceptable audio quality.

- For each cluster, you may define up to 50 audio sources from files as well as one fixed audio source. A Cisco CallManager Administration window supports addition, update, and deletion of each audio source. All servers use local copies of the same 50 or fewer files. You must set up the fixed audio source that is configured per cluster on each server.
- For each cluster, you may define at most 20 music on hold servers. The Cisco CallManager Administration window allows import, addition, update, and deletion of music on hold servers. The window allows administrators to specify the following characteristics for each server:
  - Name
  - Node (server host name)
  - Device pool
  - Maximum number of unicast and multicast streams
  - Sources to multicast
  - For each multicast source: IP address, port, and time to live (maximum number of router hops)

- Cisco CallManager Administration allows definition of at least 500 media resource groups per cluster. Each media resource group may include any combination of at least 20 media resources, including music on hold servers, media termination points, transcoders, and conference devices. Music on hold servers in one cluster support at least 10,000 simultaneous music on hold streams. See "Media Resource Groups" in the *Cisco CallManager System Guide* for details of media resource groups.
- Cisco CallManager Administration allows definition of media resource group lists. See "Media Resource Group Lists" in the *Cisco CallManager System Guide* for details of media resource group lists.
- Modifications to the Cisco CallManager Administration device configuration windows for phones and gateways allow the selection of a media resource group list, hold stream source, and consult stream source as optional parameters for a device.
- Modifications to the Cisco CallManager Administration Directory Number configuration windows allow selection of a user hold source and a network hold source.
- Modifications to the Cisco CallManager Administration Service Parameters allows entry to a clusterwide, default music on hold stream source (default specifies 1) and default media resource group type (default specifies unicast).
- The number of streams that the music on hold server can use may decrease if the annunciator, software MTP, or software conference bridge is in use on the same MCS server.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Failover and Fallback

The music on hold server supports Cisco CallManager lists and failover as implemented by the software conference bridge and media termination point. Upon failover, the system maintains connections to a backup Cisco CallManager if one is available.

Cisco CallManager takes no special action when a music on hold server fails during an active music on hold session. The held party receives nothing from this point, but this situation does not affect normal call functions.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Configuration Checklist

Table 6-2 provides a checklist for configuring music on hold.

Table 6-2 Music On Hold Configuration Checklist

Configuration Steps		Procedures and Related Topics
Step 1	The Cisco IP Voice Media Streaming application gets installed automatically upon installation of Cisco CallManager. To provide an MOH server, you must use the Cisco CallManager Serviceability application to activate the Cisco IP Voice Media Streaming application. When a server gets added, the Cisco CallManager automatically adds the media termination point, conference bridge, annunciator, and music on hold devices to the database. **Note** During installation, Cisco CallManager installs and configures a default music on hold audio source if one does not exist. Music on hold functionality can proceed by using this default audio source without any other changes.	*Installing Cisco CallManager Release 5.0(1)*
Step 2	Run the music on hold audio translator. **Caution** If the audio translator translates files on the same server as the Cisco CallManager, serious problems may occur. The audio translator tries to use all available CPU time, and Cisco CallManager may experience errors or slowdowns.	Music On Hold Audio Sources, page 6-8
Note The installation program performs the following actions automatically. If the user manually adds the music on hold components, ensure the following steps are performed.		
Step 3	Configure the music on hold server.	Configuring a Music On Hold Server, page 6-24
Step 4	Add and configure audio source files.	Finding a Music On Hold Audio Source, page 6-17

Additional Information

See the "Related Topics" section on page 6-28.

Monitoring Music On Hold Performance

Perform the activities in Table 6-3 to monitor music on hold performance.

Table 6-3 Music On Hold Performance Monitoring

Monitoring Activity		Detailed Information
Step 1	Use the Cisco CallManager Serviceability Real-Time Monitoring Tool (RTMT) to check resource usage and device recovery state.	Viewing Music On Hold Server Performance, page 6-15 *Cisco CallManager Serviceability Administration Guide* and *Cisco CallManager Serviceability System Guide* document another method of viewing this information.
Step 2	Search the event log for Cisco IP Voice Media Streaming application entries.	*Cisco CallManager Serviceability Administration Guide* *Cisco CallManager Serviceability System Guide*
Step 3	Verify that the Cisco IP Voice Media Streaming application service is running.	Additional Information, page 6-16 *Cisco CallManager Serviceability Administration Guide* and *Cisco CallManager Serviceability System Guide* document another method of viewing this information.
Step 4	Search the Media Application trace (CMS) to see what music on hold-related activity that it detects.	*Cisco CallManager Serviceability Administration Guide* and *Cisco CallManager Serviceability System Guide*

Additional Information

See the "Related Topics" section on page 6-28.

Viewing Music On Hold Server Performance

To view music on hold server perfmon counters, use the Cisco CallManager Serviceability Real-Time Monitoring Tool (RTMT).

Table 6-4 details the performance monitoring counters that display in the Cisco CallManager Serviceability Real-Time Monitoring Tool Performance window.

Table 6-4 Music On Hold Performance Counters

Performance Counter Name	Description
MOHConnectionState	Indicates primary and secondary Cisco CallManager: • 1 = Primary • 2 = Secondary • 0 = Not connected
MOHAudioSourcesActive	Specifies total number of active audio sources, including each supported codec type. If audio Source 1 has mu-law and G.729 enabled, count for this audio source may show 2.
MOHStreamsActive	Specifies total number of active streams. Two potential overhead streams exist for each audio source/codec type: one for actual audio source, another for multicast.
MOHStreamsAvailable	Specifies total number of available simplex streams. Total represents total number of streams that are available in device driver for all devices.
MOHConnectionsLost	Specifies number of times that connection has been lost for the corresponding Cisco CallManager.
MOHStreamsTotal	Specifies total number of streams that are processed.

See the *Cisco CallManager Serviceability System Guide* for additional information about the Real-Time Monitoring Tool.

Additional Information

See the "Related Topics" section on page 6-28.

Checking Service States

To check whether the music on hold service is running, use Performance Management.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Audio Source Configuration

The integrated Music On Hold feature provides the ability to place on-net and off-net users on hold with music streamed from a streaming source. This feature includes the following actions:

- End user hold
- Network hold, which includes transfer hold, conference hold, and park hold

Music On Hold configuration comprises configuration of Music On Hold audio sources and Music On Hold servers.

Use the following topics to configure Music On Hold audio sources:

- Finding a Music On Hold Audio Source, page 6-17
- Configuring a Music On Hold Audio Source, page 6-18
- Deleting a Music On Hold Audio Source, page 6-19
- Music On Hold Audio Source Configuration Settings, page 6-19

Additional Information

See the "Related Topics" section on page 6-28.

Finding a Music On Hold Audio Source

Because you might have multiple Music On Hold audio sources in your network, Cisco CallManager lets you search for Music On Hold audio sources on the basis of specified criteria. Follow these steps to search for a specific Music On Hold audio source in the Cisco CallManager database.

Note During your work in a browser session, Cisco CallManager Administration retains your Music On Hold audio source search preferences. If you navigate to other menu items and return to this menu item, Cisco CallManager Administration retains your Music On Hold audio source search preferences until you modify your search or close the browser.

Procedure

Step 1 Choose **Media Resources > Music On Hold Audio Source**.

The Find and List Music On Hold Audio Sources window displays.

Step 2 From the first drop-down list box, choose on the following criteria:

- MOH Audio Stream Number
- MOH Audio Source Name

Note To find all Music On Hold audio sources that are registered in the database, leave the text box blank and click **Find**.

Step 3 From the second drop-down list box, choose a search pattern for your search; for example, begins with, contains, or ends with.

Step 4 Specify the appropriate search text, if applicable, and click **Find**.

The records that match your search criteria display. You can change the number of items that display on each page by choosing a different value from the Rows per Page drop-down list box.

Tip To search for MOH audio sources within the search results, click the **Search Within Results** check box and enter your search criteria as described in this step.

Note You can delete multiple Music On Hold audio sources from the Find and List Music On Hold Audio Sources window by checking the check boxes next to the appropriate Music On Hold audio sources and clicking **Delete Selected**. You can choose all of the Music On Hold audio sources in the window by clicking **Select All**.

Note that deletion does not remove the Music On Hold audio source files. Deletion only removes the association with the MOH Audio Stream number.

Step 5 From the list of records that match your search criteria, click the name of the Music On Hold audio source that you want to view.

The Music On Hold Audio Source Configuration window displays with the Music On Hold audio source that you choose.

Additional Information

See the "Related Topics" section on page 6-28.

Configuring a Music On Hold Audio Source

Perform the following procedure to add or update a Music On Hold audio source. Use this procedure to associate an existing audio source with an audio stream number or to upload a new custom audio source.

Note If a new version of an audio source file is available, you must perform the update procedure to use the new version.

Procedure

Step 1 Choose **Media Resources > Music On Hold Audio Source**.

The Find and List Music On Hold Audio Sources window displays.

Step 2 Perform one of the following tasks:

- To add a new Music On Hold audio source, click **Add New**.

  The Music On Hold Audio Source Configuration window displays.

- To update a Music On Hold audio source, locate a specific Music On Hold audio source as described in "Finding a Music On Hold Audio Source" section on page 6-17

Step 3 Enter the appropriate settings as described in Table 6-5.

Step 4 Click **Save**.

If you added a Music On Hold Audio Source, the list box at the bottom of the window now includes the new Music On Hold audio source.

Note The MOH Audio Source File Status pane tells you about the MOH audio translation status for the added source.

Additional Information

See the "Related Topics" section on page 6-28.

Deleting a Music On Hold Audio Source

Perform the following procedure to delete an existing Music On Hold audio source.

Note Deletion does not remove the Music On Hold audio source files. Deletion only removes the association with the MOH Audio Stream number.

Procedure

Step 1 Choose **Media Resources > Music On Hold Audio Source**.

The Find and List Music On Hold Audio Sources window displays.

Step 2 To locate a specific Music On Hold audio source, enter search criteria and click **Find**.

A list of Music On Hold audio sources that match the search criteria displays.

Step 3 Perform one of the following actions:

- Check the check boxes next to the Music On Hold audio sources that you want to delete and click **Delete Selected**.
- Delete all Music On Hold audio sources in the window by clicking **Select All** and then clicking **Delete Selected**.
- From the list, choose the name of the Music On Hold audio source that you want to delete and click **Delete**.

A confirmation dialog displays.

Step 4 Click **OK**.

The association of the chosen Music On Hold audio source with an audio stream number gets deleted.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Audio Source Configuration Settings

Table 6-5 describes the configuration settings that are used for configuring Music On Hold audio sources.

Table 6-5 Music On Hold Audio Source Configuration Settings

Field	Description
Music On Hold Audio Source Information	
MOH Audio Stream Number	Use this field to choose the stream number for this MOH audio source. To do so, click the drop-down arrow and choose a value from the list that displays. For existing MOH audio sources, this value displays in the MOH Audio Source title.
MOH Audio Source File	Use this field to choose the file for this MOH audio source. To do so, click the drop-down arrow and choose a value from the list that displays.
Upload File	To upload an MOH audio source file that does not display in the drop-down list box, click the **Upload File** button. In the Upload File popup window that displays, enter the path to a file that specifies an audio source file. If you do not know the path and file name, search for the file by clicking the **Browse...** button to the right of the File field. After you locate the audio source file, click the **Upload** button to complete the upload. After the audio file gets uploaded, the Upload Result window tells you the result of the upload. Click **Close** to close this window. **Note** Uploading a file uploads the file to the Cisco CallManager server and performs audio conversions to create codec-specific audio files for MOH. Depending on the size of the original file, processing may take several minutes to complete. **Note** Uploading an audio source file to an MOH server uploads the file only to one MOH server. You must upload an audio source file to each MOH server in a cluster by using Cisco CallManager Administration on each server. MOH audio source files do *not* automatically propagate to other MOH servers in a cluster.
MOH Audio Source Name	Enter a unique name in this field for the MOH audio source. This name can comprise up to 50 characters. Valid characters include letters, numbers, spaces, dashes, dots (periods), and underscores.
Play continuously (repeat)	To specify continuous play of this MOH audio source, check this check box. **Note** Cisco recommends checking this check box. If continuous play of an audio source is not specified, only the first party placed on hold, not additional parties, will receive the MOH audio source.
Allow Multicasting	To specify that this MOH audio source allows multicasting, check this check box.

Table 6-5 Music On Hold Audio Source Configuration Settings (continued)

Field	Description
MOH Audio Source File Status	This pane displays information about the source file for a chosen MOH audio source. For an MOH audio source, the following attributes display: • Input File Name • Error Code • Error Text • Duration (in) Seconds • Disk Space KB • Low Date Time • High Date Time • Output File List – ULAW wav file name and status – ALAW wav file name and status – G.729 wav file name and status – Wideband wav file name and status • Date MOH Audio Translation completed
MOH Server Reset Information	To reset all MOH servers, click the **Reset** button. **Note** Cisco CallManager makes Music On Hold unavailable while the servers reset.
MOH Audio Sources	
(list of MOH audio sources)	For each MOH audio source that has been added, the MOH audio source name displays in this list box. Click the name of an MOH audio source to configure that MOH audio source.

Additional Information

See the "Related Topics" section on page 6-28.

Fixed Music On Hold Audio Source Configuration

The Music On Hold server supports one fixed-device stream source in addition to the file stream sources. This source represents the fixed audio source, which gets configured in the Fixed Music On Hold (MOH) Audio Source Configuration window. The fixed audio source gets sourced from a fixed device that uses the local computer audio driver.

For each cluster, you may define one fixed audio source. You must set up the fixed audio source that is configured per cluster on each MOH server. To do so, use the Cisco USB MOH sound adaptor, which must be ordered separately.

Use the following topics to configure the fixed Music On Hold audio source:

- Configuring the Fixed Music On Hold (MOH) Audio Source, page 6-22
- Deleting a Fixed Music On Hold (MOH) Audio Source, page 6-22
- Fixed Music On Hold (MOH) Audio Source Configuration Settings, page 6-23

Configuring the Fixed Music On Hold (MOH) Audio Source

Perform the following procedure to configure the fixed Music On Hold audio source.

Procedure

Step 1 Choose **Media Resources > Fixed MOH Audio Source**.

The Fixed MOH Audio Source Configuration window displays.

Step 2 To configure and enable a fixed Music On Hold (MOH) audio source, enter the appropriate settings as described in Table 6-6.

Step 3 Click **Save**.

The Fixed MOH Audio Source Configuration window displays an *Update Successful* status message.

Additional Information

See the "Related Topics" section on page 6-28.

Deleting a Fixed Music On Hold (MOH) Audio Source

Perform the following procedure to delete an existing fixed Music On Hold audio source.

Procedure

Step 1 Choose **Media Resources > Fixed MOH Audio Source**.

The Fixed MOH Audio Source Configuration window displays.

Step 2 If the fixed MOH audio source that displays is enabled (that is, the Enable check box has been checked), you can delete this fixed MOH audio source.

To delete this fixed MOH audio source, click **Delete**.

A confirmation dialog box displays.

Step 3 Click **OK**.

The chosen fixed Music On Hold audio source gets deleted from the database.

Additional Information

See the "Related Topics" section on page 6-28.

Fixed Music On Hold (MOH) Audio Source Configuration Settings

Table 6-6 describes the configuration settings that are used for configuring the fixed Music On Hold (MOH) audio source.

Table 6-6 Fixed Music On Hold (MOH) Audio Source Configuration Settings

Field	Description
Fixed MOH Audio Source Information	
Source ID	This field displays the stream number for this fixed MOH audio source.
Name	Enter a unique name in this field for the fixed MOH audio source. This name can comprise up to 50 characters. Valid characters include letters, numbers, spaces, dashes, dots (periods), and underscores.
Allow Multicasting	To specify that this fixed MOH audio source allows multicasting, check this check box.
Enable (If checked, Name is required.)	To enable this fixed MOH audio source, check this check box.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Server Configuration

You can configure servers for Music On Hold for a media resource group. Use the following topics to configure Music On Hold servers:

- Finding a Music On Hold Server, page 6-23
- Configuring a Music On Hold Server, page 6-24
- Resetting or Restarting a Music On Hold Server, page 6-25
- Music On Hold Server Configuration Settings, page 6-26

For any Music On Hold server that you configure, you may trace the configuration of that server. Refer to the *Cisco CallManager Serviceability Administration Guide* and *the Cisco CallManager Serviceability System Guide* for more information.

Additional Information

See the "Related Topics" section on page 6-28.

Finding a Music On Hold Server

Because you might have several music on hold servers in your network, Cisco CallManager lets you locate specific music on hold servers on the basis of specific criteria. Use the following procedure to locate music on hold servers.

Procedure

Step 1 Choose **Media Resources > Music On Hold Server**.

The Find and List Music On Hold Servers window displays. Use the two drop-down list boxes to search for a music on hold server.

Step 2 From the first Find Music On Hold Servers where drop-down list box, choose one of the following criteria:

- Name
- Description
- Device Pool Name

Tip To find all music on hold servers that are registered in the database, click **Find** without entering any search text.

Step 3 From the second Find Music On Hold Servers where drop-down list box, choose a search pattern for your text search; for example, begins with, contains, or ends with.

Step 4 Specify the appropriate search text, if applicable, and click **Find**.

The records that match your search criteria display. You can change the number of items that display on each page by choosing a different value from the Rows per Page drop-down list box.

Tip To search for Music On Hold servers within the search results, click the **Search Within Results** check box and enter your search criteria as described in this step.

Step 5 From the list of records that match your search criteria, click the name of the Music On Hold server that you want to view.

The Music On Hold (MOH) Server Configuration window displays with the Music On Hold server that you choose.

Additional Information

See the "Related Topics" section on page 6-28.

Configuring a Music On Hold Server

Perform the following procedure to update a Music On Hold server.

Note You cannot add nor delete a Music On Hold server.

Procedure

Step 1 Choose **Media Resources > Music On Hold Server**.

The Find and List Music On Hold Servers window displays. Use the two drop-down list boxes to search for a music on hold server.

Step 2 Perform one of the following tasks:

- To update a Music On Hold server, click the Music On Hold server that you want to update

  The Music On Hold (MOH) Server Configuration window displays.

Step 3 Enter or update the appropriate settings as described in Table 6-7.

Step 4 To update this Music On Hold server, click **Save**.

The Music On Hold server gets updated in the database.

Additional Information

See the "Related Topics" section on page 6-28.

Resetting or Restarting a Music On Hold Server

Perform the following procedure to reset an existing Music On Hold server.

Procedure

Step 1 Locate the music on hold server by using the procedure in the "Finding a Music On Hold Server" section on page 6-23.

Step 2 Click the music on hold server that you want to reset.

Step 3 Click the **Reset** button.

A popup window displays an information message.

Step 4 After reading the message, click **Restart** to restart the music on hold server or click **Reset** to reset the music on hold server.

Step 5 To close the popup window, click **Close**.

Additional Information

See the "Related Topics" section on page 6-28.

Music On Hold Server Configuration Settings

Table 6-7 describes the configuration settings that are used for configuring Music On Hold servers.

Table 6-7 Music On Hold Server Configuration Settings

Field	Description
Device Information	
Host Server	For existing Music On Hold servers, this field is display only.
Music On Hold Server Name	Enter a unique name for the Music On Hold server in this required field. This name can comprise up to 15 characters. Valid characters include letters, numbers, spaces, dashes, dots (periods), and underscores.
Description	Enter a description for the Music On Hold server. This description can comprise up to 50 characters. Ensure Description does not contain ampersand (&), double quotes (“), brackets ([]), less than (<), greater than (>), or the percent sign (%).
Device Pool	Use this required field to choose a device pool for the Music On Hold server. To do so, click the drop-down arrow and choose a device pool from the list that displays.
Location	Choose the appropriate location for this MOH server. The location specifies the total bandwidth that is available for calls to and from this location. A location setting of *None* means that the locations feature does not keep track of the bandwidth that this MOH server consumes.
Maximum Half Duplex Streams	Enter a number in this required field for the maximum number of half-duplex streams that this Music On Hold server supports. Valid values range from 0 to 500.
Maximum Multicast Connections	Enter a number in this required field for the maximum number of multicast connections that this Music On Hold server supports. Valid values range from 1 to 999999.
Fixed Audio Source Device	Enter the device name of the fixed audio source device. This device serves as the per-server override that is used if the server has a special sound device installed.
Run Flag	Use this required field to choose a run flag for the Music On Hold server. To do so, click the drop-down arrow and choose **Yes** or **No**. Choosing **No** disables the Music On Hold server.
Multicast Audio Source Information	
Enable Multicast Audio Sources on this MOH Server	Check or uncheck this check box to enable or disable multicast of audio sources for this Music On Hold server. **Note** If this MOH server belongs to a multicast media resource group, a message asks you to enable multicast on this MOH server or to update the specified media resource group(s) either by removing this MOH server or by changing the multicast setting of each group listed.

Table 6-7 Music On Hold Server Configuration Settings (continued)

Field	Description
Base Multicast IP Address	If multicast support is needed, enter the base multicast IP address in this field. Valid IP addresses for multicast range from 224.0.1.0 to 239.255.255.255. **Note** IP addresses between 224.0.1.0 and 238.255.255.255 fall in the reserved range of IP multicast addresses for public multicast applications. Use of such addresses may interfere with existing multicast applications on the Internet. Cisco strongly recommends using IP addresses in the range that is reserved for administratively controlled applications on private networks (239.0.0.0 - 239.255.255.255).
Base Multicast Port Number	If multicast support is needed, enter the base multicast port number in this field. Valid multicast port numbers include even numbers that range from 16384 to 32766.
Increment Multicast on	Click **Port Number** to increment multicast on port number. Click **IP Address** to increment multicast on IP address. **Note** Multicast by incrementing IP address is preferable in firewall situations. This results in each multicast audio source having a unique IP address and helps to avoid network saturation.
Selected Multicast Audio Sources	
	Only audio sources for which the Allow Multicasting check box was checked display in this listing. If no such audio sources exist, the following message displays: There are no Music On Hold Audio Sources selected for Multicasting. Click Configure Audio Sources in the top right corner of the page to select Multicast Audio Sources. From the Related Links drop-down list box, choose Configure Audio Sources and click **Go**.
No.	This field designates Music On Hold audio stream number that is associated with a particular multicast audio source. Only audio sources that are defined as allowing multicasting display.
Audio Source Name	This field designates name of audio source that is defined as allowing multicasting.
Max Hops	For each multicast audio source, enter the maximum number of router hops through which multicast packets should pass. Valid values range from 1 to 15. **Note** Using high values can lead to network saturation. This field is also known as *Time to Live*.

Additional Information

See the "Related Topics" section on page 6-28.

Related Topics

- Understanding Music On Hold, page 6-1
- Music On Hold Definitions, page 6-2
- Music On Hold Characteristics, page 6-3
- Music On Hold Functionality, page 6-4
- Supported Music On Hold Features, page 6-5
- Music On Hold System Requirements and Limits, page 6-12
- Music On Hold Failover and Fallback, page 6-13
- Music On Hold Configuration Checklist, page 6-14
- Monitoring Music On Hold Performance, page 6-15
- Viewing Music On Hold Server Performance, page 6-15
- Media Resource Group Configuration, *Cisco CallManager Administration Guide*
- Media Resource Group List Configuration, *Cisco CallManager Administration Guide*

Music On Hold Audio Sources

- Music On Hold Audio Sources, page 6-8
- Storing Audio Source Files, page 6-9
- Finding a Music On Hold Audio Source, page 6-17
- Configuring a Music On Hold Audio Source, page 6-18
- Deleting a Music On Hold Audio Source, page 6-19
- Music On Hold Audio Source Configuration Settings, page 6-19

Fixed Music On Hold Audio Source

- Fixed Music On Hold Audio Source Configuration, page 6-21
- Configuring the Fixed Music On Hold (MOH) Audio Source, page 6-22
- Deleting a Fixed Music On Hold (MOH) Audio Source, page 6-22
- Fixed Music On Hold (MOH) Audio Source Configuration Settings, page 6-23

Music On Hold Servers

- Music On Hold Server, page 6-8
- Music On Hold Server Configuration, page 6-23
- Finding a Music On Hold Server, page 6-23
- Configuring a Music On Hold Server, page 6-24
- Resetting or Restarting a Music On Hold Server, page 6-25
- Music On Hold Server Configuration Settings, page 6-26

Additional Cisco Documentation

- *Installing Cisco CallManager Release 5.0(1)*
- *Upgrading Cisco CallManager Release 5.0(1)*

- *Cisco CallManager Serviceability Administration Guide*
- *Cisco CallManager Serviceability System Guide*