



Configuring Video Applications

This chapter describes how to configure video support. It contains the following sections:

- [Video Applications Overview, page 719](#)
- [Video Applications Prerequisite Tasks and Restrictions, page 722](#)
- [Video Applications Configuration Task List, page 723](#)
- [Video Applications Configuration Examples, page 764](#)



Note

This chapter does not describe how to configure Multimedia Conference Manager. For more information, see the “Configuring H.323 Gatekeepers and Proxies” chapter.

For a complete description of the video application commands used in this chapter, refer to the *Cisco IOS Voice, Video, and Fax Command Reference*. To locate documentation for other commands that appear in this chapter, use the command reference master index or search online.

To identify the hardware platform or software image information mentioned in this appendix, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the “Identifying Supported Platforms” section in the “Using Cisco IOS Software” chapter.

Video Applications Overview

This section contains the following subsections:

- [Cisco Video Support by Platform, page 720](#)
- [Multimedia Conference Manager with Voice Gateway Image and RSVP to ATM SVC Mapping, page 721](#)
- [ATM Nonreal-Time VBR SVC Support for Video, page 722](#)

Cisco Video Support by Platform

Cisco video support for various applications is listed by platform in the following sections:

- [Cisco MC3810 Multiservice Concentrator, page 720](#)
- [Cisco 2600 Series, 3600 Series, and 7200 Series Router and MC3810 Multiservice Concentrator, page 720](#)
- [Cisco 3600 Series Router, page 721](#)

Cisco MC3810 Multiservice Concentrator

The Cisco MC3810 multiservice concentrator supports video traffic within a data stream in the following ways:

- Video in pass-through mode—By this method, video traffic received from a video codec connected to a universal I/O serial port can be transported on a dedicated time slot between systems using the time-division multiplexing (TDM) functionality of the T1/E1 trunk.
- Video over ATM adaptation layer 1 (AAL1)—A serial stream from a video codec connected to a Cisco MC3810 on serial port 0 or 1 can be converted to ATM and transported across an ATM network using AAL1 circuit emulation services (CES) encapsulation.
- Video over ATM permanent virtual circuits (PVCs) and switched virtual circuits (SVCs)—A serial stream from a video codec connected to a Cisco MC3810 using the plug-in video dialing module (VDM) can be converted to ATM and transported across an ATM network using AAL1 CES encapsulation.



Note

Before configuring your MC3810 multiservice concentrator to support video traffic, you must first configure the clock source for the Cisco MC3810 interfaces. For more information, refer to the “Configuring Synchronized Clocking” appendix.



Note

Only V.35 cable is supported for video traffic over serial port 0 or 1.

Cisco 2600 Series, 3600 Series, and 7200 Series Router and MC3810 Multiservice Concentrator

Cisco 2600 series, 3600 series, and 7200 series routers and the MC3810 multiservice concentrator support Multimedia Conference Manager with voice gateway image and Resource Reservation Protocol (RSVP) to ATM SVC mapping. Multimedia Conference Manager delivers H.323 gatekeeper, proxy, and voice gateway solutions with routing as a single Cisco IOS image. In addition, Multimedia Conference Manager enables H.323 RSVP reservations to be mapped to ATM nonreal-time variable bit rate (nRTVBR) SVCs to guarantee quality of service (QoS) for video applications over ATM backbones.

Cisco 3600 Series Router

Circuit emulation is a service based on ATM Forum standards that allows communications to occur between AAL1 CES and ATM user network interfaces (UNIs), that is, between non-ATM telephony devices (such as classic PBXs or time-division multiplexers) and ATM devices (such as Cisco 3600 series routers). Thus, a Cisco 3600 series router equipped with an OC-3/STM-1 ATM CES network module offers a migration path from classic T1/E1 data communications service to emulated CES T1/E1 unstructured (clear channel) services or structured (N x 64) services in an ATM network.

The OC-3/STM-1 ATM CES network module uses the CES clock and passes the clocking information to the T1 and E1 controller and to the ATM interface.

For specific information regarding OC-3/STM-1 ATM CES network module configurations, refer to the *Cisco IOS Wide-Area Networking Configuration Guide* and the *Cisco IOS Quality of Service Solutions Configuration Guide*.

Multimedia Conference Manager with Voice Gateway Image and RSVP to ATM SVC Mapping

Multimedia Conference Manager with voice gateway image and RSVP to ATM SVC mapping is implemented on Cisco IOS software. Multimedia Conference Manager is supported on the Cisco 2600 series, 3600 series, and 7200 series routers and on the MC3810 multiservice concentrator.

Multimedia Conference Manager with voice gateway image and RSVP to ATM SVC mapping enables you to limit the H.323 traffic on the LAN and WAN; it provides user accounting for records based on the service use; it guarantees QoS for the H.323 traffic generated by applications such as Voice over IP (VoIP), data conferencing, and videoconferencing; and it guarantees the implementation of security for H.323 communications. In addition, this new and separate image also incorporates Cisco voice gateway and routing functionalities in the same image.

With voice gateway image and RSVP to ATM SVC mapping, you can stipulate bandwidth limits for each videoconferencing connection and an aggregate bandwidth limit for all videoconferencing sessions. This voice gateway image allows you to provide bandwidth limitation to the endpoints.

Additional benefits include the following:

- The proxy can forward T.120 connections, which enhances real-time data conferencing capabilities.
- The gatekeeper can perform load-balancing functionality for external H.323 Version 2 gateways.
- The gatekeeper supports call accounting for proxied calls. Proxied calls are recorded into call history to provide additional call detail information.

Multimedia Conference Manager is recommended for multiple Cisco CallManagers or CallManager cluster domains. Multimedia Conference Manager provides critical connection admission control (CAC) between domains to guarantee that the number of calls between locations does not exceed available bandwidth.

For more detailed information about Multimedia Conference Manager, see the “Configuring H.323 Gatekeepers and Proxies” chapter.

ATM Nonreal-Time VBR SVC Support for Video

ATM nonreal-time variable bit rate (nRTVBR) SVC service operates much like X.25 SVC service although ATM allows much higher throughput. Virtual circuits are created and released dynamically, providing user bandwidth on demand. This service requires a signaling protocol between the router and the switch. Each ATM node is required to establish a separate connection to every other node in the ATM network with which it needs to communicate. All such connections are established using a PVC or an SVC with an ATM signaling mechanism.

Using ATM nRTVBR SVC for video on an ATM backbone guarantees that video sessions will traverse that backbone with QoS features enabled. The Cisco IOS image takes H.323 RSVP reservations and maps them to ATM nRTVBR SVCs that are dynamically established and torn down when video sessions are established and terminated. End-to-end IP routing across the network backbone is no longer required to guarantee video QoS.

ATM nonreal-time nRTVBR SVC service is supported on the Cisco 2600 series, 3600 series, and 7200 series routers and on the MC3810 multiservice access server.

For more information on configuring ATM, refer to the *Cisco IOS Wide-Area Networking Configuration Guide*.

Video Applications Prerequisite Tasks and Restrictions

The following prerequisites and restrictions apply when using Multimedia Conference Manager with voice gateway image and RSVP to ATM SVC mapping:

- Permanent virtual pathways (PVPs) are supported only on OC-3 cards and DS3/E3 cards. Neither the T1-IMA cards nor the T1 interface on the Cisco MC3810 supports PVPs.
- T.120 proxy has been tested and proved to work with Microsoft NetMeeting 3.01. Based on testing, T.120 proxying does not work with VCON endpoints. T.120 proxy works only with endpoints that can connect to ports other than the default port of 1503. Microsoft NetMeeting 3.01 can do this, but VCON cannot.
- Some older H.323 endpoint implementations, especially those used in videoconferencing, may not be able to connect to an H.225 call setup port number other than 1720. If you have to use those endpoints with the H.323 gatekeeper proxy feature, consider using an image without the Cisco H.323 VoIP gateway (an -ix- image).
- For Multimedia Conference Manager with voice gateway image and RSVP to ATM SVC mapping to function properly, you must have 16 megabytes of Flash memory and 64 megabytes of DRAM memory. For the Cisco 3660 router and for the Cisco 7200 series router, 96 megabytes of DRAM are required.

Video Applications Configuration Task List

Video applications require different tasks. To configure video support, perform one of the following:

- [Configuring Video in Pass-Through Mode, page 723](#)
- [Configuring Video over ATM AAL1, page 725](#)
 - [Tuning Circuit Emulation Services Settings, page 728](#)
- [Configuring Video over ATM PVCs and SVCs, page 728](#)
 - [Configuring Network Clocks and Controllers, page 731](#)
 - [Configuring Serial Interfaces to Support the Video Codec, page 735](#)
 - [Configuring ATM Interfaces to Support Video over PVCs and SVCs, page 736](#)
 - [Configuring Video Dial Peers, page 744](#)
 - [Troubleshooting Video over ATM SVCs and PVCs, page 747](#)
- [Configuring the CES Clock, page 752](#)
- [Configuring Structured CES, page 754](#)
- [Configuring the Proxy and T.120, page 757](#)
- [Configuring the Gatekeeper to Support Zone Bandwidth, page 761](#)
- [Configuring RSVP-ATM QoS Interworking, page 762](#)

Configuring Video in Pass-Through Mode

Video in pass-through mode is supported on the Cisco MC3810 multiservice concentrator.

To configure support for video in pass-through mode, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# network-clock base-rate {56k 64k}	Configures the network clock base rate. The default is 56 kbps.
Step 2	Router(config)# interface serial <i>number</i> { multipoint point-to-point }	Enters serial interface configuration mode for either serial port 0 or 1. <ul style="list-style-type: none"> • multipoint—Assumes that there is a fully meshed network. • point-to-point—Specifies that a video connection will be over a point-to-point network.
Step 3	Router(config-if)# encapsulation clear-channel	Configures the serial interface to be in clear-channel mode for pass-through traffic.
Step 4	Router(config-if)# clock rate network-clock rate	Configures the network clock speed for serial port 0 or 1 in DCE mode on the MC3810 multiservice access server. The <i>rate</i> argument is the network clock speed in bits per second. The range is from 56 kbps to 2048 kbps. The value entered should be a multiple of the value set for the network-clock base-rate command. The maximum rate supported is 2048 Mbps.

	Command	Purpose
Step 5	Router(config-if)# exit	Exits interface configuration mode.
Step 6	Router(config)# controller t1 0	Enters controller configuration mode for controller T1 0.
Step 7	Router(config-controller)# tdm-group <i>tdm-group-no</i> timeslot <i>timeslot-list</i> [type { e&m fxs [loop-start ground-start] fxo [loop-start ground-start] fxs-melcas fxo-melcas e&m-melcas }]	<p>Configures a list of time slots for creating clear channel groups (pass-through) for time-division multiplexing (TDM) cross-connect.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>tdm-group-no</i>—Specifies the TDM group number. • timeslot—Specifies the timeslot number. • <i>timeslot-list</i>—Specifies the timeslot list. The valid range is from 1 to 24 for T1, and it is from 1 to 15 and 17 to 31 for E1. • type—(Optional) (Valid only when the mode cas command is enabled.) Specifies the voice signaling type of the voice port. If configuring a TDM group for data traffic only, do not specify the type keyword. <p>Choose from one of the following options:</p> <ul style="list-style-type: none"> – e&m—Specifies E&M signaling. – fxs—Specifies Foreign Exchange Office (FXO) signaling. (Optionally, you can also specify loop-start or ground-start.) – fxo—Specifies Foreign Exchange Station (FXS) signaling. (Optionally, you can also specify loop-start or ground-start.) – fxs-melcas—Specifies FXS Mercury Exchange Limited (MEL) Channel Associated Signaling (CAS). – fxo-melcas—Specifies FXO MEL CAS. • e&m-melcas—Specifies ear and mouth (E&M) MEL CAS.
Step 8	Router(config-controller)# exit	Exits controller configuration mode.

	Command	Purpose
Step 9	<pre>Router(config)# cross-connect id controller-1 tdm-group-no-1 controller-2 tdm-group-no-2</pre>	<p>Cross-connects two groups of digital signal level 0s (DS0s) from two controllers on the Cisco MC3810 or cross-connects the Universal I/O (UIO) serial port for pass-through traffic to a trunk controller.</p> <p>Configures cross-connect pass-through from Universal I/O (UIO) serial port 0 or 1 to a controller. The arguments are as follows:</p> <ul style="list-style-type: none"> • <i>id</i>—Specifies the unique identification (ID) assigned to this cross-connection. The valid range is from 0 to 31. • <i>controller-1</i>—Specifies the type of the first controller (T1 0, T1 1, or E1). • <i>tdm-group-no-1</i>—Specifies the time-division multiplexing (TDM) group number assigned to the first controller. • <i>controller-2</i>—Specifies the type of the second controller (T1, E1 0, or E1 1). • <i>tdm-group-no-2</i>—Specifies the TDM group number assigned to the second controller.

Configuring Video over ATM AAL1

This section describes how to configure video over ATM AAL1 PVCs using CES. This functionality does not use the VDM, and SVCs are not supported. This section describes the video functionality supported on the MC3810 multiservice concentrator.

To configure video support over ATM AAL1 PVCs on a Cisco 3600 series router, see the “Configuring Structured CES” configuration task table in this chapter and refer to the *Cisco IOS Wide-Area Networking Configuration Guide* or the *OC-3/STM-1 ATM Circuit Emulation Service Network Module*.

To configure support for video streaming data over ATM AAL1 encapsulation using CES, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<pre>Router(config) # network-clock base-rate {56k 64k }</pre>	<p>Configures the network clock base rate.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • 56k—Sets the network clock to 56 kbps. • 64k—Sets the network clock to 64 kbps.
Step 2	<pre>Router(config) # controller {t1 e1} 0</pre>	<p>Selects T1/E1 controller 0. ATM is supported only on controller 0.</p>
Step 3	<pre>Router(config-controller) # mode atm</pre>	<p>Specifies that the controller will support ATM encapsulation and creates virtual ATM interface 0, which you will use to create the ATM permanent virtual circuits (PVCs).</p>
Step 4	<pre>Router(config-controller) # exit</pre>	<p>Exits controller configuration mode.</p>

	Command	Purpose
Step 5	Router(config)# interface atm 0 {multipoint point-to-point}	<p>Enters interface configuration mode to configure ATM interface.</p> <ul style="list-style-type: none"> • 0—Indicates the ATM port number. Because the ATM interface processor (AIP) and all ATM port adapters have a single ATM interface, the port number is always 0. • multipoint point-to-point—Specifies a multipoint or point-to-point subinterface.
Step 6	Router(config-if)# pvc [name] vpi/vci [ilmi qsaal smds]	<p>Creates an ATM permanent virtual circuit (PVC) and enters ATM PVC configuration mode.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>name</i>—(Optional) Specifies the name of the PVC or map. The name can be as many as 16 characters long. • <i>vpi</i>—Specifies the ATM network VPI for the PVC that you named. <p>The ATM network VPI of this PVC is an 8-bit field in the header of the ATM cell. The <i>vpi</i> value is unique only on a single link, not throughout the ATM network, because it has local significance only. The <i>vpi</i> value must match that of the switch. Valid values are from 0 to 255, but the value is usually 0 for ILMI communications. If a value is not specified, the <i>vpi</i> value is set to 0.</p> <p>Note You cannot set both <i>vpi</i> and <i>vci</i> to 0; if one is 0, the other cannot be 0.</p> <ul style="list-style-type: none"> • <i>vci</i>—Specifies the ATM network VCI for the PVC you named. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has only local significance. The <i>vci</i> value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp command. <p>Note Typically, the low <i>vci</i> values 0 to 31 are reserved for specific traffic (for example, F4 operations, administration, and maintenance [OAM]; SVC signaling; and ILMI). Do not use them for other PVCs.</p>

Command	Purpose
	<ul style="list-style-type: none"> • ilmi—(Optional) Sets up communication with the ILMI; the associated <i>vpi</i> and <i>vci</i> values ordinarily are 0 and 16, respectively. • qsaal—(Optional) Specifies a signaling-type PVC used for setting up or tearing down SVCs; the associated <i>vpi</i> and <i>vci</i> values ordinarily are 0 and 5, respectively. • smds—(Optional) A signaling-type PVC used for setting up or tearing down SVCs; the associated <i>vpi</i> and <i>vci</i> values ordinarily are 0 and 5, respectively.
Step 7 Router(config-if-atm-pvc)# encapsulation aal1	Sets the PVC to support ATM adaptation layer 1 (AAL1) encapsulation for video.
Step 8 Router(config-if-atm-pvc)# cbr rate	Configures the CBR for the ATM circuit emulation service (CES) for an ATM PVC on the Cisco MC3810 multiservice concentrator. By default, the <i>rate</i> argument used is the value configured with the vc-class command. The valid rate is from 56 to 10,000 kbps. The formula to calculate the CBR is 1.14 times the clock rate on the serial port.
Step 9 Router(config-if-atm-pvc)# exit	Exits ATM PVC configuration mode.
Step 10 Router(config)# interface serial number {multipoint point-to-point}	<p>Enters interface configuration mode for either serial port 0 or 1.</p> <p>For a full explanation of the keywords and argument, see Step 2 in the “Configuring Video in Pass-Through Mode” configuration task table in this chapter.</p>
Step 11 Router(config-if)# clock rate network-clock rate	Configures the network clock speed for serial ports 0 or 1 in data circuit-terminating equipment (DCE) mode on the Cisco MC3810 multiservice concentrator. The <i>rate</i> argument is the network clock speed in bits per second. The range is from 56 kbps to 2048 kbps. The value entered should be a multiple of the value set for the network-clock base-rate command. The maximum rate supported is 2048 Mbps.
Step 12 Router(config-if)# encapsulation atm-ces	Enables CES ATM encapsulation on the Cisco MC3810.

	Command	Purpose
Step 13	Router(config-if)# ces connect <i>atm-interface</i> pvc [<i>name</i> [<i>vpi</i> /] <i>vci</i>]	<p>Maps the CES service to the PVC.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> <i>atm-interface</i>—Specifies the number of the ATM interface. The only valid option on the Cisco MC3810 multiservice concentrator is ATM0. pvc—Specifies that the connection is to an ATM PVC. <i>name</i>—(Optional) The name of the ATM PVC. <i>vpi</i>—(Optional) The virtual path identifier value. <i>vci</i>—(Optional) The virtual channel identifier value.

Tuning Circuit Emulation Services Settings

Video streaming traffic over AAL1 uses CES. The default CES settings are sufficient for most configurations. However, you can tune the CES settings as needed.

To change the CES settings, use the following commands, beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# ces initial-delay <i>bytes</i>	Configures the maximum size of the CES circuit transmit buffer. The <i>bytes</i> argument specifies the size of the receive buffer of the CES circuit. The valid range is from 1 to 16,000 bytes. This command is used to accommodate cell jitter on the network. Bytes received from the ATM network are buffered by this amount before being sent to the CES port.
Step 2	Router(config-if)# ces partial-fill <i>octet</i>	Configures the number of user octets per cell for CES. The <i>octet</i> argument specifies the number of user octets per cell for the CES. Possible values of <i>octet</i> range from 0 to 47. Setting this number to zero disables partial cell fill and causes all cells to be completely filled before they are sent.

Configuring Video over ATM PVCs and SVCs

Video over ATM SVCs enables the Cisco MC3810 multiservice concentrator to provide dynamic and flexible videoconferencing system support. Using a plug-in VDM to provide an EIA/TIA-366 dialing interface to an H.320 video codec, the Cisco MC3810 automatically accepts dial-out requests from the video system. The codec connects to one of the Cisco MC3810 serial ports and also to the Cisco MC3810 EIA/TIA-366 dialup port.

This feature permits automatic PVC connections through a serial port. Each codec must place a call to the other videoconferencing system prior to the expiration of the video codec timeout period (set on the codec, usually 1 minute). Using a video dial map, each system reconciles the dialed number with a PVC that has already been configured, allowing fast connectivity.

This section describes the video functionality supported on the Cisco MC3810 and contains the following sections:

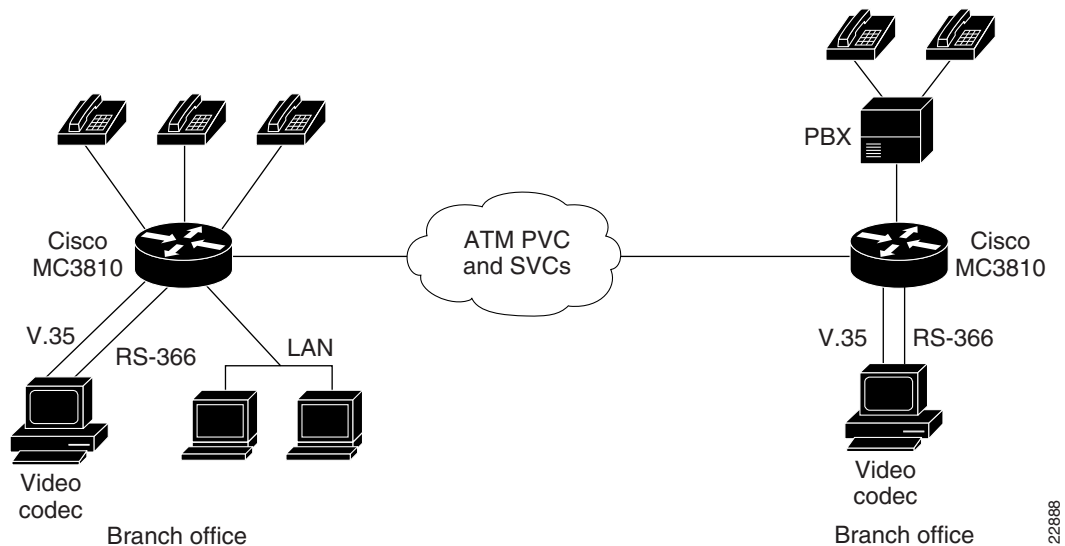
- [Configuring Network Clocks and Controllers, page 731](#)
- [Verifying Network Clock and Controller Configuration, page 734](#)
- [Configuring Serial Interfaces to Support the Video Codec, page 735](#)
- [Verifying Serial Interface Configuration for Video Codecs, page 736](#)
- [Configuring ATM Interfaces to Support Video over PVCs and SVCs, page 736](#)
- [Verifying ATM Interface Configuration for Video over PVCs and SVCs, page 742](#)
- [Configuring Video Dial Peers, page 744](#)
- [Verifying Video Dial-Peer Configuration, page 747](#)
- [Troubleshooting Video over ATM SVCs and PVCs, page 747](#)

Service providers, educational organizations, and enterprises can combine video streams and packet data on a single high-speed ATM link. A separate ATM access multiplexer is not needed. Features of the Cisco ATM SVC implementation include the following:

- AAL1 and CES encapsulation is used to transport video traffic to the destination using a single CBR virtual circuit that includes multiple ATM SVCs.
- The implementation adheres to the required features of the ATM Forum UNI specification, version 4.0, which simultaneously supports PVCs and SVCs.
- Video over ATM SVCs support codec speeds of 128, 384, 768, and 1152 kbps.
- The Cisco MC3810, responding to the design of many leading H.320-based video systems, receives the called-party information from the EIA/TIA-366 interface and then reconciles the dialed address with a standard 20-octet ATM network service access point (NSAP) address.

Figure 120 shows a sample ATM video application.

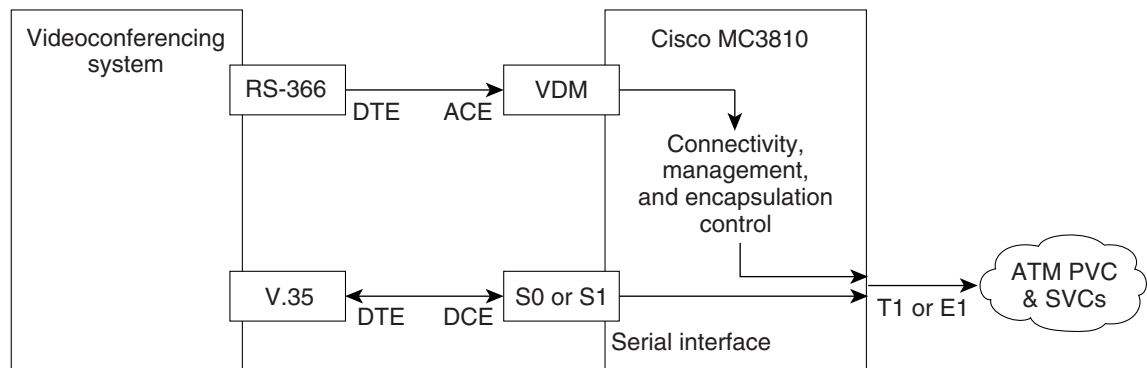
Figure 120 Sample ATM Video Application



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Figure 121 shows how the physical interfaces interact with software, the codec, and video data to handle connectivity and video functionality. The VDM automatic calling equipment (ACE) provides the EIA/TIA-366 interface to the video codec, and one of the Cisco MC3810 serial interfaces connects to the video codec DTE interface. The Video Call Manager (ViCM) software manages video calls that travel over a T1 or E1 facility through the Cisco MC3810 multiflex trunk (MFT) interface.

Figure 121 Physical Interfaces and Their Functions



DTE=data terminal equipment
DCE=data communications equipment
ACE=automatic calling equipment
VDM=video dialing module

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The following restrictions apply to video over ATM using SVCs:

- Point-to-point connectivity for ATM SVC video does not support tandem switching and network (local) hunting.
- You can connect only one video codec to a Cisco MC3810.

- For video SVCs, the ATM service class is not configurable. It is automatically set to CBR, which is the standard service class for video.

The following special hardware is required for this feature:

- A Cisco MC3810 video dialing module VDM and an MFT module for ATM network connectivity
- Two cables:
 - A new Cisco serial V.35 DCE cable (product number 72-1721-01) that includes a ringing indicator (RI) conductor. This cable carries the video stream between the Cisco MC3810 and the video equipment. Videoconferencing equipment often uses the V.35 RI as the incoming call-alerting signal. Cisco standard serial V.35 cables do not include the RI conductor.
 - A Cisco EIA/TIA-366 ACE cable (product number 72-1722-01) to connect the VDM to the videoconferencing equipment EIA/TIA-366 dialup DTE port.

For additional information about installation and other hardware considerations, refer to the *Cisco MC3810 Multiservice Concentrator Hardware Installation Guide*.

Configuring Network Clocks and Controllers

Because real-time video communications require a continuous and tightly meshed data stream to avoid loss of information, you must synchronize source and destination devices to a single master clock. In the following example, the clock source is derived from a device attached to T1 controller 0; then it is distributed to the devices attached to the local Cisco MC3810 serial ports and to T1 controller 1. Clock source decisions should be based on the network configuration, and a hierarchy of clock sources can be set up so that backup clock sources are available. For details, see the “Configuring Synchronized Clocking” appendix.

To configure network clocks and the controller to support real-time video, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# controller {T1 E1} <i>number</i>	Enters controller configuration mode for controller T1/E1 0. The <i>number</i> argument indicates the network module number. The range is from 0 to 2. ATM traffic is supported on controller T1/E1 0 only.
Step 2	Router(config-controller)# clock source {line internal loop-timed}	Configures controller T1/E1 0 to obtain its clocking from the internal network clock PLL. (Use the internal keyword.) Keyword definitions are as follows: <ul style="list-style-type: none"> • line—Specifies that the DS1 link uses the recovered clock. The line value is the default clock source used when the multiflex trunk module (MFT) is installed. • internal—Specifies that the DS1 link uses the internal clock. The internal value is the default clock source used when the digital voice module (DVM) is installed.

Command	Purpose
	<ul style="list-style-type: none"> • loop-timed—Specifies that the T1/E1 controller will take the clock from the Rx (line) and use it for Tx. This setting decouples the controller clock from the system-wide clock set with the network-clock-select command. The loop-timed clock enables the DVM to connect to a PBX and to connect the MFT to a central office when both the PBX and the central office function as DCE clock sources. This situation assumes that the PBX also takes the clocking from the central office, thereby synchronizing the clocks on the DVM and the MFT.
Step 3 Router(config-controller)# no shutdown	Activates the controller.
Step 4 Router(config)# controller {T1 E1} 1	Enters controller configuration mode for controller T1/E1 1. The <i>number</i> argument indicates the network module number. The range is from 0 to 2.
Step 5 Router(config-controller)# clock source {line internal loop-timed}	Sets the T1/E1 line clock source. For an explanation of the keywords, see Step 2 in this configuration task table.
Step 6 Router(config-controller)# no shutdown	Activates the controller.
Step 7 T1 Line Router(config-controller)# framing {sf esf} E1 Line Router(config-controller)# framing {crc4 no-crc4} [australia]	Sets the framing for the E1 or T1 data line. The keywords are as follows: <ul style="list-style-type: none"> • sf—Specifies Super Frame as the T1 frame type. • esf—Specifies Extended Super Frame as the T1 frame type. This frame type is required for ATM on T1 lines. This setting is automatic for T1 when ATM mode is set. • crc4—Specifies CRC4 frame as the E1 frame type. This frame type is required for ATM on E1 lines. This setting is automatic for E1 when the ATM mode is set. • no-crc4—Specifies no CRC4 frame as the E1 frame type. • australia—(Optional) Specifies the E1 frame type used in Australia.

	Command	Purpose
Step 8	Router(config-controller)# linecode { ami b8zs hdb3 }	<p>Selects the line-code type for T1 or E1 lines.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • ami—Specifies alternate mark inversion (AMI) as the line-code type. It is valid for T1 or E1 controllers. This is the default for T1 lines. • b8zs—Specifies binary 8-zero substitution (B8ZS) as the line-code type. It is required for ATM on T1 lines. This setting is automatic for T1 when the ATM mode is set. • hdb3—Specifies high-density bipolar 3 (HDB3) as the line-code type. It is required for ATM on E1 lines. This setting is automatic for E1 when the ATM mode is set. <p>Note When the E1 controller is specified, you must also configure scrambling on the ATM 0 interface. See Step 3 of the “Configuring ATM Interfaces to Support Video over PVCs and SVCs” configuration task table in this chapter.</p>
Step 9	Router(config-controller)# mode { atm cas }	<p>Sets the mode of the T1/E1 controller and enters specific configuration commands for each mode type.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • atm—Sets the controller into ATM mode and creates an ATM interface (ATM 0) on the Cisco MC3810. When ATM mode is enabled, no channel groups, channel-associated signaling (CAS) groups, common channeling signaling (CCS) groups, or clear channels are allowed because ATM occupies all the DS0s on the T1/E1 trunk. <p>When you set the controller to ATM mode, the controller framing is automatically set to ESF for T1 or CRC4 for E1. The line code is automatically set to B8ZS for T1 or HDBC for E1. When you remove ATM mode by entering the no mode atm command, ATM interface 0 is deleted.</p> <p>ATM mode is supported only on controller 0 (T1 or E1 0).</p> <ul style="list-style-type: none"> • cas—Sets the controller into CAS mode, which allows you to create channel groups, CAS groups, and clear channels (both data and CAS modes). <p>CAS mode is supported on both controllers 0 and 1.</p>
Step 10	Router(config-controller)# exit	Exits controller configuration mode.

Command	Purpose
Step 11 Router(config)# network-clock base-rate {56k 64k}	<p>Sets the network clock base rate for the serial ports. For video stream rates of 384, 768, 1.152, or 1.28 kbps, set the rate to 64 kbps. The default is 56 kbps. (see Step 1 in the “Configuring Video over ATM AAL1” configuration task table in this chapter.)</p> <p>Note At this point, you can also configure network protocol settings, such as IP hosts. For more information, see the <i>Cisco IOS IP Configuration Guide</i>.</p>

Verifying Network Clock and Controller Configuration

To verify the configuration of network clock sources and controller settings, complete the following steps:

- Step 1** Enter the **show network-clocks** privileged EXEC command to see the status of clock source settings. In this example, the “inactive config” clock setting is the current configuration:

```
Router# show network-clocks

Priority 1 clock source(inactive config): T1 0
Priority 1 clock source(active config): T1 0
Clock switch delay: 10
Clock restore delay: 10
T1 0 is clocking system bus for 9319 seconds.
Run Priority Queue: controller0
```

- Step 2** Enter the **show controllers t1** or **show controllers e1** privileged EXEC commands to see the status of T1 or E1 controllers, as in the following example:

```
Router# show controller t1 1

T1 1 is up.
  Applique type is Channelized T1
  Cablelength is long gain36 0db
  No alarms detected.
  Slot 4 CSU Serial #07789650 Model TEB HWVersion 4.70 RX level = 0DB
  Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
  Data in current interval (819 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Data in Interval 1:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Data in Interval 2:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  .
  .
  Data in Interval 96:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```



```

Total Data (last 24 hours)
    0 Line Code Violations, 0 Path Code Violations,
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs

!
Router# show controllers E1 1
E1 1 is up.
    Applique type is Channelized E1 - balanced
    No alarms detected.
    Slot 4 Serial #06868949 Model TEB HWVersion 3.80
    Framing is CRC4, Line Code is HDB3, Clock Source is Internal.
    Data in current interval (292 seconds elapsed):
        0 Line Code Violations, 0 Path Code Violations
        0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
        0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
    .
    .
    .
Total Data (last 66 15 minute intervals):
    9 Line Code Violations, 0 Path Code Violations,
    1 Slip Secs, 0 Fr Loss Secs, 4 Line Err Secs, 0 Degraded Mins,
    5 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs

```

Configuring Serial Interfaces to Support the Video Codec

The configuration of serial interfaces to support the video codec is supported only on the Cisco MC3810 multiservice concentrator.

To configure the serial interfaces, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# interface serial {0 1}	Enters interface configuration mode for either for serial 0 or serial 1, depending on where the video codec is connected.
Step 2	Router(config-if)# clock rate network rate	Configures the network clock speed for DCE mode, in bits per second, corresponding to the video stream rate you are using. The <i>rate</i> must be a multiple of the value set with the network-clock base-rate command in Step 11 of the “Configuring Network Clocks and Controllers” configuration task table in this chapter. Make sure this setting is 384000, 768000, or 1152000. 768000 is a common setting.
Step 3	Router(config-if)# encapsulation atm-ces	Configures the interface for ATM encapsulation circuit emulation service (CES), which is required for video codec support.

	Command	Purpose
Step 4	Router(config-if)# serial restart-delay <i>count</i>	<p>Sets the amount of time that the router waits before trying to bring up a serial interface when the interface goes down. The router resets the hardware each time the restart timer expires. This command is often used with dial backup and with the pulse-time command, which sets the amount of time to wait before redialing when a data terminal ready (DTR) dialed device fails to connect.</p> <p>The <i>count</i> argument is a value from 0 to 900 in seconds. This is the frequency at which the hardware is reset. A value of 0 means that the hardware is not reset when down. If the interface is used to answer a call, it does not cause the DTR circuit to drop. If the DTR circuit drops, the modem can disconnect.</p>

Verifying Serial Interface Configuration for Video Codecs

To see the status of all serial interfaces or of a specific serial interface, enter the privileged EXEC command **show interfaces serial** as shown in the example below. You can use this command to check the encapsulation, scrambling, and serial restart delay settings:

```
Router# show interface serial0

Serial0 is down, line protocol is down
  Hardware is PQUICC Serial Trans
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 65/255, rxload 1/255
  Encapsulation CES-ATM, loopback not set
  Keepalive not set
  Scramble enabled
  Restart-Delay is 0 secs
  Last input never, output never, output hang never
  Last clearing of "showshow interface" counters 5d13h
  Queueing strategy: fifo
  Output queue 0/100, 101 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    13452224 packets input, 1526136219 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    215189699 packets output, 1654453088 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
  Cable attached: V.35 (DCE)
  Hardware config: V.35; DCE; PLL nx64K;
  DSR = UP   DTR = DOWN   RTS = DOWN   CTS = DOWN   DCD = DOWN
```

Configuring ATM Interfaces to Support Video over PVCs and SVCs

This section demonstrates how to set up the ATM interface and how to configure the ATM interface to support video over PVCs and SVCs. The video NSAP addressing commands specify session target information for SVC video communications.

This feature is supported only on the Cisco MC3810 multiservice concentrator.

To configure ATM interfaces to support video over PVCs and SVCs (including configuring a dial PVC for videoconferencing), use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# interface atm <i>slot/port.subinterface-number</i> { multipoint point-to-point }	<p>Enters interface configuration mode.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>slot</i>—Specifies the backplane slot number on your router. The value ranges from 0 to 4, depending on what router you are configuring. Refer to your router hardware documentation. • <i>/0</i>—ATM port number. Because the ATM Interface Processor (AIP) and all ATM port adapters have a single ATM interface, the port number is always 0. • <i>.subinterface-number</i>—Specifies a subinterface number in the range from 1 to 4294967293. • multipoint—Specifies that your network is fully meshed and you want to communicate with multiple routers. • point-to-point—Configures the subinterface for communication with one router, as in a hard-wired connection. There is no default for this parameter.
Step 2	Router(config-if)# ip address <i>ip-address mask</i> [secondary]	<p>For IP protocol communications, assigns the IP address and subnet mask to the interface.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>ip-address</i>—IP address. • <i>mask</i>—Mask for the associated IP subnet. • secondary—(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.
Step 3	Router(config-if)# atm scramble-enable	(E1 configuration only) Helping to ensure reliability, scrambling randomizes the ATM cell payload frames to avoid continuous nonvariable bit patterns and to improve the efficiency of ATM cell delineation algorithms.

Command	Purpose
Step 4 Router(config-if)# atm video aesa { default <i>esi-address</i> }	<p>Sets the unique ATM end-station address (AESA) for an ATM video interface that is using switched virtual circuit (SVC) mode.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • default—Automatically creates a network service access point (NSAP) address for the interface, based on a prefix from the ATM switch (26 hexadecimal characters), the MAC address (12 hexadecimal characters) as the end system identifier (ESI), and a selector byte (two hexadecimal characters). • <i>esi-address</i>—Requires that you enter 12 hexadecimal characters as the ESI. The ATM switch provides the prefix, and the video selector byte provides the remaining characters. <p>You can view the assigned address by using the show atm video-voice address command.</p>
Step 5 Router(config-if)# pvc [<i>name</i>] <i>vpi/vci</i> [ilmi qsaal smds]	<p>Creates or assigns a name to an ATM permanent virtual circuit (PVC), specifies the encapsulation type on an ATM PVC, and enters interface-ATM-VC configuration mode.</p> <p>Note To set up communication with the Integrated Local Management Interface (ILMI), enter the ilmi keyword for ATM adaptation layer encapsulation; the associated <i>vpi</i> and <i>vci</i> values are ordinarily 0 and 16, respectively.</p> <p>Note To enable the signaling for setup and teardown of SVCs, specify the Q.SAAL (signaling ATM adaptation layer) encapsulation as the <i>name</i>; the associated <i>vpi</i> and <i>vci</i> values are ordinarily 0 and 5, respectively. You cannot create this PVC on a subinterface.</p>

Command	Purpose
	<p>Complete keyword and argument definitions are as follows:</p> <ul style="list-style-type: none"> • <i>name</i>—(Optional) Specifies a unique label that can be up to 16 characters long. It identifies to the processor the virtual path identifier-virtual channel identifier (VPI-VCI) pair to use for a particular packet. • <i>vpi</i>—Specifies the ATM network VPI for the PVC that you named. The absence of the "/" and a <i>vpi</i> value defaults the <i>vpi</i> value to 0. The ATM network VPI of this PVC is an 8-bit field in the header of the ATM cell. The <i>vpi</i> value is unique only on a single link, not throughout the ATM network, because it has local significance only. The <i>vpi</i> value must match that of the switch. Valid values are from 0 to 255, but the value is usually 0 for ILMI communications. If a value is not specified, the <i>vpi</i> value is set to 0. <p>Note You cannot set both <i>vpi</i> and <i>vci</i> to 0; if one is 0, the other cannot be 0.</p> <ul style="list-style-type: none"> • <i>vci</i>—Specifies the ATM network VCI for the PVC you named. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has only local significance. The <i>vci</i> value ranges from 0 to 1 less than the maximum value set for this interface by the atm vc-per-vp command. <p>Note Typically, the low <i>vci</i> values 0 to 31 are reserved for specific traffic (for example, F4 operations, administration, and maintenance [OAM]; SVC signaling; and ILMI). Do not use them for other PVCs.</p> <ul style="list-style-type: none"> • <i>ilmi</i>—(Optional) Sets up communication with the ILMI; the associated <i>vpi</i> and <i>vci</i> values ordinarily are 0 and 16, respectively.

Command	Purpose
	<ul style="list-style-type: none"> • qsaal—(Optional) Specifies a signaling-type PVC used for setting up or tearing down SVCs; the associated <i>vpi</i> and <i>vci</i> values ordinarily are 0 and 5, respectively. • smds—(Optional) Specifies encapsulation for switched multimegabit data service (SMDS) networks. If you are configuring an ATM PVC on the ATM Interface Processor (AIP), you must configure AAL3/4SMDS using the atm aal aal3/4 command before specifying smds encapsulation. If you are configuring an ATM network processor module (NPM), the atm aal aal3/4 command is not required. SMDS encapsulation is not supported on the ATM port adapter.
<p>Step 6</p> <pre>Router(config-if-atm-pvc)# protocol protocol {<i>protocol-address</i> inarp} [[no] broadcast]</pre>	<p>Configures a static map for an ATM permanent PVC, SVC, or virtual circuit (VC) class or enables Inverse Address Resolution Protocol (ARP) or Inverse ARP broadcasts on an ATM PVC.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>protocol</i>—Specifies one of the following: <ul style="list-style-type: none"> – aarp—AppleTalk ARP – apollo—Apollo domain – appletalk—AppleTalk – arp—IP ARP – arpbridge—bridging – bstun—block serial tunnel – cdp—Cisco Discovery Protocol – clns—ISO Connectionless Network Service (CLNS) – clns_es—ISO CLNS end system – clns_is—ISO CLNS intermediate system – cmns—ISO Connection-Mode Network Service (CMNS) – compressedtcp—Compressed TCP – decnet—DECnet – decnet_node—DECnet node – decnet_prime_router—DECnet prime router – decnet_router-l1—DECnet router L1 – decnet_router-l2—DECnet router L2

Command	Purpose
	<ul style="list-style-type: none"> - dlsw—data link switchin - ip—IP - ipx—Novell IPX - llc2—llc2 - pad—Packet assembler/disassembler (PAD) links - qllc—Qualified Logical Link Control protocol - rsrb—remote source-route bridging - snapshot—snapshot routing support - stun—serial tunnel - vines—Banyan VINES - xns—Xerox Network Systems protocol • <i>protocol-address</i>—Specifies the destination address that is being mapped to a PVC. • inarp—(Valid only for IP and IPX protocols on PVCs) Enables Inverse ARP on an ATM PVC. If you specify <i>protocol-address</i> instead of inarp, Inverse ARP is automatically disabled for that protocol. • [no] broadcast—(Optional) broadcast indicates that this map entry is used when the corresponding protocol sends broadcast packets to the interface (for example, Interior Gateway Routing Protocol [IGRP] updates. Pseudobroadcasting is supported. The broadcast keyword of the protocol command takes precedence if you previously configured the broadcast command on the ATM PVC or SVC.
Step 7 Router(config-if-atm-pvc)# cbr <i>rate</i>	Configures the CBR for the ATM circuit emulation service (CES) for an ATM PVC on the Cisco MC3810 multiservice concentrator. By default, the <i>rate</i> argument used is the value configured with the vc-class command. The valid rate is from 56 to 10,000 kbps. The formula for calculating the CBR is 1.14 times the clock rate on the serial port.
Step 8 Router(config-if-atm-pvc)# encapsulation aal1	Configures ATM adaptation layer 1 (AAL1) encapsulation necessary for videoconferencing using PVCs.

Verifying ATM Interface Configuration for Video over PVCs and SVCs

To verify ATM interface configuration, complete the following steps:

- Step 1** Enter the **show atm pvc** command with the VPI/VCI specified to see the PVCs that are set up for ILMI management and Q.SAAL signaling, as in the following examples:

```
Router# show atm pvc 0/5
```

```
ATM0: VCD: 2, VPI: 0, VCI: 5, Connection Name: SAAL
UBR, PeakRate: 56
AAL5-SAAL, etype:0x4, Flags: 0x26, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s), OAM retry frequency: 1
second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP DISABLED
InPkts: 2044, OutPkts: 2064, InBytes: 20412, OutBytes: 20580
InProc: 2044, OutProc: 2064, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Compress: Disabled
Status: INACTIVE, State: NOT_IN_SERVICE
!
```

```
Router# show atm pvc 0/16
```

```
ATM0: VCD: 1, VPI: 0, VCI: 16, Connection Name: ILMI
UBR, PeakRate: 56
AAL5-ILMI, etype:0x0, Flags: 0x27, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s), OAM retry frequency: 1
second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP DISABLED
InPkts: 398, OutPkts: 421, InBytes: 30493, OutBytes: 27227
InProc: 398, OutProc: 421, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Compress: Disabled
Status: INACTIVE, State: NOT_IN_SERVICE
```


- Step 2** Enter the **show interface atm 0** privileged EXEC command to see information about the ATM interface, as in the following example:

```
Router# show interface atm 0
```

```
ATM0 is up, line protocol is up
  Hardware is PQUICC Atom1
  Internet address is 9.1.1.6/8
  MTU 1500 bytes, sub MTU 1500, BW 1536 Kbit, DLY 20000 usec,
    reliability 255/255, txload 22/255, rxload 11/255
  NSAP address: 47.0091810000000002F26D4901.000011116666.06
  Encapsulation ATM
  292553397 packets input, 3437519137 bytes
  164906758 packets output, 1937663833 bytes
  0 OAM cells input, 0 OAM cells output, loopback not set
  Keepalive not supported
  Encapsulation(s):, PVC mode
  1024 maximum active VCs, 28 current VCCs
  VC idle disconnect time: 300 seconds
  Signalling vc = 1, vpi = 0, vci = 5
  UNI Version = 4.0, Link Side = user
  Last input 00:00:00, output 2d05h, output hang never
  Last clearing of "show interface" counters never
  Input queue: -1902/75/0 (size/max/drops); Total output drops: 205
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 67000 bits/sec, 273 packets/sec
  5 minute output rate 136000 bits/sec, 548 packets/sec
  76766014 packets input, 936995443 bytes, 0 no buffer
  Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  367264676 packets output, 3261882795 bytes, 0 underruns
  0 output errors, 0 collisions, 2 interface resets
  0 output buffer failures, 0 output buffers swapped out
```

- Step 3** Enter the **show atm vc** privileged EXEC command to see how SVCs and PVCs are set up, as in the following example:

```
Router# show atm vc
```

VCD /						Peak	Avg/Min	Burst		
Interface	Name	VPI	VCI	Type	Encaps	SC	Kbps	Kbps	Cells	Sts
0	1	0	5	PVC	SAAL	UBR		56		UP
0	2	0	16	PVC	ILMI	UBR		56		UP
0	3	34	35	PVC	AAL1	CBR	768	768		UP
0	4	38	39	SVC	CES	CBR	768	768		UP

- Step 4** Enter the **show atm video-voice address** privileged EXEC command to see information about the ATM interface address, which is particularly helpful because the address is assigned automatically through the **atm voice aesa** command. The following example also confirms that the ILMI status is confirmed—the ILMI PVC is set up to allow SVC management:

```
Router# show atm video-voice address
```

nsap address	type	ilmi status
47.0091810000000002F26D4901.00107B4832E1.FE	VOICE_AAL5	Confirmed
47.0091810000000002F26D4901.00107B4832E1.C8	VIDEO_AAL1	Confirmed

Configuring Video Dial Peers

The video dial peer feature is supported on only the Cisco MC3810 multiservice concentrator.

To configure video dial peers, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# port signal <i>slot/port</i>	<p>Specifies the slot where the video dialing module (VDM) is located and the port for the EIA/TIA-366 interface.</p> <p>The arguments are as follows:</p> <ul style="list-style-type: none"> • <i>slot</i>—Indicates that the value of the VDM is either 1 or 2. • <i>port</i>—Enters the port location of the RS-366 interface. The Cisco MC3810 VDM has only one video port, so the <i>port</i> value is 0.
Step 2	Router(config)# dial-peer video <i>tag</i> { videocodec videoatm }	<p>Defines a video ATM dial peer for the remote system and enters dial-peer configuration mode. Video dial peers are persistent and exist until they are specifically removed with the no form of the dial-peer video command.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>tag</i>—Identifies the dial peer and must be unique on the Cisco MC3810. Do not duplicate a specific tag number. Valid values are from 1 to 10000. • videocodec—Specifies a local video codec connected to the router. • videoatm—Specifies a remote video codec on the ATM network.
Step 3	Router(config-dial-peer)# destination-pattern [+] <i>string</i> [T]	<p>Specifies the E.164 address associated with this dial peer.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • +—(Optional) Specifies a character indicating an E.164 standard number. The plus sign (+) is not supported on the Cisco MC3810. • <i>string</i>—Indicates a series of digits that specify the E.164 or private dialing plan telephone number. Valid entries are the digits 0 through 9, the letters A through D, and the following special characters: <ul style="list-style-type: none"> – The asterisk (*) and pound sign (#)—Indicate the keys that appear on standard touch-tone dial pads.

Command	Purpose
	<ul style="list-style-type: none"> – Comma (,)—Inserts a pause between digits. – Period (.)—Matches any entered digit (this character is used as a wildcard). – Percent sign (%)—Indicates that the preceding digit or pattern occurred zero or multiple times, similar to the wildcard in the regular expression. – Plus sign (+)—Specifies a sequence of one or more of the character or pattern. <p>Note The plus sign used as part of the digit string is different from the plus sign that can be used in front of the digit string to indicate that the string is an E.164 standard number.</p> <ul style="list-style-type: none"> – Circumflex accent (^)—Indicates a match to the beginning of the string. – Dollar sign (\$)—Matches the null string at the end of the input string. – Backslash symbol (\)—Indicates a character followed by a single character matching the first character or by a single character having no other significance. – Question mark (?)—Indicates that the preceding digit occurred zero or one time. – Brackets ([])—Indicate a range of digits. A range is a sequence of characters enclosed in the brackets; only numeric characters from 0 to 9 are allowed in the range. This is similar to a regular expression rule. – Parentheses ()—Indicate a pattern and are the same as the regular expression rule, for example, 408(555). Parentheses are used in conjunction with symbols ?, %, and +. <p>For more information on applying wildcard symbols to destination patterns and the dial strings that result, see the “Configuring Dial Plans, Dial Peers, and Digit Manipulation” chapter.</p> <ul style="list-style-type: none"> • T—(Optional) Control character indicating that the destination-pattern value is a variable-length dial string.

	Command	Purpose
Step 4	Cisco MC3810 Multiservice Concentrator <pre>Router(config-dial-peer)# session target {serial atm} interface {svc nsap nsap-address pvc {name vpi/vci vci}}</pre>	<p>Configures the ATM session target for the dial peer.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • serial—Specifies the serial interface for the dial-peer address. • atm—Specifies the ATM interface number. The only valid number is 0. • interface—Specifies the interface number. • svc nsap—Specifies the switched virtual circuit (SVC) network service access point (NSAP) address. • nsap-address—Specifies a 40-digit hexadecimal number for the session target NSAP. • pvc—Specifies a permanent virtual circuit (pvc). • name—Specifies the name of the session target ATM PVC. • vpi/vci—Specifies the ATM network virtual path identifier (VPI) and virtual channel identifier (VCI) of this PVC. • vci—Specifies the ATM network VCI of this PVC. <p>Note If you are using PVCs to send video data, you can also specify a PVC defined on the ATM interface as a session target by using a name or a VPI-VCI combination.</p>
Step 5	<pre>Router(config-dial-peer)# exit</pre>	Exits dial peer configuration mode.
Step 6	<pre>Router(config)# dial-peer video tag {videocodec videoatm}</pre>	<p>Defines a video ATM dial peer for the local video codec.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • tag—Defines the dial peer and assigns the protocol type to the peer. Valid entries are from 1 to 10000. The tag must be unique on the router. • videocodec—Specifies a local video codec connected to the router. • videoatm—Specifies a remote video codec on the ATM network.
Step 7	<pre>Router(config-dial-peer)# destination-pattern [+] string [T]</pre>	<p>Specifies the E.164 address associated with this dial peer.</p> <p>For an explanation of the keywords and arguments, see Step 3 of this configuration task table.</p>
Step 8	<pre>Router(config-dial-peer)# port signal slot/port</pre>	<p>Specifies the slot where the VDM is located and the port for the EIA/TIA-366 interface.</p> <p>For an explanation of the arguments, see Step 1 in this configuration task table.</p>

	Command	Purpose
Step 9	Router(config-dial-peer)# port media <i>interface</i>	Specifies the serial interface where the local video codec is connected for a local video dial peer. The <i>interface</i> argument indicates the serial interface where the local codec is connected. Valid entries are the numbers 1 or 0.
Step 10	Router(config-dial-peer)# nsap <i>nsap-address</i>	Specifies the NSAP address for the codec. The <i>nsap-address</i> argument is a 40-digit hexadecimal number that must be unique on the device.

Verifying Video Dial-Peer Configuration

To verify the dial-peer configuration, enter the **show dial-peer video** privileged EXEC command. In the following example, note that the third dial peer uses a PVC specified with a VPI-VCI value while the second uses an SVC. The first dial peer is for the local codec.

```
Router# show dial-peer video

Video Dial-Peer 1
  type = videocodec, destination-pattern = 111
  port signal = 1/0, port media = Serial1
  nsap = 47.0091810000000050E201B101.00107B09C6F2.C8
Video Dial-Peer 2
  type = videoatm, destination-pattern = 222
  session-target = ATM0 svc nsap 47.0091810000000050E201B101.00E01E92ADC2.C8
Video Dial-Peer 3
  type = videoatm, destination-pattern = 333
  session-target = ATM0 pvc 70/70
```

Troubleshooting Video over ATM SVCs and PVCs

When problems occur with video over ATM PVCs or SVCs on the Cisco MC3810 multiservice concentrator, perform the following steps to find the source of your problems. Common problems are addressed before more complex problems:



Note

If you are using dial PVCs (rather than SVCs) for video communications, ensure that both parties dial one another within the timeout period that is set on the codec. This timeout period is usually one minute.

- Step 1** Check the LEDs on the EIA/TIA-366 interface. If the green LED is not lit, there may be a hardware problem, or the correct image may not be loaded. For more information, see the *Cisco MC3810 Multiservice Concentrator Hardware Installation Guide*.
- Step 2** Make sure that the ATM interface, serial ports, and controllers are set to **no shutdown**.

Step 3 Check the serial interface configuration.

- If you are using dial PVCs for video, do not include the **ces connect** serial interface command because this command does not provide mapping to the ATM interface for PVCs (or SVCs) for the dial video feature. Instead, create dial PVCs under ATM interface configuration. If the **ces connect** command has been configured, it appears in **show running-config** command output under serial interface 0 or 1.
- Enter the **show interfaces serial** privileged EXEC command. Ensure that the serial interface communications circuitry is operational, as shown in the last line of the **show interfaces serial** command output:

```
DSR = UP   DTR = UP   RTS = UP   CTS = UP   DCD = UP
```

Step 4 (For SVCs only) On both Cisco MC3810 multiservice concentrators, make sure that ILMI and Q.SAAL PVCs are set up to allow SVC communications. The **show atm pvc** privileged EXEC command displays information about configured PVCs, including the ILMI and Q.SAAL PVCs.

```
Router# show atm pvc
```

VCD /											
Interface	Name	VPI	VCI	Type	Encaps	Peak SC	Avg/Min Kbps	Burst Kbps	Cells	Sts	
0	1	0	5	PVC	SAAL	UBR		56		UP	
0	2	0	16	PVC	ILMI	UBR		56		UP	

Step 5 (For dial PVCs only) On both Cisco MC3810 multiservice concentrators, make sure that PVCs are set up to allow dial PVC connections and that CBR is the configured service class (SC). In addition, the bit rate must correspond to the rate set on the serial interface. The **show atm pvc** privileged EXEC command displays information about configured PVCs.

```
Router# show atm vc
```

VCD /											
Interface	Name	VPI	VCI	Type	Encaps	Peak SC	Avg/Min Kbps	Burst Kbps	Cells	Sts	
0	3	38	35	PVC	AAL1	CBR	384	384		UP	

Step 6 (For SVCs only) Ensure that NSAP addresses are set up and confirmed as operational under the ATM interfaces of the Cisco MC3810 multiservice concentrators on both sides of the communication. Enter the **show atm video-voice address** or **show atm ilmi-status** privileged EXEC commands, as shown in the following example. The **show atm ilmi-status** command provides more details about the ILMI PVC than does the **show atm video-voice address** command.

```
Router# show atm video-voice address
```

nsap address	type	ilmi status
47.0091810000000002F26D4901.00107B4832E1.FE	VOICE_AAL5	Confirmed
47.0091810000000002F26D4901.00107B4832E1.C8	VIDEO_AAL1	Confirmed

```
Router# show atm ilmi-status
```

```
Interface : ATM0 Interface Type : Private UNI (User-side)
ILMI VCC : (0, 16) ILMI Keepalive : Enabled (5 Sec 4 Retries)
ILMI State: UpAndNormal
Peer IP Addr: 10.1.1.11 Peer IF Name: ATM1/0/0
Peer MaxVPIbits: 8 Peer MaxVCIBits: 14
Active Prefix(s) :
47.0091.8100.0000.0002.f26d.4901
End-System Registered Address(s) :
47.0091.8100.0000.0002.f26d.4901.0000.1111.5555.05(Confirmed)
47.0091.8100.0000.0002.f26d.4901.0010.7b48.32e1.fe(Confirmed)
47.0091.8100.0000.0002.f26d.4901.0010.7b48.32e1.c8(Confirmed)
```

- Step 7** Check for clocking problems. Enter the **show controllers t1** or **show controllers e1** privileged EXEC command to check for slip errors, as shown in the following excerpt from the command output:

```
.
.
.
Data in current interval (819 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Data in Interval 1:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Data in Interval 2:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Data in Interval 3:
    0 Line Code Violations, 0 Path Code Violations
    0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
    0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
.
.
.
```

A few slip errors may not indicate a problem with clocking. However, if there are numerous errors, check the following possibilities:

- The network clocks are not set to the same clock rate. Enter the **show network-clocks** command on the devices to ensure that these clock rates match.
- The Cisco MC3810 multiservice concentrators may not be using the same clock source. For example, if there are two back-to-back Cisco MC3810 multiservice concentrators and one is using an internal clock source, the other must use the line clock source to obtain clocking from the same device. Enter the **show network-clocks** and **show controllers t1** or **show controllers e1** commands to see the clock source settings. For additional guidance, see the “Configuring Synchronized Clocking” appendix.

- Step 8** Check the functionality of the Service-Specific Connection-Oriented Protocol (SSCOP). Enter the **show sscop** privileged EXEC command. See the following excerpt from the command output:

```
Router# show sscop

SSCOP details for interface ATM0
Current State = Data Transfer Ready
```

Interpretation of the command output requires familiarity with SSCOP, so unless you are familiar with the protocol, just use the command to ensure that the protocol is in a state of readiness. If you need to make changes, see the *Cisco IOS Wide-Area Networking Configuration Guide*.



Note If you plan to adjust SSCOP parameters, you may wish to complete the rest of the troubleshooting steps before doing so.

- Step 9** Enter the **show dial-peer video** command on the local and remote concentrators to verify that each has been configured properly to communicate with the other:

```
Router1# show dial-peer video

dial-peer video 111 videocodec
nsap 47.0091810000000002F26D4901.00107B4832E1.C8
port signal 1/0
```

```

port media Serial0
destination-pattern 121
!
dial-peer video 221 videoatm
destination-pattern 221
session target ATM0 svc nsap 47.0091810000000002F26D4901.00107B09C645.C8

```

```
Router2# show dial-peer video
```

```

dial-peer video 111 videocodec
nsap 47.0091810000000002F26D4901.00107B09C645.C8
port signal 1/0
port media Serial0
destination-pattern 221
!
dial-peer video 121 videoatm
destination-pattern 121
session target ATM0 svc nsap 47.0091810000000002F26D4901.00107B4832E1.C8

```

- Step 10** Enter the **show video call summary** command to quickly check the status of calls on the local and remote multiservice access concentrators. “ViCM” is the internal video call manager.

When no call is in progress, the output looks like this:

```
Router# show video call summary
```

```
Serial0:ViCM = Idle, Codec Ready
```

When a call is starting, the output looks like this:

```
Router# show video call summary
```

```
Serial0:ViCM = Call Connected
```

When a call is disconnecting, the output looks like this:

```
Router# show video call summary
```

```
Serial0:ViCM = Idle
```

- Step 11** Enter the privileged EXEC **show call history video record** command to see information about current and recent video calls, allowing analysis of possible problems:

```
Router# show call history video record
```

```

CallId = 4
CalledNumber = 221
CallDuration = n/a - call is in progress
DisconnectText = n/a - call is in progress
SVC: call ID = 8598630
Remote NSAP = 47.0091810000000002F26D4901.00107B09C645.C8
Local NSAP = 47.0091810000000002F26D4901.00107B4832E1.C8
vcd = 414, vpi = 0, vci = 158
SerialPort = Serial0
VideoSlot = 1, VideoPort = 0

```

```

CallId = 3
CalledNumber = 221
CallDuration = 557 seconds
DisconnectText = local hangup
SVC: call ID = 8598581
Remote NSAP = 47.0091810000000002F26D4901.00107B09C645.C8
Local NSAP = 47.0091810000000002F26D4901.00107B4832E1.C8
vcd = 364, vpi = 0, vci = 108

```



```

SerialPort = Serial0
VideoSlot = 1, VideoPort = 0

CallId = 2
CalledNumber = n/a - incoming call
CallDuration = 125 seconds
DisconnectText = local hangup
SVC: call ID = 8598484
Remote NSAP = n/a
Local NSAP = 47.0091810000000002F26D4901.00107B4832E1.C8
vcd = 264, vpi = 0, vci = 273
SerialPort = Serial0
VideoSlot = 1, VideoPort = 0

CallId = 1
CalledNumber = n/a - incoming call
CallDuration = 171651 seconds
DisconnectText = remote hangup
SVC: call ID = 8594356
Remote NSAP = n/a
Local NSAP = 47.0091810000000002F26D4901.00107B4832E1.C8
vcd = 7, vpi = 0, vci = 39
SerialPort = Serial0
VideoSlot = 1, VideoPort = 0

```

Step 12 Enter the **debug video vicm** command to follow in-progress calls carefully. Comments are framed in asterisks (*):

```

Router# debug video vicm

Video ViCM FSM debugging is on

***** Starting Video call *****

Router# SVC HANDLE in rcvd:0x80001B:

00:42:55:ViCM - current state = Idle, Codec Ready
00:42:55:ViCM - current event = SVC Setup
00:42:55:ViCM - new state = Call Connected

00:42:55:ViCM - current state = Call Connected
00:42:55:ViCM - current event = SVC Connect Ack
00:42:55:ViCM - new state = Call Connected

*****Video Call Disconnecting*****

Router#

00:43:54:ViCM - current state = Call Connected
00:43:54:ViCM - current event = SVC Release
00:43:54:ViCM - new state = Remote Hangup

00:43:54:ViCM - current state = Remote Hangup
00:43:54:ViCM - current event = SVC Release Complete
00:43:54:ViCM - new state = Remote Hangup
mc3810_video_lw_periodic:Codec is not ready
mc3810_video_lw_periodic:sending message

00:43:55:ViCM - current state = Remote Hangup
00:43:55:ViCM - current event = DTR Deasserted
00:43:55:ViCM - new state = Idle

```

```

mc3810_video_lw_periodic:Codec is ready
mc3810_video_lw_periodic:sending message

00:43:55:ViCM - current state = Idle
00:43:55:ViCM - current event = DTR Asserted
00:43:55:ViCM - new state = Idle, Codec Ready

```

Configuring the CES Clock

The OC-3/STM-1 ATM CES network module uses the CES clock and passes the clocking information to the T1 controller and to the ATM interface. The clock must be set up on the CES interface, and then the T1 controller and ATM interface must be configured to use either its own physical loop or the clocking information that is passed. Some examples of the CES clock settings are shown at the end of this section.

To configure video support over ATM AAL1 PVCs, it is also necessary to perform the tasks in the “Configuring Structured CES” configuration task table in this chapter.

This feature is supported on the Cisco 3600 series routers.

To configure the CES clock, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# ces <i>slot/port</i>	Configures Circuit Emulation Service (CES) on a router port and enters CES configuration mode. The <i>slot/port</i> argument indicates the backplane slot number and port number on the interface. The port value is always 0 because the interface configuration applies to all ports in the slot.
Step 2	Router(config-ces)# clock-select <i>priority-no interface slot/port</i>	Establishes the sources and priorities of the requisite clocking signals for the OC-3/STM-1 ATM CES network module. The arguments are as follows: <ul style="list-style-type: none"> <i>priority-no</i>—Indicates the priority of the clock source. The values are from 1 (high priority) to 4 (low priority). <i>interface</i>—Specifies the interface that will supply the clock source. <i>slot/port</i>—Specifies the backplane slot number and port number on the interface.
Step 3	Router(config-ces)# exit	Exits CES configuration mode.
Step 4	Router(config)# controller { T1 E1 } <i>slot/port</i>	Enters controller configuration mode for the T1 or E1 controller at the specified <i>slot/port</i> location. The prompt changes again to show that you are in controller configuration mode.

	Command	Purpose
Step 5	Router(config-controller)# clock source { line { primary secondary } internal }	<p>Specifies which end of the circuit provides clocking for the T1 or E1 interface.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • line—Specifies that the interface will clock its transmitted data from a clock recovered from the line's receive data stream. This is the default. • primary—Specifies the source of primary line clocking. The default primary TDM clock source is from the T0 controller. • secondary—Specifies the source of secondary line clocking. The default secondary TDM clock source is from the T1 controller. • internal—Specifies that the interface will clock its transmitted data from its internal clock. <p>Note The clock source should be set to use internal clocking when the installed video WAN interface card (VWIC) uses the clocking designated by the CES clock setting.</p>
Step 6	Router(config-controller)# exit	Exits controller configuration mode.
Step 7	Router(config)# interface atm <i>slot/port</i>	<p>Configures the clocking on the ATM interface and enters interface configuration mode.</p> <p>The <i>slot/port</i> arguments are as follows:</p> <ul style="list-style-type: none"> • <i>slot</i>—Specifies the backplane slot number on the router. The value ranges from 0 to 4, depending on what router you are configuring. Refer to your router hardware documentation. • <i>port</i>—Specifies the port number. The number depends on the number of ports on the network module.
Step 8	Router(config-if)# atm clock internal	<p>Specifies which end of the circuit provides clocking for the ATM interface. The clock source should be set to use internal clocking when the CES clock is set to anything other than ATM. The no atm clock internal command should be set if using the ATM physical loop for clocking</p>

Configuring Structured CES

Structured CES allows you to allocate bandwidth in a highly flexible and efficient manner. With structured services, you use only the bandwidth actually required to support the active structured circuits that you configure.

Structured CES is supported on Cisco 3600 series routers for video over AAL1 using the OC-3/STM-1 ATM CES network module.

For information on configuring unstructured CES service and channel-associated signaling for structured CES, refer to the *Cisco IOS Wide-Area Networking Configuration Guide*.

To configure the T1/E1 port for structured CES, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<code>Router(config)# controller {T1 E1} slot/port</code>	Enters controller configuration mode for the T1 or E1 controller at the specified <i>slot/port</i> location. The prompt changes again to show that you are in controller configuration mode.
Step 2	<code>Router(config-controller)# clock source {line {primary secondary} internal}</code>	<p>Specifies which end of the circuit provides clocking for the T1 or E1 interface.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • line—Specifies that the interface will clock its transmitted data from a clock recovered from the line's receive data stream. This is the default. • primary—Specifies the source of primary line clocking. The default primary TDM clock source is from the T0 controller. • secondary—Specifies the source of secondary line clocking. The default secondary TDM clock source is from the T1 controller. • internal—Specifies that the interface will clock its transmitted data from its internal clock. <p>The clock source should be set to use internal clocking when the installed video WAN interface card (VWIC) uses the clocking designated by the CES clock setting.</p>

	Command	Purpose
Step 3	<p>T1 Line</p> <pre>Router(config-controller)# framing {sf esf}</pre> <p>E1 Line</p> <pre>Router(config-controller)# framing {crc4 no-crc4} [australia]</pre>	<p>Sets the framing for the E1 or T1 data line.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • sf—Specifies Super Frame as the T1 frame type. • esf—Specifies Extended Super Frame as the T1 frame type. This frame type is required for ATM on T1 lines. This setting is automatic for T1 when ATM mode is set. • crc4—Specifies CRC4 frame as the E1 frame type. This frame type is required for ATM on E1 lines. This setting is automatic for E1 when the ATM mode is set. • no-crc4—Specifies no CRC4 frame as the E1 frame type. • australia—(Optional) Specifies the E1 frame type used in Australia.
Step 4	<pre>Router(config-controller)# linecode {ami b8zs hdb3}</pre>	<p>Selects the line-code type for T1 or E1 lines.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • ami—Specifies alternate mark inversion (AMI), which is available for T1 or E1 lines. It represents zeros using a 01 within each bit cell, and ones are represented by 11 or 00, alternately, within each bit cell. AMI requires that the sending device maintain ones density. Ones density is not maintained independently of the data stream. • b8zs—Sets the line encoding according to your service provider's instructions. Bipolar-8 zero substitution (B8ZS), available only for T1 lines, encodes a sequence of eight zeros in a unique binary sequence to detect line coding violations. • hdb3—Specifies high-density bipolar 3 (HDB3) as the line-code type. It is required for ATM on E1 lines. This setting is automatic for E1 when the ATM mode is set. <p>Note When the E1 controller is specified, you must also configure scrambling on the ATM 0 interface. (See Step 3 of the configuration task table in the “Configuring ATM Interfaces to Support Video over PVCs and SVCs” section on page 736.)</p>

	Command	Purpose
Step 5	Router(config-controller)# ces-clock [adaptive srts synchronous]	<p>Specifies the type of clocking used for T1 interfaces using structured CES.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • adaptive—Adjusts output clock on a received AAL1 on first-in, first-out basis. Use in unstructured mode. • srts—Sets the clocking mode to synchronous residual time stamp. • synchronous—Configures the timing recovery to synchronous for structured mode. <p>Note Only synchronous clocking can be used with structured CES.</p>
Step 6	Router(config-controller)# tdm-group <i>tdm-group-no</i> timeslot <i>timeslot-list</i> [type (e&m fxs [loop-start ground-start] fxo [loop-start ground-start] fxs-melcas fxo-melcas e&m-melcas)	<p>Configures a list of time slots for creating clear channel groups (pass-through) for time-division multiplexing (TDM) cross-connect.</p> <p>For an explanation of the keywords and arguments, see Step 7 in the “Configuring Video in Pass-Through Mode” configuration task table in this chapter.</p>
Step 7	Router(config-controller)# exit	Exits controller configuration mode.
Step 8	Router(config)# connect <i>connection-name</i> atm <i>slot/port-1</i> [<i>name of PVC/SVC</i> <i>vpi/vci</i>] { T1 E1 } <i>slot/port-2</i> <i>TDM-group-number</i>	<p>Defines the connections between T1 or E1 controller ports and the ATM interface.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • <i>connection-name</i>—Specifies a name for this connection. • atm—Specifies the ATM interface. • <i>slot/port-1</i>—Specifies the location of the ATM controller to be connected. • <i>name of PVC/SVC</i>—Specifies the permanent or switched virtual circuit. • <i>vpi/vci</i>—Specifies a virtual path identifier (VPI) and virtual channel identifier (VCI). • T1—Specifies a T1 port. • E1—Specifies an E1 port.
		<ul style="list-style-type: none"> • <i>slot/port-2</i>—Specifies the location of the T1 or E1 controller to be connected. • <i>TDM-group-number</i>—Specifies the number identifier of the time-division multiplexing (TDM) group associated with the T1 or E1 controller port and created by using the tdm-group command. Valid values are from 0 to 23 for T1 and from 0 to 30 for E1

Configuring the Proxy and T.120

To configure the Multimedia Conference Manager for voice, video, and data traffic, see the “Configuring H.323 Gatekeepers and Proxies” chapter in this configuration guide.



Note

This feature is supported on the Cisco 2600 series, 3600 series, and 7200 series routers and on the Cisco MC3810 multiservice concentrator.

To configure Multimedia Conference Manager for this feature, follow these steps beginning in global configuration mode:

	Command	Purpose/Comment
Step 1	Router(config)# proxy h323	Enables the proxy feature on your router.
Step 2	Router(config)# ip routing	Makes sure that Fast Switching, which is required for the T.120 feature, is enabled.
Step 3	Router(config)# interface <i>type number</i> [<i>name-tag</i>]	Configures an interface type and enters interface configuration mode. The keywords and arguments are as follows: <ul style="list-style-type: none"> • <i>type</i>—Specifies the type of interface to be configured. (For a list of the interface type keywords, see Table 54, which follows this configuration task table.) • <i>number</i>—Specifies the port, connector, or interface card number. On a Cisco 4000 series router, specifies the network process monitor (NPM) number. The numbers are assigned at the factory at the time of installation or when added to a system, and they can be displayed with the show interfaces command. • <i>name-tag</i>—(Optional) Specifies the logical name to identify the server configuration so that multiple entries of server configuration can be entered. This optional argument is for use with the Redundant Link Manager (RLM) feature.
Step 4	Router(config-if)# ip route-cache same-interface	Tells the proxy that when sending the packets out, it should use the same interface that the packets came in on. The packets are sent within the interrupt service context. Otherwise, the packets are queued for processing by the Cisco IOS, which is slower and may lead to packet loss.

Command	Purpose/Comment
Step 5 Router(config-if)# h323 interface <i>[port number]</i>	<p>Selects an interface whose IP address will be used by the proxy to register with the gatekeeper. The <i>port number</i> argument specifies the port number on which the proxy will listen for incoming call setup requests.</p> <p>The range is from 1 to 65,356. The default port number for the proxy is 11,720 in -isx- or -jsx- Cisco IOS images.</p> <p>The default port number for the proxy is 1720 in -ix- Cisco IOS images that do not contain the Voice over IP (VoIP) gateway.</p> <p>To use the default port, enter the no h323 interface command and then the h323 interface command.</p>
Step 6 Router(config-if)# h323 h323-id	<p>Specifies the name of the proxy being registered with the gatekeeper.</p> <p>The <i>h323-id</i> argument specifies the name of the proxy. It is recommended that this be a fully qualified e-mail identification (ID), with the domain name being the same as that of its gatekeeper.</p> <p>If the proxy has registered successfully on a Cisco gatekeeper, you can see the name of the proxy when you enter the show gatekeeper endpoints command.</p>

	Command	Purpose/Comment
Step 7	<pre>Router(config-if)# h323 gatekeeper [<i>id</i> gatekeeper-id] {<i>ipaddr</i> <i>ipaddr</i> [<i>port</i>] multicast}</pre>	<p>Specifies the gatekeeper associated with a proxy and controls how the gatekeeper is discovered.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • id <i>gatekeeper-id</i>—(Optional) Specifies the gatekeeper name. Typically, this is a Domain Name System (DNS) name, but it can also be a raw IP address in dotted form. If this parameter is specified, gatekeepers that have either the default or explicit flags set for the proxy's subnet will respond. If this parameter is not specified, only those gatekeepers with the default subnet flag will respond. • ipaddr <i>ipaddr</i> [<i>port</i>]—Specifies that the gatekeeper discovery message will be unicast to this address and, optionally, to the port specified. • multicast—Specifies that the gatekeeper discovery message will be multicast to the well-known Registration, Authentication, and Status (RAS) multicast address and port.
Step 8	<pre>Router(config-if)# h323 t120 {bypass proxy}</pre>	<p>Enables the T.120 capabilities on the router and specifies bypass or proxy mode.</p> <p>The keywords are as follows:</p> <ul style="list-style-type: none"> • bypass—Specifies that the H.245 Open Logical Channel messages for T.120 data channels are passed unmodified through the proxy and that TCP connections for T.120 are established directly between the two endpoints of the H.323 call. • proxy—Sets proxy mode. In this mode, T.120 features function properly.

The following table lists the interface types that may be used for the type argument with the interface command.

Table 54 Interface “Type” Keywords

Keyword	Interface Type
async	Port line used as an asynchronous interface.
atm	ATM interface.
bri	ISDN BRI. This interface configuration is propagated to each of the B channels. B channels cannot be individually configured. The interface must be configured with dial-on-demand commands for calls to be placed on that interface.
dialer	Dialer interface.
ethernet	Ethernet IEEE 802.3 interface.

Table 54 *Interface “Type” Keywords*

Keyword	Interface Type
fastethernet	100-Mbps Ethernet interface on the Cisco 4500, Cisco 4700, Cisco 7000, and Cisco 7500 series routers.
fddi	Fiber Distributed Data Interface (FDDI).
group-async	Master asynchronous interface.
hssi	High-Speed Serial Interface (HSSI).
lex	LAN Extender (LEX) interface.
loopback	Software-only loopback interface that emulates an interface that is always up. It is a virtual interface supported on all platforms. The interface number is the number of the loopback interface that you want to create or configure. There is no limit on the number of loopback interfaces you can create.
null	Null interface.
port-channel	Port channel interface.
pos	Packet OC-3 interface on the Packet over SONET Interface Processor.
serial	Serial interface.
switch	Switch interface.
tokenring	Token Ring interface.
tunnel	Tunnel interface; a virtual interface. The number is the number of the tunnel interface that you want to create or configure. There is no limit on the number of tunnel interfaces you can create.
vg-anylan	100VG-AnyLAN port adapter.

Configuring the Gatekeeper to Support Zone Bandwidth

Gatekeeper support for zone bandwidth is supported on the Cisco 2600 series, 3600 series, and 7200 series routers and on the MC3810 multiservice concentrator.

For more information on configuring gatekeepers to support zone bandwidth, refer to the document *Configuring H.323 VoIP Gatekeeper for Cisco Access Platforms*.

To configure the gatekeeper to support zone bandwidth, use the following commands beginning in gatekeeper configuration mode:

	Command	Purpose/Comment
Step 1	Router(config)# gatekeeper	Enters gatekeeper configuration mode.
Step 2	Router(config-gk)# bandwidth { interzone total session } { default zone <i>zone-name</i> } <i>bandwidth-size</i>	<p>Specifies the maximum aggregate bandwidth for H.323 traffic.</p> <p>The keywords and arguments are as follows:</p> <ul style="list-style-type: none"> • interzone—Specifies the maximum bandwidth for H.323 traffic between one zone and another zone. • total—Specifies the maximum bandwidth for H.323 traffic within a zone and between zones (intrazone and interzone). • session—Specifies the maximum bandwidth allowed for a single session in a specific zone or in all zones. • default—Specifies the maximum bandwidth for all applicable zones, depending on the keyword with which it is used. • zone—Specifies a particular zone. • <i>zone-name</i>—Names the particular zone. • <i>bandwidth-size</i>—Specifies maximum bandwidth. For interzone and total, the range is from 1 to 10,000,000 kbps. For session, the range is from 1 to 5000 kbps.
Step 3	Router(config-gk)# bandwidth remote <i>bandwidth-size</i>	Specifies the total bandwidth for H.323 traffic between this gatekeeper and another gatekeeper. The <i>bandwidth-size</i> argument specifies the maximum bandwidth. The range is from 1 to 10,000,000 kbps.

Configuring RSVP-ATM QoS Interworking

RSVP-ATM QoS interworking provides support for controlled load service using RSVP over an ATM core network. This feature requires the ability to signal for establishment of SVCs across the ATM cloud in response to RSVP reservation messages. To meet this requirement, RSVP over ATM supports mapping of RSVP sessions to ATM SVCs. Refer to the document *RSVP-ATM QoS Interworking* for information on how to configure RSVP over an ATM core network.

RSVP-ATM QoS interworking is supported on the Cisco 2600 series, 3600 series, and 7200 series routers and on the MC3810 multiservice concentrator.

Verifying RSVP-ATM QoS Interworking Configuration

- Step 1** To see information about the remote bandwidth, enter the **show gatekeeper status** command.

```
Router# show gatekeeper status

Gatekeeper State:UP
Zone Name:      DVM1
Zone Name:      DVM2
Zone Name:      test1
Accounting:      DISABLED
Security:        DISABLED
Maximum Remote Bandwidth:
Current Remote Bandwidth:0 kbps
```

- Step 2** To display bandwidth information for all zones, enter the **show gatekeeper zone status** command.

```
Router# show gatekeeper zone status

                                GATEKEEPER ZONES
                                =====
GK name      Domain Name      RAS Address      PORT  FLAGS
-----
DVM1         dvm1.com          172.28.129.50    1719  LS
BANDWIDTH INFORMATION (kbps) :
  Maximum interzone bandwidth :
  Current interzone bandwidth : 0
  Maximum total bandwidth :
  Current total bandwidth : 0
  Maximum session bandwidth :
SUBNET ATTRIBUTES :
  All Other Subnets : (Enabled)
PROXY USAGE CONFIGURATION :
  Inbound Calls from DVM2 :
    to terminals in local zone DVM1 :use proxy
    to gateways in local zone DVM1 :do not use proxy
  Outbound Calls to DVM2 :
    from terminals in local zone DVM1 :use proxy
    from gateways in local zone DVM1 :use proxy
  Inbound Calls from all other zones :
    to terminals in local zone DVM1 :use proxy
    to gateways in local zone DVM1 :do not use proxy
  Outbound Calls to all other zones :
    from terminals in local zone DVM1 :use proxy
    from gateways in local zone DVM1 :do not use proxy
```

```

DVM2          dvm2.com      172.28.129.50   1719   LS
BANDWIDTH INFORMATION (kbps) :
  Maximum interzone bandwidth :
  Current interzone bandwidth :    0
  Maximum total bandwidth :
  Current total bandwidth :    0
  Maximum session bandwidth :
SUBNET ATTRIBUTES :
  All Other Subnets :(Enabled)
PROXY USAGE CONFIGURATION :
  Inbound Calls from all other zones :
    to terminals in local zone DVM2 :use proxy
    to gateways in local zone DVM2  :do not use proxy
  Outbound Calls to all other zones :
    from terminals in local zone DVM2 :use proxy
    from gateways in local zone DVM2  :do not use proxy

test1         cisco.com     172.28.129.50   1719   LS
BANDWIDTH INFORMATION (kbps) :   Maximum session bandwidth :
SUBNET ATTRIBUTES :
  All Other Subnets :(Enabled)
PROXY USAGE CONFIGURATION :
  Inbound Calls from all other zones :
    to terminals in local zone test1 :use proxy
    to gateways in local zone test1  :do not use proxy
  Outbound Calls to all other zones :
    from terminals in local zone test1 :use proxy
    from gateways in local zone test1  :do not use proxy

TEST2         test2.com     172.28.129.54   1719   RS
  Maximum interzone bandwidth :
  Current interzone bandwidth :    0

```

Step 3 To display information about the proxy, such as the T.120 mode and what port is being used, enter the **show proxy h323 status** command.

```

Router# show proxy h323 status

H.323 Proxy Status
=====
H.323 Proxy Feature:Enabled
Proxy interface = Ethernet0:UP
Proxy IP address = 172.28.129.50
Proxy IP port = 11720
Application Specific Routing:Disabled
RAS Initialization:Complete
Proxy aliases configured:
  H323_ID:PROXY
Proxy aliases assigned by Gatekeeper:
  H323_ID:PROXY
Gatekeeper multicast discovery:Disabled
Gatekeeper:
  Gatekeeper ID:DVM1
  IP address:172.28.129.50
Gatekeeper registration succeeded
T.120 Mode:PROXY
RTP Statistics:OFF
Number of calls in progress:0

```

Video Applications Configuration Examples

This section provides the following configuration examples:

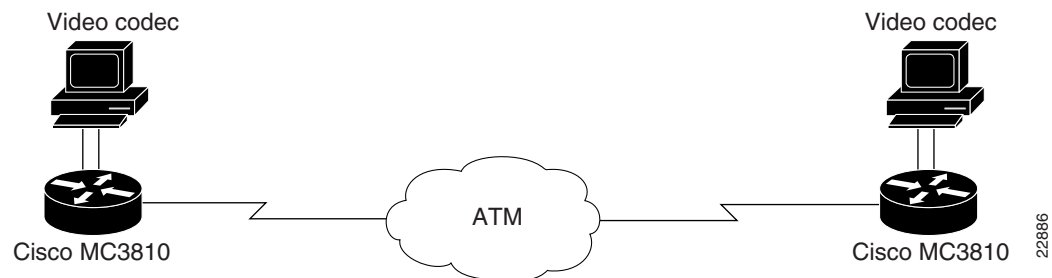
- [Video over ATM PVCs and SVCs Configuration Examples, page 764](#)
- [CES Video Traffic on the Cisco MC3810 Multiservice Concentrator Configuration Example, page 766](#)
- [Video Traffic on a Cisco 3600 Series Router Configuration Example, page 767](#)
- [Cisco IP/VC 3510 Multipoint Control Unit with Cisco IOS Gatekeeper/Proxy Configuration Example, page 769](#)
- [CES Clock Configuration Examples, page 771](#)

Video over ATM PVCs and SVCs Configuration Examples

The configuration excerpts in this section illustrate how two Cisco MC3810 multiservice concentrators communicate back-to-back as shown in [Figure 122](#).

These examples focus on the specific requirements of ATM video SVCs and PVCs rather than on the complete ATM setup.

Figure 122 Two Cisco MC3810s Using ATM SVCs or PVCs for Videoconferencing



Initially, the network clocks are set up on each multiservice access concentrator so that video codecs can operate at a multiple of 64 kbps:

Hostname MC3810A

```
!
network-clock base-rate 64k
ip subnet-zero
ip wccp version 2
ip host router 225.255.255.254
!
appletalk routing
ipx routing 1111.0045.0005
```

Hostname MC3810B

```
!
network-clock base-rate 64k
ip subnet-zero
ip wccp version 2
ip host router 225.255.255.254
!
appletalk routing
ipx routing 1111.0045.0002
```

The following commands show the configuration of the T1 0 controller, which is for ATM service. Extended Superframe (ESF) framing and B8ZS are required for ATM. The default clock source is line, and the default for the T1 1 controller automatically becomes internal.

Hostname MC3810A

```
controller T1 0
 framing esf
 linecode b8zs
 mode atm
!
```

Hostname MC3810B

```
controller T1 0
 framing esf
 linecode b8zs
 mode atm
!
```

Serial interface 0 connects to the local video codec. The restart delay is set to 0 minutes so that the hardware is not reset when it goes down. The clock rate of 384 kbps is the speed at which the video images are sent.

Hostname MC3810A

```
interface Serial0
 no ip address
 no ip directed-broadcast
 encapsulation atm-ces
 no ip route-cache
 no ip mroute-cache
 no keepalive
 serial restart-delay 0
 clockrate network 384000
```

Hostname MC3810B

```
interface Serial0
 no ip address
 no ip directed-broadcast
 encapsulation atm-ces
 no ip route-cache
 no ip mroute-cache
 no keepalive
 serial restart-delay 0
 clockrate network 384000
```

The following commands show how to configure the ATM interface and set up PVCs to supply Q.SAAL signaling and ILMI management for SVC communications. Note that you can also specify the NSAP address by using the **atm video aesa** command with an ESI value.

Hostname MC3810A

```
interface ATM0
 ip address 10.1.1.5 255.0.0.0
 no ip directed-broadcast
 no ip route-cache
 atm pvc 1 0 5 qsaal
 atm pvc 2 0 16 ilmi
 atm ilmi-keepalive
 atm video aesa default
```

Hostname MC3810B

```
interface ATM0
 ip address 10.1.1.6 255.0.0.0
 no ip directed-broadcast
 no ip route-cache
 atm pvc 1 0 5 qsaal
 atm pvc 2 0 16 ilmi
 atm ilmi-keepalive
 atm video aesa default
```

The following examples show dial PVCs for video communications. CBR is required for reliable video. The CBR speed is set at 117 percent of the video data rate of 384 kbps, which is configured on serial interface 0.

Hostname MC3810A

```
pvc 10 32 69
  cbr 449
  encapsulation aal1
```

Hostname MC3810B

```
pvc 11 33 70
  cbr 449
  encapsulation aal1
```

The following examples show dial peers set up for SVC video. Specify local peers through the **port signal** command, which indicates the slot location of the VDM and the port location of the EIA/TIA-366 interface. Enter the **port media** command to specify the serial interface for the codec connection. The two configurations are shown one after the other rather than side by side.

The commands are as follows for MC3810A:

```
dial-peer video 111 videocodec
  nsap 47.0091810000000002F26D4901.00107B4832E1.C8
  port signal 1/0
  port media Serial0
  destination-pattern 121
  !
dial-peer video 221 videoatm
  destination-pattern 221
  session target ATM0 svc nsap 47.0091810000000002F26D4901.00107B09C645.C8
```

The commands are as follows for MC3810B:

```
dial-peer video 111 videocodec
  nsap 47.0091810000000002F26D4901.00107B09C645.C8
  port signal 1/0
  port media Serial0
  destination-pattern 221
  !
dial-peer video 121 videoatm
  destination-pattern 121
  session target ATM0 svc nsap 47.0091810000000002F26D4901.00107B4832E1.C8
```

CES Video Traffic on the Cisco MC3810 Multiservice Concentrator Configuration Example

The following is an example of configuring video traffic over ATM AAL1 using CES on a Cisco MC3810 multiservice concentrator:

```
network-clock base-rate 64k

controller T1 0
  mode atm

interface Serial0 point-to-point
  no ip address
  encapsulation atm-ces
  clockrate network-clock 768000
  ces connect 25 atm0 pvc 25/100
```



```
interface ATM0 point-to-point
 ip address 223.223.224.229 255.255.255.0
 no ip mroute-cache
 no ip route-cache
 map-group atm1
 pvc 25 25 100
 encapsulation aal1
 cbr 870

no ip classless

map-list atm1
 ip 223.223.224.228 atm-vc 26 broadcast

line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 login
```

Video Traffic on a Cisco 3600 Series Router Configuration Example

In the following example, the OC-3/STM-1 ATM CES network module is configured for video traffic. This feature is configurable on the Cisco 3600 series routers.

```
version 12.1
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 3640
!
ces 1/0
 clock-select 1 ATM1/0
!
ip subnet-zero
no ip routing
!
cns event-service server
!
controller T1 1/0
 framing esf
 clock source internal
 linecode b8zs
 cablelength short 133
 tdm-group 0 timeslots 1-6
!
controller T1 1/1
!
interface Ethernet0/0
 ip address 1.2.60.127 255.255.0.0
 ip broadcast-address 1.2.255.255
 no ip route-cache
 no ip mroute-cache
!
interface ATM1/0
 no ip address
 no ip route-cache
 no ip mroute-cache
 no atm ilmi-keepalive
 pvc 0 0/41 ces
!
```

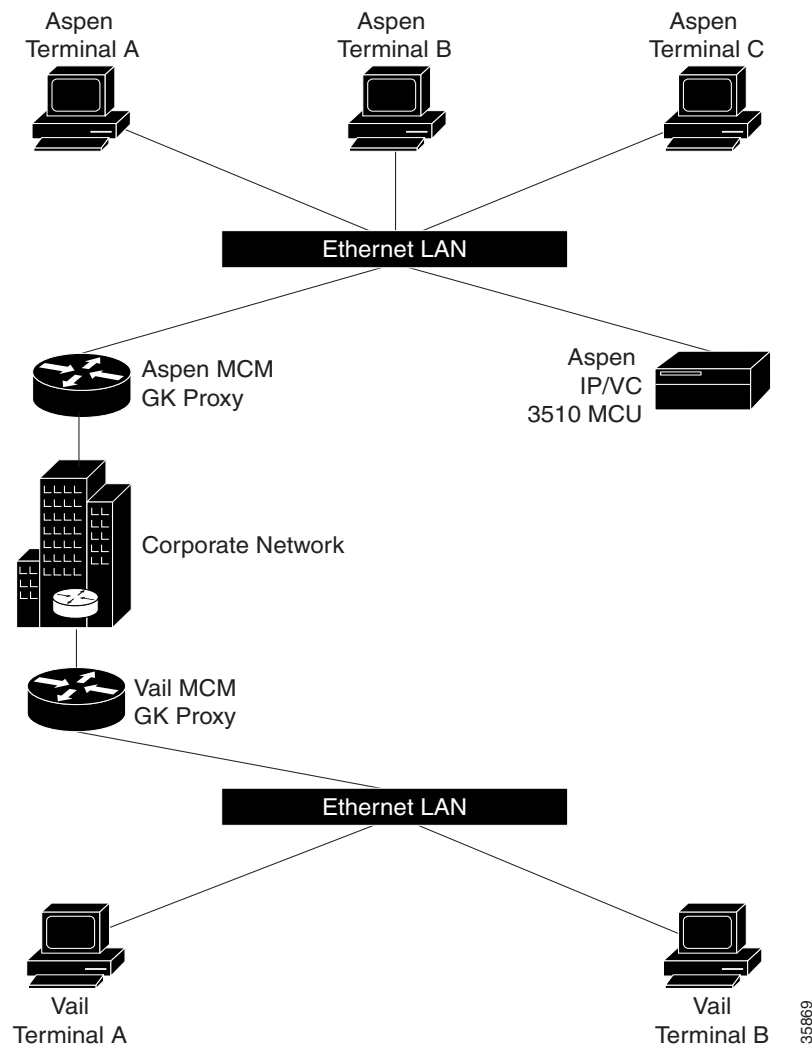
```
ip default-gateway 1.2.0.1
ip classless
ip route 223.255.254.0 255.255.255.0 1.2.0.1
no ip http server
!
connect video-1 ATM1/0 0/41 T1 1/0 0
!
line con 0
  transport input none
line aux 0
line vty 0 4
  login
!
```

Cisco IP/VC 3510 Multipoint Control Unit with Cisco IOS Gatekeeper/Proxy Configuration Example

The Cisco IP/VC 3510 multipoint control unit with Cisco IOS gatekeeper/proxy is configurable on the Cisco 2600 series, 3600 series, and 7200 series routers and on the Cisco MC3810 multiservice concentrator.

The following example shows an interzone calling configuration with two zones defined as Aspen and Vail.

Figure 123 Interzone Calling Configuration with Two Zones



The terminals are H.323 terminals.

The definitions for the above are as follows:

- Aspen Terminal A has an E.164 address of 31.
- Aspen Terminal B has an E.164 address of 32.
- Aspen Terminal C has an E.164 address of 33.

- Aspen IP/VC 3510 multipoint control unit (MCU) has an IP address of 10.0.0.2.
- Aspen IP/VC 3510 MCU has three conference prefixes defined 60, 61, and 62.
- Aspen H.323 Gatekeeper (MCM) Proxy has an IP Address of 10.0.0.1.
- Domain is cisco.com.

Vail Terminal A has an E.164 address of 21. The following is the configuration for Aspen MCM GK Proxy:

```

Hostname          Aspen_MCM_GK_Proxy
Proxy h323
interface Ethernet0/0
ip address 10.0.0.1 255.0.0.0
h323 interface
h323 qos ip-precedence 6
h323 h323-id aspen-proxy
h323 gatekeeper id aspen ipaddr 10.0.0.1
gatekeeper
zone local aspen    cisco.com 10.0.0.1
zone remote vail cisco.com 12.0.0.1
zone prefix aspen 11
zone prefix vail 12
use-proxy aspen default outbound-from gateway
no shutdown

```

The following is the configuration for Vail MCM GK Proxy:

```

Hostname          Vail_MCM_GK_Proxy
Proxy h323
interface Ethernet0/0
ip address 10.0.0.1 255.0.0.0
h323 interface
h323 qos ip-precedence 6
h323 h323-id vail-proxy
h323 gatekeeper id vail ipaddr 12.0.0.1
gatekeeper
zone local vail cisco.com 12.0.0.1
zone remote aspen cisco.com 10.0.0.1
zone prefix aspen 11
zone prefix vail 12
gw-type-prefix 60 hopoff aspen
gw-type-prefix 61 hopoff aspen
gw-type-prefix 62 hopoff aspen
use-proxy aspen default outbound-from gateway
no shutdown

```

In this example, any terminal registered with the Aspen or Vail gatekeeper may participate in a multiparty call with any participant in either zone. For example, Aspen Terminal A could have a conference with Aspen Terminal C and Vail Terminal A by dialing 61555**33**1221. The conference prefix is 61, the conference password is 555, the invite is **, the E.164 address of Aspen Terminal C is 33, the zone prefix to reach the Vail zone is 12, and the E.164 address of Vail Terminal A is 21.

Alternatively, each terminal could independently dial 61555 to join the conference.

CES Clock Configuration Examples

Table 55 shows allowable combinations for CES clocking configuration.

Table 55 CES Clock Configuration Combinations

T1 Controller	ATM Interface	CES Clock	Network Module Status
clock source internal	no atm clock internal	clock-select 1 ATM x/0	slave to ATM
clock source internal	atm clock internal	clock-select 2 T1 x/0	slave to T1
clock source internal	atm clock internal	clock-select 1 Local Oscillator	master clock

The following sample configurations can be used for CES clock settings.

Network Module As Slave to T1 Clock

In this example the OC-3/STM-1 ATM CES network is using the T1 clock.

```
ces 1/0
  clock-select 1 T1 1/0
controller T1 1/0
  clock source internal
interface ATM 1/0
  atm clock internal
```

Network Module As Master Clock

In this example the OC-3/STM-1 ATM CES network module is providing the clock.

```
ces 1/0
  clock-select 1 Local Oscillator
controller T1 1/0
  clock source internal
interface ATM 1/0
  atm clock internal
```

Network Module As Slave to ATM Clock

In this example the OC-3/STM-1 ATM CES network module is using the ATM clock.

```
ces 1/0
  clock-select 1 ATM 1/0
controller T1 1/0
  clock source internal
interface ATM 1/0
  no atm clock internal
```

