Integrated Voice and Data WAN on T1 E1 Interfaces

Last Updated: December 14, 2011

This chapter describes how to implement the Integrated Voice and Data WAN on T1/E1 Interfaces with the AIM-ATM-VOICE-30 Module feature. This card provides a voice-processing termination solution at a density of 30 VoIP or VoFR voice or fax channels, while not consuming a network-module slot. It provides the following benefits:

- Integrated voice and serial data WAN functionality on the same T1/E1 interface or on the second port of the voice/WAN interface cards (VWIC)
- Support for high-complexity codecs

The serial interface supports the following features:

- Point-to-Point Protocol (PPP), Frame Relay (FR), and high-level data link control (HDLC) encapsulations--Up to 120 channels
- FR, HDLC, and PPP encapsulation and voice on the same T1/E1 voice interface available in the following two options:
  - Channel associated signaling (CAS) or Primary Rate Interface (PRI) group, plus the channel group are defined on the same T1/E1 interface in the Cisco 2600 WIC slot.
  - The DS0 or PRI, plus the channel groups are configured across two ports of the same T1/E1 VWIC. For example, you can configure a DS0 group or a PRI group on port 0, and a channel group on the same port or another port.
- HDLC data inversion--Meets the density requirement for T1 links
- Compression support--Software and hardware compression is supported on the Cisco 3660, Cisco 3725, and Cisco 3745

There is only one advanced integration module (AIM) slot on Cisco 2600 platforms, so hardware compression is not applicable to the Cisco 2600 series.

- Multilink PPP
- G.703 (E1 unframed mode)
Feature History for Integrated Voice and Data WAN on T1/E1 Interfaces with the AIM-ATM-VOICE-30 Module

<table>
<thead>
<tr>
<th>Release</th>
<th>Modification</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.2(15)T</td>
<td>This feature was introduced.</td>
</tr>
</tbody>
</table>

- Finding Feature Information, page 2
- Prerequisites for Configuring Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module, page 2
- Restrictions for Configuring Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module, page 3
- Information About Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module, page 3
- How to Configure Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module, page 6
- Configuration Examples for Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module, page 21
- Additional References, page 26

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

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

Prerequisites for Configuring Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module

- Perform the prerequisites that are listed in the "Prerequisites for Configuring an ISDN Voice Interface" section.

Cisco 2600 series and Cisco 2600XM

- Ensure that you have the following:
  - 64-MB RAM and 32-MB flash memory
  - Appropriate voice-interface hardware, as listed in AIM-ATM, AIM-VOICE-30, and AIM-ATM-VOICE-30 on the Cisco 2600 Series and Cisco 3660

Cisco 3660, Cisco 3725, and Cisco 3745

- Ensure that you have the following:
  - Cisco IOS Release 12.2(15)T IP Plus or a later release
Restrictions for Configuring Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module

Restrictions are described in the Restrictions for Configuring ISDN Voice Interfaces section. In addition, the following apply.

Cisco 2600 Series Restrictions

- This feature does not support Drop and Insert.
- Voice channels can appear only on a single port of the two T1/E1 interfaces on the VWIC. Data channels can appear on both.

Other Platform Restrictions

- This feature is not supported on the following platforms: Cisco 1700 series, Cisco MC3810, and Cisco AS5x00.

Hardware Restrictions

- This feature is not supported on the AIM-VOICE-30 card or the AIM-ATM card.
- Modem relay is not supported on AIM-ATM-VOICE-30 DSPs.
- Codec GSM-EFR is not supported.
- With a high-complexity image set, an AIM-ATM-VOICE-30 DSP card can process up to only 16 voice channels. The 16 associated time slots must be within a contiguous range. Applications and voice interfaces that can be used with the three types of AIM are listed in AIM-ATM, AIM-VOICE-30, and AIM-ATM-VOICE-30 on the Cisco 2600 Series and Cisco 3660.

Information About Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module

General information about ISDN voice interfaces is presented in the “Information About ISDN Voice Interfaces” section.

- AIM-ATM-VOICE-30 Module, page 4
- Integrated Voice and Data WAN, page 4
- High-Complexity Voice Compression, page 5
- Network Clock Source and Participation, page 6
**AIM-ATM-VOICE-30 Module**

The AIM-ATM-VOICE-30 module is an advanced integration module capable of supporting up to 30 voice or fax channels when used in a supported platform with one of the T1/E1 voice/WAN interface cards (such as VWIC-1T1). The module includes DSPs that are used for a number of voice-processing tasks such as voice compression and decompression, voice-activity detection or silence suppression, and PBX or PSTN signaling protocols.

The module supports VoIP, VoFR, and VoIP over ATM (VoATM) while leaving the router network-module slot open for other functions such as asynchronous or synchronous serial concentration. For additional information, see AIM-ATM, AIM-VOICE-30, and AIM-ATM-VOICE-30 on the Cisco 2600 Series and Cisco 3660.

**Integrated Voice and Data WAN**

This feature adds integrated voice and serial-data WAN service on the same T1 or E1 interface or VWIC on AIM-ATM-VOICE-30 DSP cards. This enhancement enables you to use some DS0 channels for serial-data Frame Relay, high-level data link control (HDLC), and Point-to-Point Protocol (PPP), for example, while the remaining T1 or E1 channels can be used for voice channel-associated signaling (CAS) or PRI.

The figure below shows a typical application scenario in which 16 channels of a T1 line are used for voice and 4 channels are used for Frame relay data. Integrating voice and serial data on the same T1 or E1 line minimizes the recurring cost of providing PSTN and data WAN access. In particular, integrated access provides a number of voice DS0s (for PSTN access) and a Frame Relay link on the same T1.

*Figure 1: Typical Application Scenario*
The figure below shows a typical deployment scenario in which port 0 of the VWIC-MFT module is connected to an integrated voice and data service provider with 20 channels. These 20 channels are used for voice (running CAS or PRI); the remaining four channels are used for serial data (running Frame Relay). Using this type of configuration, you can take advantage of the integrated service offered by a service provider and minimize the cost of leasing and supporting T1 or E1 lines.

![Typical Feature Deployment Diagram]

**High-Complexity Voice Compression**

This feature adds high-complexity G.723, G.728, and GSM-FR codec support to the AIM-ATM-VOICE-30 module so that the DSP can support both medium- and high-complexity codecs running separately. Each DSP core can process up to two voice channels, so each module can support up to 16 voice channels when running a high-complexity DSP firmware image.

The following high-complexity codecs are supported:

- G.723 5.3K
- G.723 6.3K
- G.723 1A 5.3K
- G.723 1A 6.3K
- G.728
- G.729
- G.729B
- GSM-FR

The following medium-complexity codecs are supported in high-complexity mode:

- G.711 mu-law
- G.711 a-law
- G.726
- G.729A
- G.729 AB
- Clear-channel codec
- Fax relay

---

**Note**

Neither modem-relay nor GSM-EFR is supported.
Network Clock Source and Participation

Packet voice and video are sensitive to time delays. To prevent mismatches and data slips, you must synchronize data flows to a single clock source, known as the network clock. When a network clock is configured on a gateway, the router is externally clocked by one T1 or E1 port and passes that clock signal across the backplane to another T1 or E1 port on another WIC or network module slot. Use of a network clock on a gateway is configured by naming the network modules and interface cards that are participating in network clocking, and then selecting a port to act as the source of timing for the network clock.

You must configure network clock source and participation to use the Integrated Voice and Data WAN on T1/E1 Interfaces Using the AIM-ATM-VOICE-30 Module feature.

The network clock provides timing from the source, through the port to the AIM, and then out to all participating router slots. The number of supported AIM slots is as follows:

- The Cisco 2600 series and Cisco 2600XM support one internal AIM slot.
- The Cisco 3660, Cisco 3725, and Cisco 3745 support two internal AIM slots.

The network clock source must be derived from an external source--for example, PSTN, PBX, or ATM network. For digital voice ports, the clock source command in configures the type of timing (internal or from the line) for each port that you designate as a primary source or backup for the network clock.

This command allows maximum flexibility. For example, on a router with a multiflex trunk VWIC connected to an ATM network and a digital T1/E1 packet voice trunk network module connected to a PBX, you can set up network clocking in any of three ways:

- The multiflex trunk VWIC provides clocking to the AIM, which provides it to the digital T1/E1 packet voice trunk network module (that is, to the PBX).
- The digital T1/E1 packet voice trunk network module provides clocking to the AIM, which provides it to the multiflex trunk VWIC.
- The ATM network and the PBX run their own clocks, which are not necessarily synchronized. However, this scenario could result in poor voice quality.

For a detailed discussion of clock sources on individual ports, see the information about clock sources on digital T1/E1 voice ports in the chapter on configuring voice ports in the Cisco IOS Voice, Video, and Fax Configuration Guide.

How to Configure Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module


- Configuring Network Clock Source and Participation, page 7
Configuring Network Clock Source and Participation

To configure a clock with an internal source, perform the following steps.

**Note**

You must configure network clock source and participation to use the Integrated Voice and Data WAN on T1/E1 Interfaces Using the AIM-ATM-VOICE-30 Module feature.

Configure the controller for PRI or DS0 groups and for ATM AIM or CAS before configuring network-clock participation parameters.

**SUMMARY STEPS**

1. `enable`
2. `configure terminal`
3. `controller {t1 | e1} slot/port`
4. `clock source {line [primary] | internal}`
5. `mode atm [aim aim-slot-number]`
6. `exit`
7. `network-clock-participate [slot slot-number | wic wic-slot | aim aim-slot-number]`
8. `exit`

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1 enable</strong></td>
<td>Enters privileged EXEC mode. Enter your password when prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2 configure terminal</strong></td>
<td>Enters configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 3</strong> controller {t1</td>
<td>e1} slot/port</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config)# controller t1 1/0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> clock source {line [primary]</td>
<td>internal}</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-controller)# clock source internal</td>
<td>• line --Clock recovered from the line’s receive data stream. This is the default.</td>
</tr>
<tr>
<td></td>
<td>• primary --External source to which the port is connected. This option also puts a second port, which is generally connected to the PBX, into looped-time mode. Both ports are configured with line, but only the port connected to the external source is configured with primary.</td>
</tr>
<tr>
<td></td>
<td>• internal --T1 or E1 controller internal PLL.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>With the default, the clock source does not appear in the show running-config command output. Use the show controllers command to display the current source for a port.</td>
</tr>
<tr>
<td><strong>Step 5</strong> mode atm [aim aim-slot-number]</td>
<td>Specifies that the configuration on this controller is for ATM, using the AIM in the specified slot for ATM processing, and creates ATM interface 0. Use when you connect the T1 line to an ATM network. The argument is as follows:</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-controller)# mode atm aim 0</td>
<td>• aim-slot-number --AIM slot number on the router chassis:</td>
</tr>
<tr>
<td></td>
<td>◦ Cisco 2600 series: 0</td>
</tr>
<tr>
<td></td>
<td>◦ Cisco 3660 and Cisco 3700 series: 0 or 1</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>This command without the aim keyword uses software rather than the AIM to perform ATM SAR. This is supported on Cisco 2600 series WIC slots only and not on network module slots.</td>
</tr>
<tr>
<td><strong>Step 6</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-controller)# exit</td>
<td></td>
</tr>
</tbody>
</table>
### Configuring the Clock-Source Line

To configure the clock-source line, perform the following steps.

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 7</strong> network-clock-participate [slot slot-number</td>
<td>wic wic-slot</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# network-clock-</td>
<td></td>
</tr>
<tr>
<td>participate slot 5</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# network-clock-</td>
<td></td>
</tr>
<tr>
<td>participate wic 0</td>
<td></td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# network-clock-</td>
<td></td>
</tr>
<tr>
<td>participate aim 0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# exit</td>
<td></td>
</tr>
</tbody>
</table>
### SUMMARY STEPS

1. enable
2. configure terminal
3. controller \{t1 | e1\} slot/port
4. clock source \{line [primary] | internal\}
5. Do one of the following:
   - mode atm \[aim aim-slot\]
   - mode cas
   - ds0-group group-number timeslots timeslot-range type type
   - pri-group timeslots timeslot-range
6. exit
7. network-clock-participate [slot slot-number | wic wic-slot| aim aim-slot-number]
8. network-clock-select priority \{t1 | e1\} slot/port
9. exit

### DETAILED STEPS

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 enable</td>
<td>Enables privileged EXEC mode. Enter your password if prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td>Step 2 configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td>Step 3 controller {t1</td>
<td>e1} slot/port</td>
</tr>
<tr>
<td>Example:</td>
<td></td>
</tr>
<tr>
<td>Router(config)# controller t1 1/0</td>
<td></td>
</tr>
</tbody>
</table>
### Command or Action

**Step 4**  
\texttt{clock source \{line [primary] | internal\}}

### Purpose

Specifies the source from which the phase-locked loop (PLL) on this port derives its clocking and, if the source is \texttt{line}, whether this port is the primary source. Keywords are as follows:

- **line** -- Clock recovered from the line’s receive data stream. This is the default.
- **primary** -- External source to which the port is connected. This option also puts a second port, which is generally connected to the PBX, into looped-time mode. Both ports are configured with \texttt{line}, but only the port connected to the external source is configured with \texttt{primary}.
- **internal** -- T1 or E1 controller internal PLL.

**Note**  
With the default, the clock source does not appear in the \texttt{show running-config} command output. Use the \texttt{show controllers} command to display the current source for a port.

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
</table>
| **Step 4**  
\texttt{clock source \{line [primary] | internal\}} | Specifies the source from which the phase-locked loop (PLL) on this port derives its clocking and, if the source is \texttt{line}, whether this port is the primary source. Keywords are as follows: |
| **Example:**              | **Note**  
With the default, the clock source does not appear in the \texttt{show running-config} command output. Use the \texttt{show controllers} command to display the current source for a port. |
| \texttt{Router(config-controller)# clock source line} | |
### Command or Action

**Step 5** Do one of the following:

- `mode atm aim-slot`
- `mode cas`
- `ds0-group group-number timeslots timeslot-range`  
  `type type`
- `pri-group timeslots timeslot-range`

**Purpose**

**Example:**

Router(config-controller)# mode atm aim 0

**Example:**

Router(config-controller)# mode cas

**Example:**

Router(config-controller)# ds0-group 0 timeslots 1-4,8-23 type fxs-loop-start

**Note**

This command without the `aim` keyword uses software (rather than AIM) to perform ATM segmentation and reassembly. This is supported on Cisco 2600 series WIC slots only and is not supported on network module slots.

**Example:**

Router(config-controller)# mode atm aim 0

**Example:**

Router(config-controller)# mode cas

**Example:**

Router(config-controller)# ds0-group 0 timeslots 1-4,8-23 type fxs-loop-start

**Example:**

Router(config-controller)# mode atm aim 0

**Example:**

Router(config-controller)# mode cas

**Example:**

Router(config-controller)# ds0-group 0 timeslots 1-4,8-23 type fxs-loop-start

**Example:**

Router(config-controller)# mode atm aim 0

**Example:**

Router(config-controller)# mode cas

**Example:**

Router(config-controller)# ds0-group 0 timeslots 1-4,8-23 type fxs-loop-start
<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-controller)# pri-group timeslots 1-4,8-23</td>
<td></td>
</tr>
<tr>
<td><strong>Step 6</strong></td>
<td>exit</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config-controller)# exit</td>
<td></td>
</tr>
<tr>
<td><strong>Step 7</strong></td>
<td>network-clock-participate [slot slot-number</td>
</tr>
<tr>
<td></td>
<td>wic wic-slot</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config)# network-clock-participate wic 0</td>
<td></td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td></td>
</tr>
<tr>
<td>Router(config)# network-clock-participate slot 5</td>
<td></td>
</tr>
</tbody>
</table>
**Configuring the AIM-ATM-VOICE-30 Card for High-Complexity Codecs and Time Slots**

To configure the AIM-ATM-VOICE-30 card for high-complexity codecs and time slots, perform the following steps.

**SUMMARY STEPS**

1. enable
2. configure terminal
3. voice-card slot
4. codec complexity {high | medium}
5. dspfarm
6. exit
7. controller {t1 | e1} slot/port
8. ds0-group group-number timeslots timeslot-range type type
9. exit
**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enters privileged EXEC mode. Enter your password when prompted.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router&gt; enable</td>
<td></td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router# configure terminal</td>
<td></td>
</tr>
<tr>
<td><strong>Step 3</strong> voice-card slot</td>
<td>Enters voice-card configuration mode to configure DSP resources on the specified card. The argument is as follows:</td>
</tr>
<tr>
<td></td>
<td>- slot --AIM slot number on the router chassis:</td>
</tr>
<tr>
<td></td>
<td>- Cisco 2600 series and Cisco 2600XM--0</td>
</tr>
<tr>
<td></td>
<td>- Cisco 3660--7 is AIM slot 0; 8 is AIM slot 1</td>
</tr>
<tr>
<td></td>
<td>- Cisco 3725--3 is AIM slot 0; 4 is AIM slot 1</td>
</tr>
<tr>
<td></td>
<td>- Cisco 3745--5 is AIM slot 0; 6 is AIM slot 1</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config)# voice-card 0</td>
<td></td>
</tr>
<tr>
<td><strong>Step 4</strong> codec complexity [high</td>
<td>medium]</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config-voice-card)# codec complexity high</td>
<td></td>
</tr>
<tr>
<td><strong>Step 5</strong> dspfarm</td>
<td>(Optional) Enters the DSP resources on the AIM specified in the voice-card command into the DSP resource pool.</td>
</tr>
<tr>
<td><strong>Example:</strong> Router(config-voicecard)# dspfarm</td>
<td></td>
</tr>
<tr>
<td>Command or Action</td>
<td>Purpose</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Step 6</strong> exit</td>
<td>Exits the current mode.</td>
</tr>
</tbody>
</table>

Example:
```
Router(config-voicecard)# exit
```

| **Step 7** controller {t1 | e1} slot/port | Enters controller configuration mode on the T1 or E1 controller on the selected slot/port. |
|---------------------------------------------|---------------------------------------------------------------------------------------|

Example:
```
Router(config)# controller e1 1/0
```

| **Step 8** ds0-group group-number timeslots timeslot-range type type | Creates a DS0 group that makes up a logical voice port on a T1/E1 controller. The keyword and argument are as follows:
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| **Example:**                                                        | • **timeslots** timeslot-range --Number, range of numbers, or multiple ranges of numbers separated by commas. T1 range: 1 to 24. E1 range: 1 to 31.
|                                                                     | • **type** **type** -- Signaling type by which the router communicates with the PBX or PSTN.                                                                                     |

**Note** High-complexity codecs with the AIM-ATM-VOICE-30 module can process up to 16 voice channels.

<table>
<thead>
<tr>
<th><strong>Step 9</strong> exit</th>
<th>Exits the current mode.</th>
</tr>
</thead>
</table>

Example:
```
Router(config-controller)# exit
```

### Configuring Integrated Voice and Serial Data WAN

To configure integrated voice and serial data WAN, perform the following steps.
**SUMMARY STEPS**

1. enable
2. configure terminal
3. controller {t1 | e1} slot/port
4. clock source {line [primary] | internal}
5. channel-group channel-group-number timeslots timeslot-range [speed bit-rate] aim aim-slot-number
6. Do one of the following:
   - ds0-group ds0-group-number timeslots timeslot-range type type
   - •
   - • pri-group timeslots timeslot-range | d-channel timeslot rlm-timeslot timeslot number
7. no shutdown
8. exit

**DETAILED STEPS**

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> enable</td>
<td>Enters privileged EXEC mode. Enter your password when prompted.</td>
</tr>
<tr>
<td>Example:</td>
<td>Router&gt; enable</td>
</tr>
<tr>
<td><strong>Step 2</strong> configure terminal</td>
<td>Enters global configuration mode.</td>
</tr>
<tr>
<td>Example:</td>
<td>Router# configure terminal</td>
</tr>
<tr>
<td><strong>Step 3</strong> controller {t1</td>
<td>e1} slot/port</td>
</tr>
<tr>
<td>Example:</td>
<td>Router(config)# controller e1 0/1</td>
</tr>
</tbody>
</table>
### Configuring the Clock-Source Line

<table>
<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 4</strong> clock source (\text{line {primary} \mid internal})</td>
<td>Specifies the source from which the phase-locked loop (PLL) on this port derives its clocking and, if the source is line, whether this port is the primary source. Arguments and keywords are as follows:</td>
</tr>
<tr>
<td>(\text{Example:})</td>
<td></td>
</tr>
<tr>
<td>(\text{Example: router(config-controller)}# \text{clock source internal})</td>
<td>(\text{Example: router(config-controller)}# \text{clock source internal})</td>
</tr>
<tr>
<td></td>
<td>• (\text{line}) --Clock recovered from the line’s receive data stream. This is the default.</td>
</tr>
<tr>
<td></td>
<td>• (\text{primary}) --External source to which the port is connected. This option also puts a second port, which is generally connected to the PBX, into looped-time mode. Both ports are configured with line, but only the port connected to the external source is configured with primary.</td>
</tr>
<tr>
<td></td>
<td>• (\text{internal}) --T1 or E1 controller internal PLL.</td>
</tr>
<tr>
<td><strong>Note</strong></td>
<td>With the default, the clock source does not appear in the show running-config command output. To display the current source for a port, use the show controllers command.</td>
</tr>
</tbody>
</table>

| **Step 5** channel-group channel-group-number timeslots timeslot-range [speed bit-rate] aim aim-slot-number | Directs HDLC traffic from the T1/E1 interface to the AIM-ATM-VOICE-30 digital signaling processor (DSP) card. Use to specify T1/E1 timeslots to be used for HDLC/PPP/Frame-relay encapsulated data. |
| **Example:** | **Example:** |
| \(\text{Example: router(config-controller)}\# \text{channel-group 1 timeslots 1-5 aim 0}\) | \(\text{Example: router(config-controller)}\# \text{channel-group 1 timeslots 1-5 aim 0}\) |
### Command or Action

**Step 6** Do one of the following:

- `ds0-group ds0-group-number timeslots timeslot-range type type`
- `pri-group timeslots timeslot-range | d-channel timeslot | rlm-timeslot timeslot number`

**Example:**

```
Router(config-controller)# ds0-group 2 timeslots 6-12 type e&m-immediate-start
```

**Note** High-complexity codecs with the AIM-ATM-VOICE-30 module can process up to 16 voice channels.

**Step 7** `no shutdown`

**Example:**

```
Router(config-controller)# no shutdown
```

Reinstates the controller.

**Step 8** `exit`

**Example:**

```
Router(config-controller)# exit
```

Exits the current mode.

### Verifying Integrated Voice and Serial Data WAN

To verify integrated voice and serial data WAN, perform the following steps (listed alphabetically).

- (DS0 groups) Creates a DS0 group that makes up a logical voice port on a T1/E1 controller. Keywords and arguments are as follows:
  - `timeslot timeslot-range` -- Number, range of numbers, or multiple ranges of numbers separated by commas. T1 range: 1 to 24. E1 range: 1 to 31.
  - `type type` -- Signaling type by which the router communicates with the PBX or PSTN.

**Note** Only one PRI group can be configured on a controller.

- (PRI groups) Creates a PRI group that makes up a logical voice port on a channelized T1 or E1 controller. The keyword and argument are as follows:
  - `timeslot timeslot-range` -- Range of numbers. T1 range: 1 to 23. E1 range: 1 to 15.
SUMMARY STEPS

1. show controllers serial
2. show interface serial
3. show isdn status
4. show network-clocks
5. show running-config
6. show voice dsp

DETAILED STEPS

Step 1  
**show controllers serial**

Use this command to display the configuration on the serial interface

Example:

Router# show controllers serial 0/0:3
Interface Serial0/0:3 is up
Hardware is ATM AIM SERIAL
hwidb=0x82C1B768, sardb=0x826404A4
slot 0, unit 0, subunit 0
Current (mxt5100_t) sardb:
  Ind_Q(0x3D53580), Ind_Q_idx(695), Ind_Q_size(30000)
  Cmd_Q(0x3D4E720), Cmd_Q_idx(359), Cmd_Q_size(20000)
  Inpool(0x3B9E1A0), Inpool_size(4096)
  Outpool(0x3D1B080), Outpool_size(4096)
  Localpool(0x3D20000), Localpool_size(256)
  StorBlk(0x3BA7000), host_blk(0x3BA4840), em_blk(0x3BA4900)
  tx_buf_desc(0x3D476A0), tx_free_desc_idx (1023)
  numFallback(0)
MXT5100 Port Info:
  Port Number (4), Port ID (0xE05)
  Interface Number (0), Interface ID (0xF5E0)
  Port Type 2, Port Open Status SUCCESS
HDLC channels opened(1)
  Port counters:Tx Packets:50686, Rx Packets:42864
  Tx Bytes:0, Rx Bytes:0
  Discards:No Resource:0, Protocol Errors 4
MXT5100 Channel Info:
  HDLC Channel Info (0):
    Chan_ID (0xF25), Open Status SUCCESS
    tx_limited=0(8)

Step 2  
**show interface serial**

Use this command to display the configuration on the serial interface.

Example:

Router# show interface serial 0/0:3
Serial0/0:3 is up, line protocol is up
  Hardware is ATM AIM SERIAL
  Internet address is 20.0.0.1/16
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation PPP, loopback not set
  LCP Open
  Open:IPCP, CDPCP
  Last input 00:00:09, output 00:00:09, output hang never
  Last clearing of "show interface" counters 18:36:25
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
Conversations: 0/1/256 (active/max active/max total)
Available Bandwidth: 48 kilobits/sec
5 minute input rate: 0 bits/sec, 0 packets/sec
5 minute output rate: 0 bits/sec, 0 packets/sec
6696 packets input, 466400 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
6697 packets output, 460924 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
Timeslot(s) Used: 4, Transmitter delay is 0 flags

Step 3 show isdn status
Use this command to display the status of all ISDN interfaces, including active layers, timer information, and switch-type settings.

Step 4 show network-clocks
Use this command to display the current chosen clock and the list of all sources of network clocks according to their priority.

Example:

Router# show network-clocks
Network Clock Configuration
---------- ---------- ------- ------
Priority Clock Source Clock State Clock Type
3 E1 6/2 GOOD E1
5 T1 2/0 GOOD T1
9 Backplane Good PLL

Current Primary Clock Source
---------- ---------- ------- ------
Priority Clock Source Clock State Clock Type
3 E1 6/2 GOOD E1

Step 5 show running-config
Use this command to display the basic router configuration.

Step 6 show voice dsp
Use this command to display the voice DSP configuration.

Example:

Router# show voice dsp
DSP DSP DSPWARE CURR BOOT PAK TX/RX
TYPE NUM CH CODEC VERSION STATE STATE RST AI VOICEPORT TS ABORT PACK COUNT
----- ---- --- ----- --------- ------ ---- --- ----- --- " " ---- ----------
C5421000 00 (high) 3.6.14 IDLE idle 0 0 0/0:0 01 0 5313/1516

Configuration Examples for Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module
Single-Serial-Data WAN Example

This example shows the configuration of a router whose E1 (0/0) controller is used for integrated voice and serial data. Note that E1 timeslots 1 to 11 are configured for serial data and E1 timeslots 12 to 31 are configured for PRI voice. Also note that interface Serial0/0:1 is the logical interface for E1 timeslots 1 to 11 and interface Serial0/0:15 is the logical interface for E1 timeslots 12 to 31.

Router# show running-config
Building configuration...
Current configuration : 1356 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname "buick-hc"
!
network-clock-participate wic 0
network-clock-participate aim 0
network-clock-select 1 E1 0/0
voice-card 5
dspfarm
!
ip subnet-zero
!!
isdn switch-type primary-qsig
no voice hpi capture buffer
no voice hpi capture destination
!
mta receive maximum-recipients 0
!
controller E1 0/0
  channel-group 1 timeslots 1-11 aim 0
  pri-group timeslots 12-31
!
controller E1 0/1
!
controller E1 0/3
controller E1 0/2
!
interface FastEthernet0/0
  no ip address
  shutdown
duplex auto
  speed auto
!
interface Serial0/0:1
  ip address 175.0.0.1 255.0.0.0
  encapsulation ppp
!
interface Serial0/0:15
  no ip address
  no logging event link-status
  isdn switch-type primary-qsig
  isdn incoming-voice voice
  no cdp enable
!
interface FastEthernet0/1
  ip address 1.10.10.1 255.0.0.0
  speed 100
  full-duplex
!
ip http server
Multiple-Serial-Data WAN Example

This example shows the configuration of a router whose E1 (0/0) controller is used voice and serial data traffic and whose E1 (0/1) controller is used completely for data traffic.

Router# show running-config
Building configuration...
Current configuration : 1492 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname "buick-hc"
!
network-clock-participate wic 0
network-clock-participate aim 0
network-clock-select 1 E1 0/0
voice-card 5
dspfarm
!
ip subnet-zero
!
no voice hpi capture buffer
do voice hpi capture destination
!
no mtas receive maximum-recipients 0
!
controller E1 0/0
  channel-group 1 timeslots 1-11 aim 0
  pri-group timeslots 12-31
!
controller E1 0/1
  channel-group 1 timeslots 1-31 aim 0
!
controller E1 0/3
!
controller E1 0/2
!
interface FastEthernet0/0
Configuration Examples for Integrated Voice and Data WAN on T1 E1 Interfaces Using the AIM-ATM-VOICE-30 Module

High-Complexity Codecs and Network Clock Example

This example shows the configuration of a router in which the WIC at slot 0 and AIM at slot 0 are configured to received clock from the network (see the lines network-clock-participate). Also note that E1 0/0 controller is the source of the network clock (see the line network-clock-select). This example also shows that the voice card in slot 5 uses a high-complexity codec.

Router# show running-config
Building configuration...
Current configuration : 1276 bytes
!
version 12.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname "router-hc"
!
network-clock-participate wic 0
network-clock-participate aim 0
network-clock-select 1 E1 0/0
voice-card 5
codec complexity high
dspfarm
!
ip subnet-zero
!
isdn switch-type primary-qsig
no voice hpi capture buffer
no voice hpi capture destination
!
mta receive maximum-recipients 0
!
controller E1 0/0
  pri-group timeslots 1-16
!
controller E1 0/1
!
controller E1 0/3
!
controller E1 0/2
!
interface FastEthernet0/0
  no ip address
  shutdown
duplex auto
  speed auto
!
interface Serial0/0:15
  no ip address
  no logging event link-status
  isdn switch-type primary-qsig
  isdn incoming-voice voice
  no cdp enable
!
interface FastEthernet0/1
  ip address 1.10.10.1 255.0.0.0
  speed 100
  full-duplex
!
ip http server
ip classless
!
call rsvp-sync
!
voice-port 0/0:15
!
mqcp profile default
!
dial-peer cor custom
!
dial-peer voice 40 pots
destination-pattern 427....
direct-inward-dial
port 0/0:15
prefix 427
!
dial-peer voice 400 voip
destination-pattern 525....
session target ipv4:0.10.10.2
!
line con 0
exec-timeout 0 0
line aux 0
line vty 0 4
login
!
end
Additional References

General ISDN References

- "Overview of ISDN Voice Interfaces" on page 3 --Describes relevant underlying technology; lists related documents, standards, MIBs, and RFCs; and describes how to obtain technical assistance
- "Additional References" section on page 64 --Lists additional ISDN references

References Mentioned in This Chapter


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