

# Transparent CCS and Frame Forwarding Enhancements on the Cisco MC3810

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This document describes enhancements to Transparent Common-Channel Signaling (CCS) and frame forwarding for the Cisco MC3810 multiservice access concentrator and includes the following sections:

- Feature Overview, page 1
- Supported Platform, page 3
- Supported Standards, MIBs, and RFCs, page 3
- Prerequisites, page 4
- Configuration Tasks, page 4
- Monitoring and Maintaining Transparent CCS and Frame Forwarding, page 10
- Configuration Examples, page 10
- Command Reference, page 32
- Debug Command Reference, page 39
- Glossary, page 43

## Feature Overview

The Transparent CCS (T-CCS) feature provides a way to interconnect private branch exchanges (PBXs), key systems (KTs), and central office switches (COs) when the private integrated services network exchange (PINX) does not support QSIG, or when the PINX uses a proprietary solution. Transparent CCS allows the connection of two PBXs with PRI or BRI interfaces that use one CCS protocol without the need for interpretation of CCS signaling for call processing. A PBX PRI group is transported transparently through the data network and the feature preserves proprietary signaling. From the PBX standpoint, this is accomplished through a point-to-point connection. Calls from the PINXs are not routed, but follow a preconfigured route to the destination. Transparent CCS is implemented in two ways:

- In the cross-connection method, CCS signaling messages are carried within a dedicated time slot. This time slot is cross-connected from the Cisco MC3810 digital voice module to the multiflex trunk module, and the information is carried transparently on-net over the intervening network, between the two DVM end-points. Cross-connect implies a fractional trunk.
- Frame forwarding, used with Transparent CCS, forwards High-Level Data Link Control (HDLC) frames over a preconfigured interface running HDLC, Frame Relay, or ATM encapsulation. CCS and frame forwarding were originally supported on the Cisco MC3810 in Release 12.0(2)T.

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**Note** The Transparent CCS feature only affects the functionality related to the D channel signaling interface (serial 1:23 for T1 and serial 1:15 for E1). This feature does not change the bearer channel (B channel) functionality for Frame Relay that was implemented in earlier Cisco IOS releases.

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## Benefits

Transparent CCS provides the following benefits:

- Provides efficient and cost-effective services on permanent (virtual) circuits or leased lines.
- Supports PBX “feature transparency” across a WAN, permitting PBX networks to provide advanced features, such as calling name and number display, camp-on/callback, network call forwarding, centralized attendant, and centralized message waiting. Usually, these capabilities are available on only a single site where users are attached to the same PBX.

## Restrictions

The following restrictions apply:

- The feature does not support Transparent CCS with VoIP.
- When CCS frame-forwarding is configured, the speed (clock rate) of serial interface 1 of the Cisco MC3810 is limited to a maximum of 192 kbps. This restriction assumes that the multiflex trunk module (MFT) is installed in slot 3 on the Cisco MC3810. If the MFT is not installed, then serial interface 1 does not operate, but CCS frame-forwarding is supported on other interfaces.
- Transparent CCS feature supports PVCs, not SVCs.
- Cross connections imply fractional trunks.
- For Frame Forwarding, pre-configured interfaces can be Serial 0, Serial 1, or T1/E1 0.

## Related Features and Technologies

CCS differs from a related technology, channel-associated signaling (CAS) in that it uses a separate transmission channel to relay signaling and address information in embedded packets conforming to standards recommendations. Examples of CCS signaling include Q.931 on ISDN Primary Rate Interface (PRI) and QSIG protocol signaling for PINX devices.

CAS signaling, which is older than CCS, has evolved over many years and is supported on many Cisco routers. CAS signals and the DTMF (or Dial pulse) digits that indicate the called party's telephone number are presented within the actual voice band transmission channel. Digital Signal processors (DSPs) in Cisco voice nodes monitor these channels, decode the status and address signaling, and report status and state changes for the telephone calls.

## Related Documents

The following documents can help you understand Transparent CCS support and related technologies:

- *Configuring Cisco MC3810 Series Concentrators to Use High-Performance Compression Modules:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120xk/1207xk/t1\\_vohcm.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120xk/1207xk/t1_vohcm.htm)
- *Voice Port Enhancements in Cisco 2600 and 3600 Series Routers and MC3810 Series Concentrators:*  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120xk/1207xk/voxpath.htm>
- *Voice over Frame Relay Using FRF.11 and FRF.12:*  
<http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120t/120t4/120tvofr/index.htm>
- *Voice over Frame Relay Using FRF.11 and FRF.12 Configuration Updates:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120xk/1207xk/vofr\\_6x.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120xk/1207xk/vofr_6x.htm)

For hardware information, including information about the high-performance compression module (HCM), see *Cisco MC3810 Multiservice Concentrator Hardware Installation*, <http://www.cisco.com/univercd/cc/td/doc/product/access/multicon/3810hwig/index.htm>

The following Cisco IOS Release 12.0 documents are also helpful:

- *Wide-Area Networking Configuration Guide:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/wan\\_c/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/wan_c/index.htm)
- *Wide-Area Networking Command Reference:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/wan\\_r/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/wan_r/index.htm)
- *Voice, Video, and Home Applications Configuration Guide:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/voice\\_c/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/voice_c/index.htm)
- *Voice, Video, and Home Applications Command Reference:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/voice\\_r/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/voice_r/index.htm)
- *Debug Command Reference:*  
[http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12supdoc/debug\\_r/index.htm](http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12supdoc/debug_r/index.htm)

## Supported Platform

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

## Supported Standards, MIBs, and RFCs

None.

## Prerequisites

- Install Cisco IOS Release 12.0(7)XK.
- Obtain T1 or E1 service from your service provider.
- Establish a working network.
  - For more information about configuring Frame Relay, see “Configuring Frame Relay” in the Cisco IOS Release 12.0 *Wide-Area Networking Configuration Guide*.
  - For more information about configuring ATM, see “Configuring ATM” in the Cisco IOS Release 12.0 *Wide-Area Networking Configuration Guide*.
  - For more information about configuring Frame Relay and ATM on the Cisco MC3810, see *Cisco MC3810 Multiservice Concentrator Configuration Guide*
- Complete your company’s dial plan.
- Establish a working telephony network based on your company’s dial plan. See “Related Documents” on page 3 for information about helpful documents.
- Install required multiflex trunk modules and the following voice components:
  - A digital voice module (DVM) to support digital cross-connect voice (channel bank functionality)
  - HCM to support voice compression. See “Related Documents” on page 3.
- Configure voice card and controller settings.
- Configure serial and LAN interfaces.
- Configure voice ports.
- Configure voice dial peers.

## Configuration Tasks

Perform the following tasks to configure your Cisco MC3810 multiservice concentrator:

- Configuring T-CCS Cross-Connect
- Configuring T-CCS Frame-Forwarding

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**Note** Although not explicitly stated in these procedures, Transparent CCS requires you to configure voice ports and dial peers also. See “Related Documents” on page 3 for other resources.

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## Configuring T-CCS Cross-Connect

This section is divided into the following procedures for CCS Cross-Connect:

- Configuring Channel Groups
- Configuring T1 and E1 Trunk Bearer Channels

## Configuring Channel Groups

When you configure CCS cross-connect for E1 or T1, you set up time slot groups, then configure cross-connect from the first T1/E1 controller to the second T1/E1 controller. The **mode ccs cross-connect** command allows the cross-connect. This enables all the channels to perform similarly to normal CAS mode, except that the signaling bit is no longer processed by the router.

To configure Transparent CCS cross-connect, complete the following steps beginning in global configuration mode:

<b>Step 1</b>	<code>router# controller T1   E1 0</code>	Enter controller configuration mode for controller E1 or T1 0.
<b>Step 2</b>	<code>router(config-controller)# tdm-group tdm-group-no timeslots timeslot-list</code>	Configure a TDM channel group. Do not specify the <b>type</b> option in the command.  Valid values for <i>tdm-group-no</i> are 0 through 23 for T1 and 0 through 30 for E1.  The valid <i>timeslots</i> values are: 1 to 24 for T1; 1 to 15 and 17 to 31 for E1. You can enter ranges or individual time slot numbers.
<b>Step 3</b>	<code>router(config-controller)# exit</code>	Exit controller configuration mode for this controller.
<b>Step 4</b>	<code>router# controller T1   E1 1</code>	Enter controller configuration mode for controller E1 or T1 1.
<b>Step 5</b>	<code>router(config-controller)# mode ccs cross-connect</code>	Configure the controller to support CCS cross-connect and trigger the signaling channel.
<b>Step 6</b>	<code>router(config-controller)# tdm-group tdm-group-no timeslots timeslot-list</code>	(T1 only) Configure a second TDM channel group. Do not specify the <b>type</b> option in the command.  Valid values for <i>tdm-group-no</i> are 0 through 23 for T1 and 0 through 30 for E1.  The valid <i>timeslots</i> values are: 1 to 24 for T1 and 1 to 15 and 17 to 31 for E1. You can enter ranges or individual time slot numbers.
<b>Step 7</b>	<code>router(config-controller)# ds0-group channel-no timeslots timeslot-list type ext-sig</code>	(E1 only) Configure the specified channel to support CCS mode.  Valid values for <i>channel-no</i> are 0 through 23 for T1 and 0 through 30 for E1.  The valid <i>timeslots</i> values are: 1 to 24 for T1 and 1 to 31 for E1. You can enter ranges or individual time slot numbers.  Specify <b>ext-sig</b> as the type for FRF.11 support. This option is available only when the <b>mode ccs cross-connect</b> command is enabled.  <b>Note</b> The <b>ds0-group</b> command replaces the <b>voice-group</b> command that was supported in earlier releases. <b>ext-sig</b> replaces the <b>ext-sig-master</b> and <b>ext-sig-slave</b> options that were supported with the <b>voice-group</b> command.
<b>Step 8</b>	<code>router(config-controller)# cross-connect id controller-1 tdm-group-no-1 controller-2 tdm-group-no-2</code>	Configure cross-connect pass-through between the two controllers. Depending on whether you are using T1 or E1, connect the two TDM controller groups (T1) or connect the TDM group controller to the DS0 group controller (E1).

## Configuring T1 and E1 Trunk Bearer Channels



**Tips** After you configure a Transparent CCS connection by entering the **connection trunk** command, no change to the configuration takes place until the connection is shut down with a **shutdown** command and then restarted with a **no shutdown** command. For example, the phone number supplied in the **connection trunk** command can be changed while the connection is in **no shutdown** state, but the change will not cause the current connection to be closed and a new connection to be opened to the new phone number. This will only take effect on the next **no shutdown** command following a **shutdown** command.

**Note** CCS cross-connect is not supported on analog PVC connections.

To use CCS cross-connect for bearer channels of the E1 or T1 trunk, you must perform the following additional configuration beginning in global configuration mode:

<b>Step 1</b>	<code>router# controller {T1   E1} number</code>	Enter controller configuration mode for the controller.
<b>Step 2</b>	<code>router(config-controller)# mode ccs cross-connect</code>	Specify the controller to support CCS cross-connect. This option automatically creates serial interface 1:15 (E1) or 1:23 (T1)
<b>Step 3</b>	<code>router(config-controller)# ds0-group channel-no timeslots timeslot-list type ext-sig</code>	Configure the specified channel to support CCS mode. Valid values for <i>channel-no</i> are 0 through 23 for T1 and 0 through 30 for E1.  The valid <i>timeslots</i> values are: 1 to 24 for T1 and 1 to 31 for E1. You can enter ranges or individual time slot numbers.  Specify <b>ext-sig</b> as the type for FRF.11 support. This option is available only when the <b>mode ccs cross-connect</b> command is enabled.  The <b>ds0-group</b> command replaces the <b>voice-group</b> command that was supported in earlier releases. <b>ext-sig</b> replaces the <b>ext-sig-master</b> and <b>ext-sig-slave</b> options that were supported with the <b>voice-group</b> command.
<b>Step 4</b>	<code>router(config-controller)# exit</code>	Exit controller configuration mode for this controller.
<b>Step 5</b>	<code>router# (config-if)# voice-port slot/port</code>	Enter voice-port configuration mode.  For digital voice ports, the <i>slot</i> number is 1 for this configuration. Valid numbers for <i>port</i> are from 1 to 24 for T1, from 1 to 15, or from 17 to 31 for E1.  <b>Note</b> The <i>slot:port</i> format is also accepted.
<b>Step 6</b>	<code>router# (config-voiceport)# connection trunk string</code>	Configure the voice-port connection. For the string, enter the number of the voice channel that was configured as the <b>ext-sig</b> type for the <b>ds0-group</b> command.

## Configuring T-CCS Frame-Forwarding

To configure CCS frame-forwarding, follow these steps beginning in global configuration mode:

<b>Step 1</b>	<code>router# controller {T1   E1} 1</code>	Enter controller configuration mode. CCS frame-forwarding is only available on controller T1 1 or E1 1.
<b>Step 2</b>	<code>router# (config-controller)# mode ccs frame-forwarding</code>	Specify the controller to support CCS frame-forwarding.

<b>Step 3</b>	<pre>router(config-controller)# ds0-group channel-no timeslots timeslot-list type ext-sig</pre>	<p>Configure the specified channel to support CCS mode. Valid values for <i>channel-no</i> are 0 through 23 for T1 and 0 through 30 for E1.</p> <p>The valid <i>timeslots</i> values are: 1 to 24 for T1 and 1 to 31 for E1. You can enter ranges or individual time slot numbers.</p> <p>Specify <b>ext-sig</b> as the type for FRF.11 support. This option is available only when the <b>mode ccs frame forwarding</b> command is enabled.</p> <p>The <b>ds0-group</b> command replaces the <b>voice-group</b> command that was supported in earlier releases. <b>ext-sig</b> replaces the <b>ext-sig-master</b> and <b>ext-sig-slave</b> options that were supported with the <b>voice-group</b> command.</p>
<b>Step 4</b>	<pre>router# (config-controller)# exit</pre>	Exit controller configuration mode.
<b>Step 5</b>	<pre>router# (config-if)# voice-port slot/port</pre>	<p>Enter voice-port configuration mode.</p> <p>For digital voice ports, the <i>slot</i> number is always 1. Valid numbers for <i>port</i> are from 0 to 23 for T1, from 0 to 15, or from 17 to 30 for E1.</p> <p><b>Note</b> The <i>slot:port</i> format is also accepted.</p>
<b>Step 6</b>	<pre>router(config-voiceport)# connection trunk string</pre>	For the string, enter the number of the voice channel that was configured as the <b>ext-sig</b> type for the <b>ds0-group</b> command.
<b>Step 7</b>	<pre>router(config-voiceport)# exit</pre>	Exit voice-port configuration mode.
<b>Step 8</b>	<pre>router (config-if)# interface serial 1:x</pre>	<p>Enter interface mode for serial 1:x where x represents the channel number. For E1, enter <b>15</b> (the actual signaling channel is 16). For T1, enter <b>23</b> (the actual signaling channel is 24).</p> <p>This procedure maps the D channel from the DVM to the specified interface.</p>
<b>Step 9</b>	<pre>router (config-if)# ccs encap frf11</pre>	<p>(Frame Relay only) This command allows you to specify the standard Annex-C format. Use this command to define the packet format for the CCS packet; it places the FRF.11 Annex-C (Data Transfer Syntax) standard header on the CCS packets only and not on B channel packets.</p> <p>Once this command is executed, you can use the <b>ccs connect</b> command to specify a CID other than 254.</p>
<b>Step 10</b>	<pre>router (config-if)# ccs connect {serial   atm } number [dlci dlci   pvc vpi/vci ] pvc string ][cid cidnumber ]</pre>	<p>(Frame Relay and ATM) Configure the CCS connection.</p> <p>If the CCS connection is over Frame Relay, specify a serial interface and the DLCI.</p> <p>If the CCS connection is over ATM, specify <b>atm</b>, interface 0, and the PVC.</p> <p>The <b>cid</b> option allows you to specify a channel identifier (CID) from 5 to 255. If you have not executed the <b>ccs encap frf11</b> command, however, any CID number other than the default of 254 is ignored, and Cisco encapsulation is used.</p>
<b>Step 11</b>	<pre>router (config-if)# no cdp enable</pre>	<p>Disable Cisco Discovery Protocol (CDP) on the interface.</p> <p><b>Note</b> CDP and keepalives are disabled by default on a D channel interface.</p>
<b>Step 12</b>	<pre>router (config-if)# no keepalive</pre>	Disable keepalive packets on the interface.

## Verifying Transparent CCS Configuration

**Step 1** To see information about voice-port configuration, enter the **show voice port summary** command.

```
router# show voice port summary
```

PORT	CH	SIG-TYPE	ADMIN	OPER	IN STATUS	OUT STATUS	EC
1:1	1	ext	up	up	on-hook	idle	y
1:2	2	ext	up	up	on-hook	idle	y
1:3	3	ext	up	up	on-hook	idle	y
1:4	4	ext	up	up	on-hook	idle	y
1:5	5	ext	up	up	on-hook	idle	y
1:6	6	ext	up	up	on-hook	idle	y
1:7	7	ext	up	up	on-hook	idle	y
1:8	8	ext	up	up	on-hook	idle	y
1:9	9	ext	up	up	on-hook	idle	y
1:10	10	ext	up	up	on-hook	idle	y
1:11	11	ext	up	up	on-hook	idle	y
1:12	12	ext	up	up	on-hook	idle	y
1:13	13	ext	up	up	on-hook	idle	y
1:14	14	ext	up	up	on-hook	idle	y
1:17	17	ext	up	up	on-hook	idle	y
1:18	18	ext	up	up	on-hook	idle	y
1:19	19	ext	up	up	on-hook	idle	y
1:20	20	ext	up	up	on-hook	idle	y
1:21	21	ext	up	up	on-hook	idle	y
1:22	22	ext	up	up	on-hook	idle	y
1:23	23	ext	up	up	on-hook	idle	y
1:24	24	ext	up	up	on-hook	idle	y
1:25	25	ext	up	up	on-hook	idle	y
1:26	26	ext	up	up	on-hook	idle	y

**Step 2** To display information about voice calls, enter the **show voice call summary** privileged EXEC command. The following example shows sample output:

```
router# show voice call summary
```

PORT	CODEC	VAD	VTSP	STATE	VPM STATE
1:1.1	g729ar8	y	S_CONNECT		S_TRUNKED
1:2.2	g729ar8	y	S_CONNECT		S_TRUNKED
1:3.3	g729ar8	y	S_CONNECT		S_TRUNKED
1:4.4	g729ar8	y	S_CONNECT		S_TRUNKED
1:5.5	g729ar8	y	S_CONNECT		S_TRUNKED
1:6.6	g729ar8	y	S_CONNECT		S_TRUNKED
1:7.7	g729ar8	y	S_CONNECT		S_TRUNKED
1:8.8	g729ar8	y	S_CONNECT		S_TRUNKED
1:9.9	g729ar8	y	S_CONNECT		S_TRUNKED
1:10.10	g729ar8	y	S_CONNECT		S_TRUNKED
1:11.11	g729ar8	y	S_CONNECT		S_TRUNKED
1:12.12	g729ar8	y	S_CONNECT		S_TRUNKED
1:13.13	g729ar8	y	S_CONNECT		S_TRUNKED
1:14.14	g729ar8	y	S_CONNECT		S_TRUNKED
1:17.17	g729ar8	y	S_CONNECT		S_TRUNKED
1:18.18	g729ar8	y	S_CONNECT		S_TRUNKED
1:19.19	g729ar8	y	S_CONNECT		S_TRUNKED
1:20.20	g729ar8	y	S_CONNECT		S_TRUNKED
1:21.21	g729ar8	y	S_CONNECT		S_TRUNKED
1:22.22	g729ar8	y	S_CONNECT		S_TRUNKED
1:23.23	g729ar8	y	S_CONNECT		S_TRUNKED
1:24.24	g729ar8	y	S_CONNECT		S_TRUNKED
1:25.25	g729ar8	y	S_CONNECT		S_TRUNKED
1:26.26	g729ar8	y	S_CONNECT		S_TRUNKED

**Step 3** To display information about configured DS0 and TDM groups, enter the **show running-config** privileged EXEC command. The following example shows sample output:

---

**Note** For full configuration details, see “Configuration Examples” on page 10.

---

```
router#show running-config
.
.
.
controller T1 0
  tdm-group 1 timeslots 24
  framing esf
  linecode b8zs
  channel-group 0 timeslots 1-23 speed 64
!
controller E1 1
  mode ccs cross-connect
  tdm-group 1 timeslots 16
  clock source internal
  ds0-group 0 timeslots 1 type ext-sig
  ds0-group 2 timeslots 2 type ext-sig
  ds0-group 3 timeslots 3 type ext-sig
  ds0-group 4 timeslots 4 type ext-sig
  ds0-group 5 timeslots 5 type ext-sig
  ds0-group 6 timeslots 6 type ext-sig
.
.
.
  ds0-group 23 timeslots 23 type ext-sig
  ds0-group 24 timeslots 24 type ext-sig
  ds0-group 25 timeslots 25 type ext-sig
  ds0-group 26 timeslots 26 type ext-sig
.
.
.
voice-port 1:0
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3001
!
voice-port 1:2
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3002
!
voice-port 1:3
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3003
!
.
.
.
```

```
dial-peer voice 12 pots
 destination-pattern 4012
 port 1:12
!
dial-peer voice 13 pots
 destination-pattern 4013
 port 1:13
!
dial-peer voice 14 pots
 destination-pattern 4014
 port 1:14
!
!
cross-connect 1 E1 1 1 T1 0 1
```

## Monitoring and Maintaining Transparent CCS and Frame Forwarding

The following commands can help you analyze your VoFR or VoATM configuration. None are new or modified.

Command	Purpose
router# <b>show frame-relay vofr</b> [ <i>interface</i> [ <i>dlci</i> [ <i>cid</i> ]]]	Displays information about FRF.11 subchannels and CIDs.
router# <b>show interface serial0</b>	Displays information the serial interface used with VoFR, the DLCIs used on the interface, and the DLCI used for the Local Management Interface (LMI).
router# <b>show frame-relay pvc</b> [ <b>interface</b> <i>interface</i> [ <i>dlci</i> ] [ <i>cid</i> ]]	Displays information about Frame-Relay PVCs, on all PVCs, or for a particular CID.
router# <b>show atm pvc</b> [ <i>vpi/vci</i> ] [ <i>name</i> ]	Displays information about all configured ATM PVCs or about a particule PVC by VPI/VCI or by name.
router# <b>show interface atm0</b>	Displays information about ATM interface configuration.

## Configuration Examples

The following examples show Transparent CCS configurations:

- Transparent CCS over FRF.11
- Transparent CCS Cross-Connect over Frame Relay
- Transparent CCS Cross-Connect over Frame Relay

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**Note** IP addresses are fictional place-holders only.

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## Transparent CCS over FRF.11

The following configuration example configures Transparent CCS with FRF.11 VoFR on both the originating and the terminating side. Other commands necessary for the configuration are included.

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### Router A: Originating Configuration

```

version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname RouterA
!
logging buffered 4096 debugging
!
!
!
!
!
network-clock base-rate 56k
ip subnet-zero
no ip routing
no ip domain-lookup
!
!
!
controller T1 0
    framing esf
    linecode b8zs
!
controller E1 1
    mode ccs frame-forwarding
    clock source internal
    ds0-group 1 timeslots 1 type ext-sig
    ds0-group 2 timeslots 2 type ext-sig
    ds0-group 3 timeslots 3 type ext-sig
    ds0-group 4 timeslots 4 type ext-sig
    ds0-group 5 timeslots 5 type ext-sig
    ds0-group 6 timeslots 6 type ext-sig
    ds0-group 7 timeslots 7 type ext-sig
    ds0-group 8 timeslots 8 type ext-sig
    ds0-group 9 timeslots 9 type ext-sig
    ds0-group 10 timeslots 10 type ext-sig
    ds0-group 11 timeslots 11 type ext-sig
    ds0-group 12 timeslots 12 type ext-sig
    ds0-group 13 timeslots 13 type ext-sig
    ds0-group 14 timeslots 14 type ext-sig
    ds0-group 17 timeslots 17 type ext-sig
    ds0-group 18 timeslots 18 type ext-sig
    ds0-group 19 timeslots 19 type ext-sig
    ds0-group 20 timeslots 20 type ext-sig
    ds0-group 21 timeslots 21 type ext-sig
    ds0-group 22 timeslots 22 type ext-sig
    ds0-group 23 timeslots 23 type ext-sig
    ds0-group 24 timeslots 24 type ext-sig
    ds0-group 25 timeslots 25 type ext-sig
    ds0-group 26 timeslots 26 type ext-sig
!

```

---

### Router B: Terminating Configuration

```

version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname RouterB
!
no logging buffered
!
!
!
!
!
network-clock base-rate 64k
network-clock-select 1 system(SCB)
ip subnet-zero
no ip routing
!
frame-relay switching
!
!
controller T1 0
    shutdown
    framing esf
    clock source internal
    linecode b8zs
!
controller E1 1
    mode ccs frame-forwarding
    clock source internal
    ds0-group 1 timeslots 1 type ext-sig
    ds0-group 2 timeslots 2 type ext-sig
    ds0-group 3 timeslots 3 type ext-sig
    ds0-group 4 timeslots 4 type ext-sig
    ds0-group 5 timeslots 5 type ext-sig
    ds0-group 6 timeslots 6 type ext-sig
    ds0-group 7 timeslots 7 type ext-sig
    ds0-group 8 timeslots 8 type ext-sig
    ds0-group 9 timeslots 9 type ext-sig
    ds0-group 10 timeslots 10 type ext-sig
    ds0-group 11 timeslots 11 type ext-sig
    ds0-group 12 timeslots 12 type ext-sig
    ds0-group 13 timeslots 13 type ext-sig
    ds0-group 14 timeslots 14 type ext-sig
    ds0-group 17 timeslots 17 type ext-sig
    ds0-group 18 timeslots 18 type ext-sig
    ds0-group 19 timeslots 19 type ext-sig
    ds0-group 20 timeslots 20 type ext-sig
    ds0-group 21 timeslots 21 type ext-sig
    ds0-group 22 timeslots 22 type ext-sig
    ds0-group 23 timeslots 23 type ext-sig
    ds0-group 24 timeslots 24 type ext-sig
    ds0-group 25 timeslots 25 type ext-sig
    ds0-group 26 timeslots 26 type ext-sig
!

```

---

**Router A: Originating Configuration**

```

interface Ethernet0
 ip address 10.8.17.44 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface Serial0
 no ip address
 no ip directed-broadcast
 encapsulation frame-relay
 no ip route-cache
 no ip mroute-cache
 no keepalive
 no fair-queue
 frame-relay interface-dlci 37
 class frs0
 vofr data 40 call-control 50
 hold-queue 1024 out
!
interface Serial1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 no keepalive
 shutdown
 no fair-queue
 hold-queue 1024 out
!
interface Serial1:15
 no ip address
 no ip directed-broadcast
 no keepalive
 ccs encap frf11
 ccs connect Serial0 37 100
 no cdp enable
!
interface FR-ATM20
 no ip address
 no ip directed-broadcast
 no ip route-cache
 shutdown
!
ip default-gateway 10.7.0.1
no ip http server
ip classless
!
map-class frame-relay frs0
 frame-relay voice bandwidth 1000000
 frame-relay fragment 200
 no frame-relay adaptive-shaping
 frame-relay cir 1024000
 frame-relay fair-queue!

```

**Router B: Terminating Configuration**

```

interface Ethernet0
 ip address 10.8.17.33 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface Serial0
 no ip address
 no ip directed-broadcast
 encapsulation frame-relay
 no ip route-cache
 no ip mroute-cache
 no keepalive
 no fair-queue
 frame-relay interface-dlci 37
 class frs0
 vofr data 40 call-control 50
 hold-queue 1024 out
!
interface Serial1
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 shutdown
!
interface Serial1:15
 no ip address
 no ip directed-broadcast
 no keepalive
 ccs encap frf11
 ccs connect Serial0 37 100
 no cdp enable
!
interface FR-ATM20
 no ip address
 no ip directed-broadcast
 no ip route-cache
 shutdown
!
no ip http server
ip classless
!
!
map-class frame-relay frs0
 frame-relay voice bandwidth 1000000
 frame-relay fragment 200
 no frame-relay adaptive-shaping
 frame-relay cir 1024000
 frame-relay fair-queue
!

```

**Router A: Originating Configuration**

```

voice-port 1:1
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3001
!
voice-port 1:2
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3002
!
voice-port 1:3
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3003
!
voice-port 1:4
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3004
!
voice-port 1:5
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3005
!
voice-port 1:6
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3006
!
voice-port 1:7
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3007
!
voice-port 1:8
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3008
!
voice-port 1:9
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3009
!
voice-port 1:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3010
!
voice-port 1:11
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3011
!
voice-port 1:12
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3012 !

```

**Router B: Terminating Configuration**

```

voice-port 1:1
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4001
!
voice-port 1:2
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4002
!
voice-port 1:3
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4003
!
voice-port 1:4
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4004
!
voice-port 1:5
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4005
!
voice-port 1:6
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4006
!
voice-port 1:7
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4007
!
voice-port 1:8
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4008
!
voice-port 1:9
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4009
!
voice-port 1:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4010
!
voice-port 1:11
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4011
!
voice-port 1:12
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4012

```

---

**Router A: Originating Configuration**

```
voice-port 1:13
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3013
!
voice-port 1:14
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3014
!
voice-port 1:17
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3017
!
voice-port 1:18
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3018
!
voice-port 1:19
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3019
!
voice-port 1:20
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3020
!
voice-port 1:21
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3021
!
voice-port 1:22
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3022
!
voice-port 1:23
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3023
!
voice-port 1:24
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3024
!
voice-port 1:25
  compand-type a-law
  timeouts wait-release 5
  connection trunk 3025
!
voice-port 1:26
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3026
```

---

**Router B: Terminating Configuration**

```
voice-port 1:13
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4013
!
voice-port 1:14
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4014
!
voice-port 1:17
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4017
!
voice-port 1:18
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4018
!
voice-port 1:19
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4019
!
voice-port 1:20
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4020
!
voice-port 1:21
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4021
!
voice-port 1:22
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4022
!
voice-port 1:23
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4023
!
voice-port 1:24
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4024
!
voice-port 1:25
  compand-type a-law
  timeouts wait-release 5
  connection trunk 4025
!
voice-port 1:26
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4026
```

---

---

**Router A: Originating Configuration**

```
dial-peer voice 1 pots
 destination-pattern 4001
 port 1:1
!
dial-peer voice 3001 vofr
 destination-pattern 3001
 session protocol frf11-trunk
 session target Serial0 37 5
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 2 pots
 destination-pattern 4002
 port 1:2
!
dial-peer voice 3002 vofr
 destination-pattern 3002
 session protocol frf11-trunk
 session target Serial0 37 6
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 3 pots
 destination-pattern 4003
 port 1:3
!
dial-peer voice 3003 vofr
 destination-pattern 3003
 session protocol frf11-trunk
 session target Serial0 37 7
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 4 pots
 destination-pattern 4004
 port 1:4
!
dial-peer voice 3004 vofr
 destination-pattern 3004
 session protocol frf11-trunk
 session target Serial0 37 8
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 5 pots
 destination-pattern 4005
 port 1:5
!
dial-peer voice 3005 vofr
 destination-pattern 3005
 session protocol frf11-trunk
 session target Serial0 37 9
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 6 pots
 destination-pattern 4006
 port 1:6
!
```

---

**Router B: Terminating Configuration**

```
dial-peer voice 1 pots
 destination-pattern 3001
 port 1:1
!
dial-peer voice 4001 vofr
 destination-pattern 4001
 session protocol frf11-trunk
 session target Serial0 37 5
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 2 pots
 destination-pattern 3002
 port 1:2
!
dial-peer voice 4002 vofr
 destination-pattern 4002
 session protocol frf11-trunk
 session target Serial0 37 6
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 3 pots
 destination-pattern 3003
 port 1:3
!
dial-peer voice 4003 vofr
 destination-pattern 4003
 session protocol frf11-trunk
 session target Serial0 37 7
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 4 pots
 destination-pattern 3004
 port 1:4
!
dial-peer voice 4004 vofr
 destination-pattern 4004
 session protocol frf11-trunk
 session target Serial0 37 8
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 5 pots
 destination-pattern 3005
 port 1:5
!
dial-peer voice 4005 vofr
 destination-pattern 4005
 session protocol frf11-trunk
 session target Serial0 37 9
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 6 pots
 destination-pattern 3006
 port 1:6
!
```

---

**Router A: Originating Configuration**

```
dial-peer voice 3006 vofr
 destination-pattern 3006
 session protocol frf11-trunk
 session target Serial0 37 10
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 7 pots
 destination-pattern 4007
 port 1:7
!
dial-peer voice 3007 vofr
 destination-pattern 3007
 session protocol frf11-trunk
 session target Serial0 37 11
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 8 pots
 destination-pattern 4008
 port 1:8
!
dial-peer voice 3008 vofr
 destination-pattern 3008
 session protocol frf11-trunk
 session target Serial0 37 12
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 9 pots
 destination-pattern 4009
 port 1:9
!
dial-peer voice 3009 vofr
 destination-pattern 3009
 session protocol frf11-trunk
 session target Serial0 37 13
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 10 pots
 destination-pattern 4010
 port 1:10
!
dial-peer voice 3010 vofr
 destination-pattern 3010
 session protocol frf11-trunk
 session target Serial0 37 14
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 11 pots
 destination-pattern 4011
 port 1:11
!
dial-peer voice 3011 vofr
 destination-pattern 3011
 session protocol frf11-trunk
 session target Serial0 37 15
 signal-type ext-signal
 codec g729ar8
```

**Router B: Terminating Configuration**

```
dial-peer voice 4006 vofr
 destination-pattern 4006
 session protocol frf11-trunk
 session target Serial0 37 10
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 7 pots
 destination-pattern 3007
 port 1:7
!
dial-peer voice 4007 vofr
 destination-pattern 4007
 session protocol frf11-trunk
 session target Serial0 37 11
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 8 pots
 destination-pattern 3008
 port 1:8
!
dial-peer voice 4008 vofr
 destination-pattern 4008
 session protocol frf11-trunk
 session target Serial0 37 12
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 9 pots
 destination-pattern 3009
 port 1:9
!
dial-peer voice 4009 vofr
 destination-pattern 4009
 session protocol frf11-trunk
 session target Serial0 37 13
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 10 pots
 destination-pattern 3010
 port 1:10
!
dial-peer voice 4010 vofr
 destination-pattern 4010
 session protocol frf11-trunk
 session target Serial0 37 14
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 11 pots
 destination-pattern 3011
 port 1:11
!
dial-peer voice 4011 vofr
 destination-pattern 4011
 session protocol frf11-trunk
 session target Serial0 37 15
 signal-type ext-signal
 codec g729ar8
```

**Router A: Originating Configuration**

```

!
dial-peer voice 12 pots
 destination-pattern 4012
 port 1:12
!
dial-peer voice 3012 vofr
 destination-pattern 3012
 session protocol frf11-trunk
 session target Serial0 37 16
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 13 pots
 destination-pattern 4013
 port 1:13
!
dial-peer voice 3013 vofr
 destination-pattern 3013
 session protocol frf11-trunk
 session target Serial0 37 17
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 14 pots
 destination-pattern 4014
 port 1:14
!
dial-peer voice 3014 vofr
 destination-pattern 3014
 session protocol frf11-trunk
 session target Serial0 37 18
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 17 pots
 destination-pattern 4017
 port 1:17
!
dial-peer voice 3017 vofr
 destination-pattern 3017
 session protocol frf11-trunk
 session target Serial0 37 19
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 18 pots
 destination-pattern 4018
 port 1:18
!
dial-peer voice 3018 vofr
 destination-pattern 3018
 session protocol frf11-trunk
 session target Serial0 37 22
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 19 pots
 destination-pattern 4019
 port 1:19
!

```

**Router B: Terminating Configuration**

```

!
dial-peer voice 12 pots
 destination-pattern 3012
 port 1:12
!
dial-peer voice 4012 vofr
 destination-pattern 4012
 session protocol frf11-trunk
 session target Serial0 37 16
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 13 pots
 destination-pattern 3013
 port 1:13
!
dial-peer voice 4013 vofr
 destination-pattern 4013
 session protocol frf11-trunk
 session target Serial0 37 17
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 14 pots
 destination-pattern 3014
 port 1:14
!
dial-peer voice 4014 vofr
 destination-pattern 4014
 session protocol frf11-trunk
 session target Serial0 37 18
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 17 pots
 destination-pattern 3017
 port 1:17
!
dial-peer voice 4017 vofr
 destination-pattern 4017
 session protocol frf11-trunk
 session target Serial0 37 19
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 18 pots
 destination-pattern 3018
 port 1:18
!
dial-peer voice 4018 vofr
 destination-pattern 4018
 session protocol frf11-trunk
 session target Serial0 37 22
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 19 pots
 destination-pattern 3019
 port 1:19
!

```

---

### Router A: Originating Configuration

```
dial-peer voice 3019 vofr
 destination-pattern 3019
 session protocol frf11-trunk
 session target Serial0 37 23
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 20 pots
 destination-pattern 4020
 port 1:20
!
dial-peer voice 3020 vofr
 destination-pattern 3020
 session protocol frf11-trunk
 session target Serial0 37 24
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 21 pots
 destination-pattern 4021
 port 1:21
!
dial-peer voice 3021 vofr
 destination-pattern 3021
 session protocol frf11-trunk
 session target Serial0 37 25
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 22 pots
 destination-pattern 4022
 port 1:22
!
dial-peer voice 3022 vofr
 destination-pattern 3022
 session protocol frf11-trunk
 session target Serial0 37 26
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 23 pots
 destination-pattern 4023
 port 1:23
!
dial-peer voice 3023 vofr
 destination-pattern 3023
 session protocol frf11-trunk
 session target Serial0 37 27
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 24 pots
 destination-pattern 4024
 port 1:24
!
```

---

### Router B: Terminating Configuration

```
dial-peer voice 4019 vofr
 destination-pattern 4019
 session protocol frf11-trunk
 session target Serial0 37 23
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 20 pots
 destination-pattern 3020
 port 1:20
!
dial-peer voice 4020 vofr
 destination-pattern 4020
 session protocol frf11-trunk
 session target Serial0 37 24
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 21 pots
 destination-pattern 3021
 port 1:21
!
dial-peer voice 4021 vofr
 destination-pattern 4021
 session protocol frf11-trunk
 session target Serial0 37 25
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 22 pots
 destination-pattern 3022
 port 1:22
!
dial-peer voice 4022 vofr
 destination-pattern 4022
 session protocol frf11-trunk
 session target Serial0 37 26
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 23 pots
 destination-pattern 3023
 port 1:23
!
dial-peer voice 4023 vofr
 destination-pattern 4023
 session protocol frf11-trunk
 session target Serial0 37 27
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 24 pots
 destination-pattern 3024
 port 1:24
!
```

---

---

**Router A: Originating Configuration**

```
dial-peer voice 3024 vofr
 destination-pattern 3024
 session protocol frf11-trunk
 session target Serial0 37 28
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 25 pots
 destination-pattern 4025
 port 1:25
!
dial-peer voice 3025 vofr
 destination-pattern 3025
 session protocol frf11-trunk
 session target Serial0 37 29
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 26 pots
 destination-pattern 4026
 port 1:26
!
dial-peer voice 3026 vofr
 destination-pattern 3026
 session protocol frf11-trunk
 session target Serial0 37 30
 signal-type ext-signal
 codec g729ar8
.
.
.
```

---

**Router B: Terminating Configuration**

```
dial-peer voice 4024 vofr
 destination-pattern 4024
 session protocol frf11-trunk
 session target Serial0 37 28
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 25 pots
 destination-pattern 3025
 port 1:25
!
dial-peer voice 4025 vofr
 destination-pattern 4025
 session protocol frf11-trunk
 session target Serial0 37 29
 signal-type ext-signal
 codec g729ar8
!
dial-peer voice 26 pots
 destination-pattern 3026
 port 1:26
!
dial-peer voice 4026 vofr
 destination-pattern 4026
 session protocol frf11-trunk
 session target Serial0 37 30
 signal-type ext-signal
 codec g729ar8
.
.
.
```

---

## Transparent CCS over ATM

The following configuration example configures Transparent CCS with VoATM on both the originating and the terminating side. Other commands necessary for the configuration are included.

### Router A: Originating Configuration

```

version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname RouterA
!
no logging buffered
!
!
!
network-clock base-rate 56k
ip subnet-zero
no ip domain-lookup
!
!
controller T1 0
mode atm
framing esf
linecode b8zs
!
controller E1 1
mode ccs frame-forwarding
clock source internal
ds0-group 1 timeslots 1 type ext-sig
ds0-group 2 timeslots 2 type ext-sig
ds0-group 3 timeslots 3 type ext-sig
ds0-group 4 timeslots 4 type ext-sig
ds0-group 5 timeslots 5 type ext-sig
ds0-group 6 timeslots 6 type ext-sig
ds0-group 7 timeslots 7 type ext-sig
ds0-group 8 timeslots 8 type ext-sig
ds0-group 9 timeslots 9 type ext-sig
ds0-group 10 timeslots 10 type ext-sig
ds0-group 11 timeslots 11 type ext-sig
ds0-group 12 timeslots 12 type ext-sig
ds0-group 13 timeslots 13 type ext-sig
ds0-group 14 timeslots 14 type ext-sig
ds0-group 17 timeslots 17 type ext-sig
ds0-group 18 timeslots 18 type ext-sig
ds0-group 19 timeslots 19 type ext-sig
ds0-group 20 timeslots 20 type ext-sig
ds0-group 21 timeslots 21 type ext-sig
ds0-group 22 timeslots 22 type ext-sig
ds0-group 23 timeslots 23 type ext-sig
ds0-group 24 timeslots 24 type ext-sig
ds0-group 25 timeslots 25 type ext-sig
ds0-group 26 timeslots 26 type ext-sig
!
interface Ethernet0
no ip address
no ip directed-broadcast
shutdown
!

```

### Router B: Terminating Configuration

```

version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname RouterB
!
no logging buffered
!
!
!
network-clock base-rate 64k
network-clock-select 1 system(SCB)
ip subnet-zero
!
controller T1 0
mode atm
framing esf
clock source internal
linecode b8zs
!
controller E1 1
mode ccs frame-forwarding
clock source internal
ds0-group 1 timeslots 1 type ext-sig
ds0-group 2 timeslots 2 type ext-sig
ds0-group 3 timeslots 3 type ext-sig
ds0-group 4 timeslots 4 type ext-sig
ds0-group 5 timeslots 5 type ext-sig
ds0-group 6 timeslots 6 type ext-sig
ds0-group 7 timeslots 7 type ext-sig
ds0-group 8 timeslots 8 type ext-sig
ds0-group 9 timeslots 9 type ext-sig
ds0-group 10 timeslots 10 type ext-sig
ds0-group 11 timeslots 11 type ext-sig
ds0-group 12 timeslots 12 type ext-sig
ds0-group 13 timeslots 13 type ext-sig
ds0-group 14 timeslots 14 type ext-sig
ds0-group 17 timeslots 17 type ext-sig
ds0-group 18 timeslots 18 type ext-sig
ds0-group 19 timeslots 19 type ext-sig
ds0-group 20 timeslots 20 type ext-sig
ds0-group 21 timeslots 21 type ext-sig
ds0-group 22 timeslots 22 type ext-sig
ds0-group 23 timeslots 23 type ext-sig
ds0-group 24 timeslots 24 type ext-sig
ds0-group 25 timeslots 25 type ext-sig
ds0-group 26 timeslots 26 type ext-sig
!
interface Ethernet0
no ip address
no ip directed-broadcast
no ip route-cache
no ip mroute-cache
shutdown

```

**Router A: Originating Configuration**

```

interface Serial0
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  no keepalive
  shutdown
  no fair-queue
  hold-queue 1024 out
!
interface Serial1
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  no keepalive
  shutdown
  no fair-queue
  hold-queue 1024 out
!
interface Serial1:15
  no ip address
  no ip directed-broadcast
  no keepalive
  ccs connect ATM0 pvc 10/42 254
  no cdp enable
!
interface ATM0
  no ip address
  no ip directed-broadcast
  no atm ilmi-keepalive
  pvc 10/42
    vbr-rt 1024 512 256
    encapsulation aal5mux voice
  !
!
interface FR-ATM20
  no ip address
  no ip directed-broadcast
  no ip route-cache
  shutdown
!
ip default-gateway 10.7.0.1
no ip http server
ip classless
!
voice-port 1:1
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3001
!
voice-port 1:2
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3002
!
voice-port 1:4
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3004
!

```

**Router B: Terminating Configuration**

```

interface Serial0
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  no keepalive
  shutdown
  no fair-queue
!
interface Serial1
  no ip address
  no ip directed-broadcast
  no ip route-cache
  no ip mroute-cache
  shutdown
!
interface Serial1:15
  no ip address
  no ip directed-broadcast
  no keepalive
  ccs connect ATM0 pvc 10/42 254
  no cdp enable
!
interface ATM0
  no ip address
  no ip directed-broadcast
  no atm ilmi-keepalive
  pvc 10/42
    vbr-rt 1024 512 256
    encapsulation aal5mux voice
  !
!
interface FR-ATM20
  no ip address
  no ip directed-broadcast
  no ip route-cache
  shutdown
!
ip default-gateway 10.7.0.2
no ip http server
ip classless
!
!
voice-port 1:1
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4001 answer-mode
!
!
voice-port 1:2
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4002 answer-mode
!
voice-port 1:3
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4003 answer-mode
!
voice-port 1:4
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4004 answer-mode

```

**Router A: Originating Configuration**

```

voice-port 1:5
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3005
!
voice-port 1:6
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3006
!
voice-port 1:3
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3003
!
voice-port 1:7
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3007
!
voice-port 1:8
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3008
!
voice-port 1:9
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3009
!
voice-port 1:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3010
!
voice-port 1:11
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3011
!
voice-port 1:12
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3012
!
voice-port 1:13
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3013
!
voice-port 1:14
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3014
!
voice-port 1:17
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3017
!

```

**Router B: Terminating Configuration**

```

!
voice-port 1:5
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4005 answer-mode
!
voice-port 1:6
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4006 answer-mode
!
voice-port 1:7
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4007 answer-mode
!
voice-port 1:8
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4008 answer-mode
!
voice-port 1:9
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4009 answer-mode
!
voice-port 1:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4010 answer-mode
!
voice-port 1:11
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4011 answer-mode
!
voice-port 1:12
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4012 answer-mode
!
voice-port 1:13
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4013 answer-mode
!
voice-port 1:14
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4014 answer-mode
!
voice-port 1:17
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4017 answer-mode

```

---

**Router A: Originating Configuration**

```
voice-port 1:18
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3018
!
voice-port 1:19
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3019
!
voice-port 1:20
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3020
!
voice-port 1:21
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3021
!
voice-port 1:22
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3022
!
voice-port 1:23
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3023
!
voice-port 1:24
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3024
!
voice-port 1:25
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3025
!
voice-port 1:26
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3026
!
```

---

**Router B: Terminating Configuration**

```
!
voice-port 1:18
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4018 answer-mode
!
voice-port 1:19
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4019 answer-mode
!
voice-port 1:20
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4020 answer-mode
!
voice-port 1:21
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4021 answer-mode
!
voice-port 1:22
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4022 answer-mode
!
voice-port 1:23
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4023 answer-mode
!
voice-port 1:24
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4024 answer-mode
!
voice-port 1:25
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4025 answer-mode
!
voice-port 1:26
  compand-type a-law
  timeouts wait-release 3
  connection trunk 4026 answer-mode
!
```

---

**Router A: Originating Configuration**

```
dial-peer voice 100 voatm
 destination-pattern 3...
 codec g729ar8
 no vad
 session target ATM0 pvc 10/42
!
dial-peer voice 1 pots
 destination-pattern 4001
 port 1:1
!
dial-peer voice 2 pots
 destination-pattern 4002
 port 1:2
!
dial-peer voice 3 pots
 destination-pattern 4003
 port 1:3
!
dial-peer voice 4 pots
 destination-pattern 4004
 port 1:4
!
dial-peer voice 5 pots
 destination-pattern 4005
 port 1:5
!
dial-peer voice 6 pots
 destination-pattern 4006
 port 1:6
!
dial-peer voice 7 pots
 destination-pattern 4007
 port 1:7
!
dial-peer voice 8 pots
 destination-pattern 4008
 port 1:8
!
dial-peer voice 9 pots
 destination-pattern 4009
 port 1:9
!
dial-peer voice 10 pots
 destination-pattern 4010
 port 1:10
!
dial-peer voice 11 pots
 destination-pattern 4011
 port 1:11
!
dial-peer voice 12 pots
 destination-pattern 4012
 port 1:12
!
dial-peer voice 13 pots
 destination-pattern 4013
 port 1:13
!
dial-peer voice 14 pots
 destination-pattern 4014
 port 1:14
```

**Router B: Terminating Configuration**

```
!
dial-peer voice 100 voatm
 destination-pattern 4...
 session target ATM0 pvc 10/42
 codec g729ar8
 no vad
!
dial-peer voice 1 pots
 destination-pattern 3001
 port 1:1
!
dial-peer voice 2 pots
 destination-pattern 3002
 port 1:2
!
dial-peer voice 3 pots
 destination-pattern 3003
 port 1:3
!
dial-peer voice 4 pots
 destination-pattern 3004
 port 1:4
!
dial-peer voice 5 pots
 destination-pattern 3005
 port 1:5
!
dial-peer voice 6 pots
 destination-pattern 3006
 port 1:6
!
dial-peer voice 7 pots
 destination-pattern 3007
 port 1:7
!
dial-peer voice 8 pots
 destination-pattern 3008
 port 1:8
!
dial-peer voice 9 pots
 destination-pattern 3009
 port 1:9
!
dial-peer voice 10 pots
 destination-pattern 3010
 port 1:10
!
dial-peer voice 11 pots
 destination-pattern 3011
 port 1:11
!
dial-peer voice 12 pots
 destination-pattern 3012
 port 1:12
!
dial-peer voice 13 pots
 destination-pattern 3013
 port 1:13
!
dial-peer voice 14 pots
 destination-pattern 3014
 port 1:14
```

---

**Router A: Originating Configuration**

```
!  
dial-peer voice 17 pots  
  destination-pattern 4017  
  port 1:17  
!  
dial-peer voice 18 pots  
  destination-pattern 4018  
  port 1:18  
!  
dial-peer voice 19 pots  
  destination-pattern 4019  
  port 1:19  
!  
dial-peer voice 20 pots  
  destination-pattern 4020  
  port 1:20  
!  
dial-peer voice 21 pots  
  destination-pattern 4021  
  port 1:21  
!  
dial-peer voice 22 pots  
  destination-pattern 4022  
  port 1:22  
!  
dial-peer voice 23 pots  
  destination-pattern 4023  
  port 1:23  
!  
dial-peer voice 24 pots  
  destination-pattern 4024  
  port 1:24  
!  
dial-peer voice 25 pots  
  destination-pattern 4025  
  port 1:25  
!  
dial-peer voice 26 pots  
  destination-pattern 4026  
  port 1:26  
.  
.  
.
```

---

**Router B: Terminating Configuration**

```
!  
dial-peer voice 17 pots  
  destination-pattern 3017  
  port 1:17  
!  
dial-peer voice 18 pots  
  destination-pattern 3018  
  port 1:18  
!  
dial-peer voice 19 pots  
  destination-pattern 3019  
  port 1:19  
!  
dial-peer voice 20 pots  
  destination-pattern 3020  
  port 1:20  
!  
dial-peer voice 21 pots  
  destination-pattern 3021  
  port 1:21  
!  
dial-peer voice 22 pots  
  destination-pattern 3022  
  port 1:22  
!  
dial-peer voice 23 pots  
  destination-pattern 3023  
  port 1:23  
!  
dial-peer voice 24 pots  
  destination-pattern 3024  
  port 1:24  
!  
dial-peer voice 25 pots  
  destination-pattern 3025  
  port 1:25  
!  
dial-peer voice 26 pots  
  destination-pattern 3026  
  port 1:26  
.  
.  
.
```

---

## Transparent CCS Cross-Connect over Frame Relay

The following configuration example configures Transparent CCS cross-connect over Frame Relay. Other commands necessary for the configuration are included.

```

!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router
!
!
!
!
!
network-clock base-rate 56k
ip subnet-zero
!
isdn voice-call-failure 0
!
!
!
xgcp snmp sgcp
!
controller T1 0
 tdm-group 1 timeslots 24
 framing esf
 linecode b8zs
 channel-group 0 timeslots 1-23 speed 64
!
controller E1 1
 mode ccs cross-connect
 tdm-group 1 timeslots 16
 clock source internal
 ds0-group 0 timeslots 1 type ext-sig
 ds0-group 2 timeslots 2 type ext-sig
 ds0-group 3 timeslots 3 type ext-sig
 ds0-group 4 timeslots 4 type ext-sig
 ds0-group 5 timeslots 5 type ext-sig
 ds0-group 6 timeslots 6 type ext-sig
 ds0-group 7 timeslots 7 type ext-sig
 ds0-group 8 timeslots 8 type ext-sig
 ds0-group 9 timeslots 9 type ext-sig
 ds0-group 10 timeslots 10 type ext-sig
 ds0-group 11 timeslots 11 type ext-sig
 ds0-group 12 timeslots 12 type ext-sig
 ds0-group 13 timeslots 13 type ext-sig
 ds0-group 14 timeslots 14 type ext-sig
 ds0-group 17 timeslots 17 type ext-sig
 ds0-group 18 timeslots 18 type ext-sig
 ds0-group 19 timeslots 19 type ext-sig
 ds0-group 20 timeslots 20 type ext-sig
 ds0-group 21 timeslots 21 type ext-sig
 ds0-group 22 timeslots 22 type ext-sig
 ds0-group 23 timeslots 23 type ext-sig
 ds0-group 24 timeslots 24 type ext-sig
 ds0-group 25 timeslots 25 type ext-sig
 ds0-group 26 timeslots 26 type ext-sig
!
!

```

```
interface Ethernet0
 ip address 1.7.85.21 255.255.255.0
 no ip directed-broadcast
 shutdown
!
interface Serial0
 no ip address
 no ip directed-broadcast
 no ip mroute-cache
 shutdown
!
interface Serial1
 no ip address
 no ip directed-broadcast
 shutdown
!
interface Serial0:0
 ip address 11.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation frame-relay
 no keepalive
 frame-relay traffic-shaping
 frame-relay interface-dlci 100
 class frs0
 vofr cisco
 frame-relay inverse-arp interval 15
!
interface FR-ATM20
 no ip address
 no ip directed-broadcast
 shutdown
!
no ip http server
ip classless
ip route 223.255.254.254 255.255.255.255 Ethernet0
!
!
map-class frame-relay frs0
 frame-relay voice bandwidth 2000000
 frame-relay fragment 64
 no frame-relay adaptive-shaping
 frame-relay cir 2000000
 frame-relay fair-queue
!
line con 0
 transport input none
line aux 0
line 2 3
line vty 0 4
 login
!
!
voice-port 1:0
 compand-type a-law
 timeouts wait-release 3
 connection trunk 3001
!
voice-port 1:2
 compand-type a-law
 timeouts wait-release 3
 connection trunk 3002
!
```

```
voice-port 1:3
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3003
!
voice-port 1:4
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3004
!
voice-port 1:5
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3005
!
voice-port 1:6
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3006
!
voice-port 1:7
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3007
!
voice-port 1:8
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3008
!
voice-port 1:9
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3009
!
voice-port 1:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3010
!
voice-port 1:11
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3011
!
voice-port 1:12
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3012
!
voice-port 1:13
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3013
!
voice-port 1:14
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3014
!
voice-port 1:17
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3017
!
```

```
voice-port 1:18
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3018
!
voice-port 1:19
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3019
!
voice-port 1:20
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3020
!
voice-port 1:21
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3021
!
voice-port 1:22
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3022
!
voice-port 1:23
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3023
!
voice-port 1:24
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3024
!
voice-port 1:25
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3025
!
voice-port 1:26
  compand-type a-law
  timeouts wait-release 3
  connection trunk 3026
!
dial-peer voice 2001 vofr
  destination-pattern 3...
  signal-type ext-signal
  session target Serial0:0 100
!
dial-peer voice 1 pots
  destination-pattern 4001
  port 1:0
!
dial-peer voice 17 pots
  destination-pattern 4017
  port 1:17
!
dial-peer voice 18 pots
  destination-pattern 4018
  port 1:18
!
dial-peer voice 19 pots
  destination-pattern 4019
  port 1:19
```

```
!  
dial-peer voice 20 pots  
  destination-pattern 4020  
  port 1:20  
!  
dial-peer voice 21 pots  
  destination-pattern 4021  
  port 1:21  
!  
dial-peer voice 22 pots  
  destination-pattern 4022  
  port 1:22  
!  
dial-peer voice 23 pots  
  destination-pattern 4023  
  port 1:23  
!  
dial-peer voice 24 pots  
  destination-pattern 4024  
  port 1:24  
!  
dial-peer voice 25 pots  
  destination-pattern 4025  
  port 1:25  
!  
dial-peer voice 26 pots  
  destination-pattern 4026  
  port 1:26  
!  
dial-peer voice 2 pots  
  destination-pattern 4002  
  port 1:2  
!  
dial-peer voice 3 pots  
  destination-pattern 4003  
  port 1:3  
!  
dial-peer voice 4 pots  
  destination-pattern 4004  
  port 1:4  
!  
dial-peer voice 5 pots  
  destination-pattern 4005  
  port 1:5  
!  
dial-peer voice 6 pots  
  destination-pattern 4006  
  port 1:6  
!  
dial-peer voice 7 pots  
  destination-pattern 4007  
  port 1:7  
!  
dial-peer voice 8 pots  
  destination-pattern 4008  
  port 1:8  
!  
dial-peer voice 9 pots  
  destination-pattern 4009  
  port 1:9  
!  
dial-peer voice 10 pots  
  destination-pattern 4010  
  port 1:10  
!
```

```
dial-peer voice 11 pots
 destination-pattern 4011
 port 1:11
!
dial-peer voice 12 pots
 destination-pattern 4012
 port 1:12
!
dial-peer voice 13 pots
 destination-pattern 4013
 port 1:13
!
dial-peer voice 14 pots
 destination-pattern 4014
 port 1:14
!
!
cross-connect 1 E1 1 1 T1 0 1
end
```

## Command Reference

The following new or modified commands are used to configure the Transparent CCS and CCS frame forwarding features. All other commands used with this feature are documented in Cisco IOS 12.0 command references and on CCO. See “Related Documents” on page 3.

- **ccs connect**
- **ccs encap frf11**
- **ds0-group**

## ccs connect

To configure a CCS connection on an interface configured to support CCS frame forwarding, use the **ccs connect** interface configuration command. To disable the CCS connection on the interface, use the **no** form of this command.

```
ccs connect {serial | atm} number [ dldci | pvc vpi/vci | pvc name ] [ cidnumber ]
no ccs connect {serial | atm} number [ dldci | pvc vpi/vci | pvc name ] [ cidnumber ]
```

### Syntax Description

*number* Specify the connection number.

The following parameters are used for Frame Relay configuration:

**serial** Make a serial CCS connection.

*dldci* Specify the DLCI number.

*cidnumber* (Optional) If you have executed the **ccs encap frf11** command, the **cid** option allows you to specify any CID number from 5 to 255.

The following parameters are used for ATM configuration:

**atm** Make an ATM CCS connection.

**pvc** *vpi/vci* Specify the PVC virtual path identifier/virtual channel identifier. Acceptable values are from 0 to 255; the slash is required.

**pvc name** Specify the PVC string that names the PVC for recognition.

### Default

No CCS connection is made.

### Command Mode

Serial interface configuration mode

### Command History

Release	Modification
Cisco IOS Release 12.0(2)T	This command was introduced for the Cisco MC3810.
Cisco IOS Release 12.0(7)XK	Added CID syntax, removed <b>dldci</b> keyword and <b>vcd</b> options.

### Usage Guidelines

Use this command to configure a CCS connection. If the CCS connection is over Frame Relay, specify a serial interface and the DLCI. If the CCS connection is over ATM, specify **atm**, the interface number (0 only on the Cisco MC3810), and the PVC.

If you have executed the **ccs encaps frf11** command, the *cidnumber* option allows you to specify any CID from 5 to 255. If you do not issue the **ccs encaps frf11** command, Cisco encapsulation is used, and any CID value other than 254 is ignored.

---

**Note** CDP and keepalives are disabled by default on a D channel interface.

---

### Examples

To configure a frame relay CCS frame-forwarding connection on DLCI 100 by using the default CID of 254, enter the following command:

```
ccs connect serial 1 100
```

or:

```
ccs connect serial 1 100 10
```

To configure a CCS frame-forwarding connection over an ATM PVC, enter the following command:

```
ccs connect atm0 pvc 100/10
```

or:

```
ccs connect atm0 pvc 10/100 21
```

or:

```
ccs connect atm0 pvc mypvc_10 21
```

To configure a Frame Relay CCS frame-forwarding connection on DLCI 100 using a CID of 110, enter the following command:

```
ccs connect serial 1 100 110
```

### Related Commands

Command	Description
<b>ccs encaps frf11</b>	Allows the specification of the standard Annex-C FRF.11 format.

## ccs encap frf11

To configure the common channel signaling (CCS) packet encapsulation format for FRF.11, use the **ccs encap frf11** command. Use the **no** form of this command to disable ccs encapsulation for FRF11.

**ccs encap frf11**

**no ccs encap frf11**

### Syntax Description

There are no keywords or arguments.

### Default

By default, the format is a Cisco packet format, using a channel ID (CID) of 254.

### Command Mode

Serial configuration mode

### Command History

Release	Modification
Cisco IOS Release 12.0(7)XK	This command was introduced for the Cisco MC3810.

### Usage Guidelines

This command allows the specification of the standard Annex-C format. Use this command to define the packet format for the CCS packet; it places the FRF.11 Annex-C (Data Transfer Syntax) standard header on the CCS packets only.

Once the **ccs encap frf11** command is executed, you can use the **ccs connect** command to specify a CID other than 254.

### Examples

The following example shows how to configure a serial interface for Frame Relay:

```
router(config)# interface Serial1:15
router(config-if)# ccs encap frf11
router(config-if)# ccs connect Serial0 990 100
```

### Related Commands

Command	Description
<b>mode ccs frame-forwarding</b>	Set to forward frames on the controller.

## ds0-group

To specify the DS0 timeslots that make up a logical voice port on a T1 or E1 controller, and to specify the signaling type, use the **ds0-group** controller configuration command. Use the **no** form of the command to remove the DS0 group and signaling setting.

**ds0-group** *ds0-group-no* **timeslots** *timeslot-list* **type** *signal-type*

**no ds0-group** *ds0-group-no*

### Syntax Description

<i>ds0-group-no</i>	A value from 0 to 23 that identifies the DS0 group.
<i>timeslot-list</i>	<p><i>timeslot-list</i> is a single timeslot number, a single range of numbers, or multiple ranges of numbers separated by commas. For T1, allowable values are from 1 to 24. Examples are:</p> <ul style="list-style-type: none"> <li>• 2</li> <li>• 1-15, 17-24</li> <li>• 1-23</li> <li>• 2, 4, 6-12</li> </ul>
<b>type</b>	<p>The signaling method selection for <b>type</b> depends on the connection that you are making. The E&amp;M interface allows connection for PBX trunk lines (tie-lines) and telephone equipment. The FXS interface allows connection of basic telephone equipment and PBXs. The FXO interface is for connecting the central office (CO) to a standard PBX interface where permitted by local regulations. The FXO interface is often used for off-premises extensions.</p> <p>The options are as follows:</p> <ul style="list-style-type: none"> <li>• <b>e&amp;m-immediate-start</b>—no specific off-hook and on-hook signaling</li> <li>• <b>e&amp;m-delay-dial</b>—the originating endpoint sends an off-hook signal and then waits for an off-hook signal followed by an on-hook signal from the destination</li> <li>• <b>e&amp;m-wink-start</b>—the originating endpoint sends an off-hook signal and waits for a wink signal from the destination</li> <li>• <b>fxs-ground-start</b>—Foreign Exchange Station ground-start signaling support</li> <li>• <b>fxs-loop-start</b> —Foreign Exchange Station loop-start signaling support</li> <li>• <b>fxo-ground-start</b>—Foreign Exchange Office ground-start signaling support</li> <li>• <b>fxo-loop-start</b>—Foreign Exchange Office loop-start signaling support</li> </ul>

The following options are available only on E1 controllers on the Cisco MC3810:

- **e&m-melcas-immed**—E&M Mercury Exchange Limited Channel Associated Signaling (MELCAS) immediate start signaling support
- **e&m-melcas-wink**—E&M MELCAS wink start signaling support
- **e&m-melcas-delay**—E&M MELCAS delay start signaling support
- **fxo-melcas**—MELCAS Foreign Exchange Office signaling support
- **fxs-melcas**—MELCAS Foreign Exchange Station signaling support

The **ext-sig** option is available only when the **mode ccs** command is enabled on the Cisco MC3810 for FRF.11 transparent CCS support.

## Default

No DS0 group is defined.

## Command Mode

Controller configuration

## Command History

Release	Modification
11.2	This command was introduced for the Cisco AS5300 as <b>cas-group</b> .
12.0(1)T	The <b>cas-group</b> command was first supported on the Cisco 3600 series.
12.0(5)T	This command was renamed <b>ds0-group</b> on the Cisco AS5300 and on the Cisco 2600 and 3600 series (requires Digital T1 Packet Voice Trunk Network Modules).
12.0(7)XK	Support for this command was extended to the Cisco MC3810. When the <b>ds0-group</b> command became available on the Cisco MC3810, the <b>voice-group</b> command was removed and no longer supported. <b>ext-sig</b> replaces the <b>ext-sig-master</b> and <b>ext-sig-slave</b> options that were available with the <b>voice-group</b> command.

## Usage Guidelines

The **ds0-group** command automatically creates a logical voice port that is numbered as follows:

Cisco 2600 and 3600 series:

*slot/port:ds0-group-no.*

Cisco MC3810:

*slot:ds0-group-no*

On the Cisco MC3810, the *slot* number is the controller number. Although only one voice port is created for each group, applicable calls are routed to any channel in the group.

### Examples

The following example configures ranges of T1 controller timeslots for FXS ground-start and FXO loop-start signaling on a Cisco 2600 or 3600 Series router:

```
router(config)# controller T1 1/0
router(config-controller)# framing esf
router(config-controller)# linecode b8zs
router(config-controller)# ds0-group 1 timeslot 1-10 type fxs-ground-start
router(config-controller)# ds0-group 2 timeslot 11-24 type fxo-loop-start
```

The following example configures DS0 groups 1 and 2 on controller T1 1 on the Cisco MC3810 to support Transparent CCS:

```
router(config)# controller T1 1
router(config-controller)# mode ccs cross-connect
router(config-controller)# ds0-group 1 timeslot 1-10 type ext-sig
router(config-controller)# ds0-group 2 timeslot 11-24 type ext-sig
```

### Related Commands

Command	Description
<b>codec complexity</b>	Matches the DSP complexity packaging to the codec(s) to be supported
<b>mode ccs</b>	Configures the T1/E1 controller to support CCS cross-connect or CCS frame-forwarding.

## Debug Command Reference

The following new **debug** command is used to configure the Transparent CCS and CCS frame forwarding features. All other **debug** commands used with this feature are documented in Cisco IOS 12.0 command references and on CCO. See “Related Documents” on page 3.

- **debug tccs signaling**
- **debug vpm signaling**

## debug tccs signaling

Enter the **debug tccs signaling** command to see information about the Transparent CCS connection. Enter the **no** form of this command to disable debugging output.

**debug tccs signaling**  
**no debug tccs signaling**

### Syntax Description

There are no configurable options or keywords.

### Default

Disabled

### Command Mode

EXEC

### Command History

Release	Modification
Cisco IOS Release 12.0(7)XK	This command was introduced.

### Usage Guidelines

Use this command with caution, because it displays every packet that the D channel transmits to the packet network and to the PBX. This command is CPU-intensive and should be used only as a last resort.

Use this command to debug a transparent CCS connection in the following cases:

- Observe the results of the **ccs connect** command results when you configure the setup.
- Observe CCS traffic at run time; the output shows the actual CCS packets received at run time and the number of packets received and transmitted

### Examples

The following example shows output from the command on both the originating and terminating sides:

```
origrouter# debug tccs signaling
TCCS Domain packet debugging is on
mazurka-4#
01:37:12: 1 tccs packets received from the port.
01:37:12: 1 tccs packets received from the network.
01:37:12: tx_tccs_fr_pkt:pkt rcvd from network->tx_start
01:37:12: tx_tccs_fr_pkt: dlci=37, cid=100, payld-type =0,
           payld-length=162, cid_type=424
01:37:12: datagramsize=26
01:37:12: [0] A4 40 C0 0
01:37:12: [4] 86 86 86 86
01:37:12: [8] 86 86 86 86
01:37:12: [12] 86 86 86 86
```

```
01:37:12: [16] 86 86 86 86
01:37:12: [20] 86 86 86 86
01:37:12: [24] 86 86 11 48
01:37:12: 2 tccs packets received from the port.
01:37:12: 1 tccs packets received from the network.
01:37:12: pri_tccs_rx_intr:from port->send_sub_channel
01:37:12: tccs_db->vcd = 37, tccs_db->cid = 100
01:37:12: pak->datagramsize=25
01:37:12: [0] A4 40 C0 0
01:37:12: [4] 42 43 43 43
01:37:12: [8] 43 43 43 43
01:37:12: [12] 43 43 43 43
01:37:12: [16] 43 43 43 43
01:37:12: [20] 43 43 43 43
01:37:12: [24] 43 43 43 0
```

```
termrouter# debug tccs signaling
00:53:26: 61 tccs packets received from the port.
00:53:26: 53 tccs packets received from the network.
00:53:26: pri_tccs_rx_intr:from port->send_sub_channel
00:53:26: tccs_db->vcd = 37, tccs_db->cid = 100
00:53:26: pak->datagramsize=7
00:53:26: [0] A4 40 C0 0
00:53:26: [4] 0 1 7F 64
00:53:27: 62 tccs packets received from the port.
00:53:27: 53 tccs packets received from the network.
00:53:27: pri_tccs_rx_intr:from port->send_sub_channel
00:53:27: tccs_db->vcd = 37, tccs_db->cid = 100
00:53:27: pak->datagramsize=7
00:53:27: [0] A4 40 C0 0
00:53:27: [4] 0 1 7F 64
00:53:28: 63 tccs packets received from the port.
00:53:28: 53 tccs packets received from the network.
00:53:28: pri_tccs_rx_intr:from port->send_sub_channel
00:53:28: tccs_db->vcd = 37, tccs_db->cid = 100
00:53:28: pak->datagramsize=7
00:53:28: [0] A4 40 C0 0
00:53:28: [4] 0 1 7F 64
00:53:29: 64 tccs packets received from the port.
00:53:29: 53 tccs packets received from the network.
```

## debug vpm signaling

Enter the **debug vpm signaling** command to see information about the voice-port module signaling. Enter the **no** form of this command to disable debugging output.

**debug vpm signaling**  
**no debug vpm signaling**

### Syntax Description

There are no configurable options or keywords.

### Default

Disabled

### Command Mode

EXEC

### Command History

Release	Modification
Cisco IOS Release 12.0(7)XK	This command was introduced.

### Examples

The following example shows output from the command:

```
origrouter# debug vpm signaling
01:52:55: [1:1.1, S_TRUNK_BUSYOUT, E_HTSP_OUT_BUSYOUT]
01:52:55: htsp_timer - 0 msec
01:52:55: [1:1.1, S_TRUNK_PEND, E_HTSP_EVENT_TIMER]
01:52:55: htsp_timer_stop htsp_setup_ind
01:52:55: htsp_timer - 2000 msec
01:52:55: [1:1.1, S_TRUNK_PROC, E_HTSP_SETUP_ACK]
01:52:55: htsp_timer_stop
01:52:55: htsp_timer - 20000 msec
01:52:55: [1:6.6, S_TRUNK_PROC, E_HTSP_SETUP_ACK]
01:52:55: htsp_timer_stop
01:52:55: htsp_timer - 20000 msec
01:52:55: [1:1.1, S_TRUNK_PROC, E_HTSP_VOICE_CUT_THROUGH]
01:52:55: %HTSP-5-UPDOWN: Trunk port(channel) [1:1.1] is up
```

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# Glossary

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**Note** For a list of other internetworking terms, see *Internetworking Terms and Acronyms* document that accompanied your access server and is available on the Documentation CD-ROM and Cisco Connection Online (CCO) at the following URL:  
<http://www.cisco.com/univercd/cc/td/doc/cisintwk/ita/index.htm>.

---

**AAL**—ATM Adaptation Layer. Service-dependent sublayer of the data link layer. The AAL accepts data from different applications and presents it to the ATM layer in the form of 48-byte ATM payload segments. AALs consist of two sublayers: convergence sublayer (CS) and segmentation and reassembly (SAR). AALs differ on the basis of the source-destination timing used, whether they use constant bit rate (CBR) or variable bit rate (VBR), and whether they are used for connection-oriented or connectionless mode data transfer. At present, the four types of AAL recommended by the ITU-T are AAL1, AAL2, AAL3/4, and AAL5.

**ATM**—Asynchronous Transfer Mode. International standard for cell relay in which multiple service types (such as voice, video, or data) are conveyed in fixed-length (53-byte) cells. Fixed-length cells allow cell processing to occur in hardware, thereby reducing transit delays. ATM is designed to take advantage of high-speed transmission media, such as E3, SONET, and T3.

**CAS**—channel-associated signaling. Trunk signaling (for example, in a T1 line) in which control signals, such as those for synchronizing and bounding frames, are carried in the same channel along with voice and data signals.

**CBR**—constant bit rate. QoS class defined by the ATM Forum for ATM networks. CBR is used for connections that depend on precise clocking to ensure undistorted delivery.

**CCS**—common channel signaling. Trunk signaling (for example, using Primary Rate Interface) in which a control channel carries signaling for separate voice and data channels.

**CES**—circuit emulation service. Enables users to multiplex or concentrate multiple circuit emulation streams for voice and video with packet data on a single high-speed ATM link without a separate ATM access multiplexer.

**CO**—central office. Local telephone company office to which all local loops in a given area connect and in which circuit switching of subscriber lines occurs.

**codec**—coder-decoder. Device that typically uses pulse code modulation to transform analog signals into a digital bit stream and digital signals back into analog.

**DSP**—digital signal processor; same as PVDM

**DVM**—Digital Voice Module

**E1**—European digital carrier facility used for transmitting data through the telephone hierarchy. The transmission rate for E1 is 2.048 megabits per second (Mbps).

**E&M**—rEceive and transMit, or Ear and Mouth. Type of signaling originally developed for analog two-state voltage telephony using the ear and mouth leads; in digital telephony, uses two bits.

**ESF**—Extended Superframe. Framing type used on T1 circuits that consists of 24 frames of 192 bits each with the 193rd bit providing timing and other functions. ESF is an enhanced version of SF format.

**FXO**—Foreign Exchange Office. A voice interface emulating a PBX trunk line to a switch or telephone equipment to a PBX extension interface.

**FXS**—Foreign Exchange Station. A voice interface for connecting telephone equipment, emulates the extension interface of a PBX or the subscriber interface for a switch.

**ISDN**—Integrated Services Digital Network. Communication protocol, offered by telephone companies, that permits telephone networks to carry data, voice, and other source traffic.

**packet**—Logical grouping of information that includes a header containing control information and (usually) user data. Packets are most often used to refer to network layer units of data.

**POTS**—plain old telephone service.

**PSTN**—Public Switched Telephone Network. General term referring to the variety of telephone networks and services in place worldwide.

**QoS**—quality of service. Measure of performance for a transmission system that reflects its transmission quality and service availability.

**QSIG**—Q (point of the ISDN model) Signaling. Signaling standard. Common channel signaling protocol based on ISDN Q.931 standards and used by many digital PBXs.

**T1**—Digital WAN carrier facility. T1 transmits DS 1-formatted data at 1.544 Mbps through the telephone switching network, by using alternate mark inversion or B8ZS coding.

**T1 trunk**—Digital WAN carrier facility. See T1.

**T-CCS**—Transparent Common Channel Signaling.

**TDM**—time-division multiplexing.

**Trunk**—Physical and logical connection between two switches across which network traffic travels. A backbone is composed of a number of trunks.

**VAD**—voice activity detection.

**VoFR**—voice over Frame Relay.

**VoATM**—voice over ATM