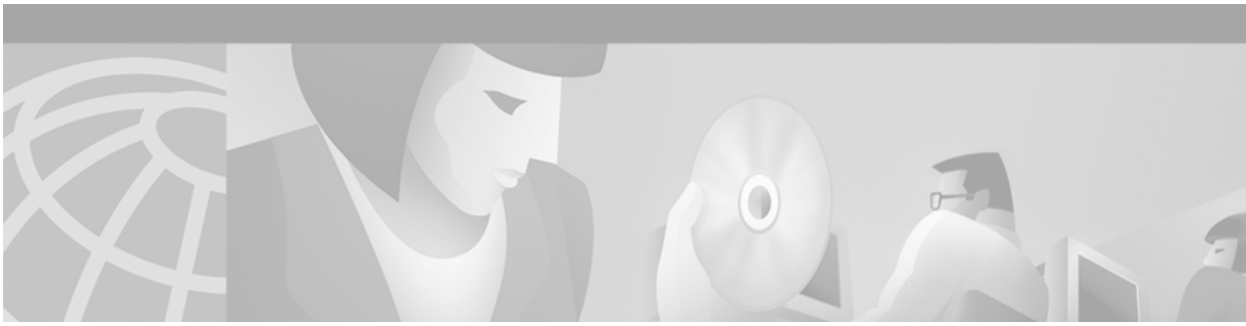


Transparent Common Channel Signaling

This document describes Transparent Common Channel Signaling (T-CCS) for Cisco 2600 series, 3600 series, 7200 series, and 7500 series routers and MC3810 concentrators and includes the following sections:

Feature Summary

The following hardware provides support for the T-CCS feature, which provides a way to interconnect private branch exchanges (PBXs) and key systems (KTs) when the private integrated services network exchange (PINX) does not support QSIG, or when the PINX uses a proprietary solution:

- Digital T1/E1 packet voice trunk network modules on Cisco 2600 series and 3600 series routers
- Two-port T1/E1 digital voice port adapters for Cisco 7200 series and 7500 series routers
- Digital voice module (DVM) on Cisco MC3810 concentrators

Transparent CCS allows the connection of two PBXs with digital interfaces that use a proprietary or unsupported CCS protocol without the need for interpretation of CCS signaling for call processing. T1/E1 traffic 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 PBXs are not routed, but follow a preconfigured route to the destination.

If you are configuring your Cisco platform to route signaling traffic for Voice over Frame Relay (VoFR) or Voice over ATM (VoATM), you can configure transparent CCS using CCS frame-forwarding.

If you are configuring your Cisco platform to route signaling traffic for Voice over Internet Protocol (VoIP), transparent CCS is configured by routing traffic over a clear channel codec.

The configuration procedures are described in the “Configuration Tasks” section on page 3.

Benefits

This feature 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.
- Transparent signaling for CCS PBXs provides compressed Voice over Frame Relay, ATM, and IP support for nearly any CCS-based PBX.
- Bandwidth is allocated to voice calls dynamically using Voice Activity Detection (VAD).

Restrictions

This feature has the following restriction:

- The digital T1/E1 packet voice trunk network module can have one or two slots for voice/WAN interface cards (VWICs); VWICs supply one or two ports. Only the dual-mode (voice/WAN) multiflex trunk cards are supported in the digital E1 packet voice trunk network module, not older VICs.
- Drop-and-Insert capability is supported only between two ports on the same multiflex card.
- Digital E1 voice is not manageable through Simple Network Management Protocol (SNMP) using existing versions of Cisco Voice Manager.

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 Cisco IOS Release 12.1 documents are helpful:

- *Wide-Area Networking Configuration Guide*
  http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/wan_c/index.htm
- *Wide-Area Networking Command Reference*
  http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/wan_r/index.htm
- *Multiservice Applications Configuration Guide*
  http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/multi_c/index.htm

- *Multiservice Applications Command Reference*
  http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121cgcr/multi_r/index.htm
- *Debug Command Reference*
  http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121sup/121debug/index.htm

Supported Platforms

This feature is supported on the following platforms:

- Cisco 2600 series
- Cisco 3600 series
- Cisco 7200 series
- Cisco 7500 series

Supported MIBs and RFCs

None.

Prerequisites

- Install Cisco IOS Release 12.1(3)T.
- Obtain T1 or E1 service from your service provider.
- Establish a working network. For more information about configuring your network, see "Related Documents" on page 2.
- Complete your company's dial plan.
- Establish a working telephony network based on your company's dial plan. See "Related Documents" on page 2 for information about helpful documents.
- Install required voice components:
  - Digital T1/E1 packet voice trunk network modules on Cisco 2600 series and 3600 series routers
  - Two-port T1/E1 digital voice port adapters for Cisco 7200 series and 7500 series routers
  - Digital voice module (DVM) on Cisco MC3810 concentrators
- Configure voice card and controller settings.
- Configure serial and LAN interfaces.
- Configure voice ports.
- Configure voice dial peers.

Configuration Tasks

The configuration of transparent CCS depends on the type of encapsulation you are using:

- Configuring Transparent CCS for Frame-Forwarding

- Configuring Transparent CCS for a Clear-Channel Codec

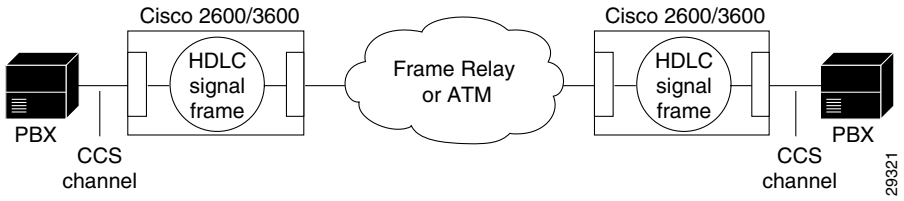
Configuring Transparent CCS for Frame-Forwarding

Cisco routers provide support for CCS frame-forwarding, which allows a router to be connected to a Private Telco Network Exchange (PTNX) without having to interpret CCS signaling information for call processing. CCS frame-forwarding forwards frames over a preconfigured interface running Frame Relay or ATM encapsulation.

With CCS frame-forwarding, the connection between PTNXs over the network must be point-to-point and preconfigured. With the CCS frame-forwarding implementation, calls from the PTNXs are not routed, but follow a preconfigured route to the destination.

Figure 1 shows an example of CCS frame-forwarding. In the example, the Cisco router captures the signaling frame from the PBX. The Cisco router then transports the signaling frame as a data frame through the Frame Relay or ATM network to the second Cisco router. The second Cisco router then forwards the signaling frame to the PBX signaling channel.

Figure 1 CCS Frame-Forwarding



Note Although not explicitly stated in the procedures, this feature also requires that voice ports and dial peers must also be configured.

To configure CCS frame-forwarding, complete the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# controller {T1 | E1} slot/port`	Enter controller configuration mode for the controller at the specified slot/port location. Valid values for slot and port are 0 and 1.
Step 2	`Router(config-controller)# mode ccs frame-forwarding`	Specify the controller to support CCS transparent signaling.
Step 3	`Router(config-controller)# channel-group channel-no timeslots timeslot-list`	Configure the specified channel to support CCS mode. Do not specify the **type** option in the command.

	Command	Purpose
Step 4	`Router(config-controller)# ds0-group ds0-group-no timeslots timeslot-list type {ext-sig}`	This command defines the T1/E1 channels for use by compressed voice calls as well as the signaling method the router uses to connect to the PBX or CO. The *ds0-group-no* parameter is a value from 0 to 23 that identifies the DS0 group. **Note** The **ds0-group** command automatically creates a logical voice port that is numbered as follows: *slot*/*port*:*ds0-group-no*. Although only one voice port is created, applicable calls are routed to any channel in the group. The value of *timeslot-list* is a single number, numbers separated by commas, or a pair of numbers separated by a hyphen to indicate a range of time slots. For T1, allowable values are from 1 through 24. For E1, allowable values are from 1 through 30. To map individual DS0 time slots, define additional groups. The system maps additional voice ports for each defined group. The signaling method selection for **type** depends on the connection that you are making: The external signaling interface specifies that the signaling traffic comes from an outside source.
Step 5	`Router(config-controller)# no shutdown`	Activate the controller.
Step 6	`Router(config-controller)# exit`	Exit controller configuration mode.
Step 7	`Router(config)# interface serial slot/port:channel-group`	Specify a serial interface by slot and port. This procedure maps the D channel from the digital T1/E1 packet voice trunk network module to the specified interface.
Step 8	`Router(config-if)# exit`	Exit interface configuration mode.

	Command	Purpose
Step 9	`Router(config)# voice-port slot/port:ds0-group-no`	Enter voice-port configuration mode. The value of *slot* is the router location where the voice module is installed. Valid entries are from 0 through 3. The value of *port* indicates the voice interface card location. Valid entries are 0 or 1. Each defined DS0 group number is represented on a separate voice port. This allows you to define individual DS0s on the digital T1 card. **Note** This **voice-port** command syntax does not apply to analog voice network modules and voice interface cards. The latter are specified using *slot*/*subunit*/*port*, designating the router slot for the voice network module, the location of the voice interface card in the network module, and the port on the voice interface card.
Step 10	`Router(config-voice-port)# ccs encap frf11`	Configure the CCS encapsulation to use the FRF11 packet format.
Step 11	`Router(config-voice-port)# ccs connect {serial |atm} slot/number [dlci dlci| pvc vci | pvc vcd | pvc vpi/vci | pvc string]`	Configure the 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, slot and interface, and the PVC.
Step 12	`Router(config-voice-port)# no cdp enable`	Disable Cisco Discovery Protocol (CDP) on the interface.
Step 13	`Router(config-voice-port)# no keepalive`	Disable keepalive packets on the interface.
Step 14	`Router(config-voice-port)# exit`	Exit voice port configuration mode.

Configuring Transparent CCS for a Clear-Channel Codec

Transparent CCS using a clear-channel codec allows tie-line emulation between two PBXs or PSTN switches running HDLC-based common channel signaling such as ISDN, DPNSS, CORNET, QSIG, and others. This configuration supports VoIP, VoFR and VoATM. Signaling frames are transparently forwarded on IP using an emulated 64-kbps channel. These frames travel over a clear channel codec that is used on the voice port designated as the signaling channel. This codec passes data without changing the signaling frame.

Transparent CCS is configured when setting up the codec for the voice dial peer. Follow these steps to set up voice dial peers to support the local and remote stations. Not all possible commands are shown here.

To learn more, see *Multiservice Applications Configuration Guide* and *Multiservice Applications Command Reference* for Cisco IOS Release 12.1.

	Command	Purpose
Step 1	`Router(config)# controller {T1|E1} slot/port`	
Step 2	`Router(config-controller)# ds0-group ds0-group-no timeslots timeslot-list type {ext-sig}`	This command defines the T1/E1 channels for use by compressed voice calls as well as the signaling method the router uses to connect to the PBX or CO. The *ds0-group-no* parameter is a value from 0 through 23 that identifies the DS0 group. **Note** The **ds0-group** command automatically creates a logical voice port that is numbered as follows: *slot*/*port*:*ds0-group-no*. Although only one voice port is created, applicable calls are routed to any channel in the group. The value of *timeslot-list* is a single number, numbers separated by commas, or a pair of numbers separated by a hyphen to indicate a range of timeslots. For T1, allowable values are from 1 through 24. For E1, allowable values are from 1 through 30. To map individual DS0 time slots, define additional groups. The system maps additional voice ports for each defined group. The signaling method selection for **type** depends on the connection that you are making: The external signaling interface specifies that the signaling traffic comes from an outside source.
Step 3	`Router(config-controller)# no shutdown`	Activate the controller.
Step 4	`Router(config-controller)# exit`	Exit controller configuration mode.
Step 5	`Router(config)# dial-peer voice number pots`	Enter the dial-peer configuration mode and define a local dial peer that will connect to the plain old telephone service (POTS) network. The value of *number* is one or more digits identifying the dial peer. Valid entries are from 1 through 2147483647. The **pots** arguement indicates a peer using a basic telephone service.

	Command	Purpose
Step 6	`Router(config-dialpeer)# destination-pattern string [T]`	Configure the dial peer's destination pattern so that the system can reconcile dialed digits with a telephone number. The value of *string* is a series of digits that specify the E.164 or private dialing plan phone number. Valid entries are the digits 0 through 9 and the letters A through D. The plus symbol (+) is not valid. You can enter the following special characters: • The star character (*) that appears on standard touch-tone dial pads can be in any dial string—but not as a leading character (for example, *650). • The period (.) acts as a wildcard character. • Use the comma (,) only in prefixes, the comma inserts a one-second pause. When the timer (T) character is included at the end of the destination pattern, the system collects dialed digits as they are entered—until the interdigit timer expires (10 seconds, by default)—or the user dials the termination of end-of-dialing key (default is #). **Note** The timer character must be a capital T.
Step 7	`Router(config-dialpeer)# port slot/port:ds0-group-no`	This command associates the dial peer with a specific logical interface. The value of *slot* is the router location where the voice module is installed. Valid entries are from 0 through 3. The value of *port* indicates the voice interface card location. Valid entries are 0 or 1. Each defined DS0 group number is represented on a separate voice port. This allows you to define individual DS0s on the digital T1 card.
Step 8	`Router(config-dialpeer)# exit`	Exit dial-peer configuration mode to complete the POTS dial-peer configuration.
Step 9	`Router(config)# dial-peer voice number voip`	Enter the dial-peer configuration mode and define a remote VoIP dial peer. The value of *number* is one or more digits identifying the dial peer. Valid entries are from 1 through 2147483647. The **voip** arguement indicates a VoIP peer using voice encapsulation on the IP network.

	Command	Purpose
Step 10	`Router(config-dialpeer)# codec clear-channel`	The voice-card configuration **codec complexity** command sets the codec options that are available when you execute this command. Set codec complexity to **clear-channel** to use the clear channel codec.
Step 11	`Router(config-dialpeer)# vad`	(Optional) This setting is enabled by default. It activates voice activity detection (VAD) which allows the system to reduce unnecessary voice transmissions caused by unfiltered background noise.
Step 12	`Router(config-controller)# Router(config-dialpeer)# destination-pattern` *string* `[T]`	See Step 6 in this procedure.
Step 13	`Router(config-dialpeer)# session target {ipv4:`*destination-address*`| dns:[$s$.| $d$.| $e$.| $u$.] `*host-name*`}`	Configure the IP session target for the dial peer. The **ipv4:***destination-address* parameter indicates IP address of the dial peer. The **dns:***host-name* parameter indicates that the domain name server will resolve the name of the IP address. Valid entries for this parameter are characters representing the name of the host device. There are also wildcards available for defining domain names with the keyword by using source, destination, and dialed information in the host name. For complete command syntax information, see *Voice, Video, and Home Applications Command Reference for Cisco IOS Release 12.1.*
Step 14	`Router(config-dialpeer)# exit`	Exit dial peer configuration mode for the VoIP dial-peer configuration.

Verifying the Configuration

To verify the T-CCS configuration, enter the **show controller e1** command to view the status for all controllers, or enter the **show controller e1** *slot/port* command to view the status for a particular controller. Make sure that the status indicates the controller is up (line 2 in the following example) and no alarms (line 4 in the following example) or errors (lines 9, 10, and 11 in the following example) have been reported.

```
router# show  controllers e1 3/0
E1 3/0 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  alarm-trigger is not set
  Version info Firmware:19990702, FPGA:6
  Framing is CRC4, Line Code is HDB3, Clock Source is Line.
  Data in current interval (2 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail
Secs

!
controller E1 3/0
 mode ccs frame-forwarding
 channel-group 15 timeslots 16
 ds0-group 0 timeslots 15 type ext-sig
 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 16 timeslots 31 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
 ds0-group 27 timeslots 27 type ext-sig
 ds0-group 28 timeslots 28 type ext-sig
 ds0-group 29 timeslots 29 type ext-sig
 ds0-group 30 timeslots 30 type ext-sig
```

Troubleshooting Tips

If the connection does not come up, check the following:

- Loose wires, splices, connectors, shorts, bridge taps, and grounds
- Backwards transmit and receive
- Mismatched framing types (for example, CRC-4 verses no-CRC-4)
- Transmit and receive pair separation (crosstalk)
- Faulty line cards or repeaters
- Noisy lines (for example, power and crosstalk)

If you see errors on the line or the line is going up and down, check the following:

- Mismatched line codes (HDB3 vs. AMI)
- Receive level
- Frame slips due to poor clocking plan

Configuration Example

This section contains two examples:

- Configuring for VoFR
- Configuring for VoIP

Configuring for VoFR

The following configuration example shows CCS frame-forwarding on controller E1. Only relevant sections of the configuration are shown. The example assumes that the IP portion of the network is already in place.

```
hostname routerA
!
voice-card 1
!
controller E1 1/0
 mode ccs frame-forwarding
 channel-group 15 timeslots 16
 ds0-group 0 timeslots 15 type ext-sig
 ds0-group 1 timeslots 1 type ext-sig
.
.
.
 ds0-group 14 timeslots 14 type ext-sig
 ds0-group 17 timeslots 17 type ext-sig
.
.
.
 ds0-group 30 timeslots 30 type ext-sig
!
interface Serial0/0
 ip address 200.200.200.2 255.255.255.0
 no ip directed-broadcast
 encapsulation frame-relay
 no ip mroute-cache
 clockrate 2000000
 frame-relay traffic-shaping
 frame-relay class fr1
 frame-relay map ip 200.200.200.1 231 broadcast
 frame-relay interface-dlci 231
  vofr data 4 call-control 5
 frame-relay intf-type dce
!
```

The E1 interface must be set to **mode ccs frame-forwarding** to enable transparent forwarding of the HDLC signaling protocol through the DSP.

The **ds0-group** command links the specified time slot of the E1 interface to the corresponding voice port, which is automatically created by the router. This allows the voice port to be tied to the correspondent dial-peer using the connection trunk command. The **ext-sig** type specifies that the signaling traffic is coming from an external source.

The serial interface is set for frame relay traffic.

The example continues with the **voice-port** and **dial-peer** configuration.

```
voice-port 1/0:0
 compand-type a-law
 timeouts wait-release 3
 connection trunk 2000 answer-mode
.
.
.
voice-port 1/0:14
 compand-type a-law
 timeouts wait-release 3
 connection trunk 2014 answer-mode
!
voice-port 1/0:17
 compand-type a-law
 timeouts wait-release 3
 connection trunk 2017 answer-mode
.
.
.
voice-port 1/0:30
 compand-type a-law
 timeouts wait-release 3
 connection trunk 2030 answer-mode
!
dial-peer voice 2000 vofr
 destination-pattern 2000
 session target Serial0/0 231
!
dial-peer voice 1001 pots
 destination-pattern 1001
 port 1/0:1
.
.
.
dial-peer voice 1030 pots
 destination-pattern 1030
 port 1/0:30
!
```

The **dial-peer voice 2000 vofr** is used to forward the signaling channel over Frame Relay.

The **dial-peer pots** command sends the trunked voice DS0 traffic to the correspondant voice DS0 lines on the E1 port 1/0.

Configuring for VoIP

The following configuration example configures CCS over IP using the clear channel codec. The commands used in the configurations are explained inline. Only relevant sections of the configuration are shown. The example assumes that the IP portion of the network is already in place.

```
hostname routerA
!
voice-card 1
!
controller E1 1/0
 ds0-group 0 timeslots 16 type ext-sig
.
.
.
 ds0-group 10 timeslots 10 type ext-sig
!
interface Ethernet0/0
ip address 30.30.30.2 255.255.255.252
no ip directed-broadcast
!
voice-port 1/0:0
 compand-type a-law
 timeouts wait-release 3
 connection trunk 4000 answer-mode
!
voice-port 1/0:1
  compand-type a-law
  timeouts wait-release 3
  connection trunk 5001 answer-mode
.
.
.
voice-port 1/0:10
  compand-type a-law
  timeouts wait-release 3
  connection trunk 5010 answer-mode
!
```

The **ds0-group** command links the specified time slot of the E1 interface to the corresponding voice port, which is automatically created by the router. This allows the voice port to be tied to the correspondent dial-peer using the connection trunk command. The **ext-sig** type specifies that the signaling traffic is coming from an external source.

The DS0 group assigned to signaling, configured as **ds0-group 0 timeslots 16**, must have the corresponding voice port and dial-peer set for the clear-channel codec to enable transparent forwarding of the HDLC signaling protocol through the DSP.

The signaling DS0 of the E1 1/0 are configured to the dial-peer whose destination pattern matches the number 4000. The **dial-peer voice 4000 voip** command is used to forward the signaling channel over IP.

The voice DS0 channels of the E1 port1/0 are configured to the dial-peer whose destination pattern matches the number 5.... The **dial-peer voice 5... voip** is used to trunk the voice channels between routers.

```
dial-peer voice 4000 voip
 destination-pattern 4000
 codec clear-channel
 session target ipv4:10.49.80.204
!
 dial-peer voice 3000 pots
 destination-pattern 3000
 port 2/0:0
!
dial-peer voice 5000 voip
 destination-pattern 5...
 session target ipv4:10.49.80.204
!
dial-peer voice 2001 pots
 destination-pattern 2001
 port 2/0:1
.
.
.
dial-peer voice 2010 pots
 destination-pattern 2010
 port 2/0:10
```

The **dial-peer voice 4000 voip** is used to forward over IP the signaling channel from the router. The clear-channel codec must be applied to this dial-peer in order to avoid that compression, and VAD will be applied to the signaling channel, which requires a transparent 644-kbps path trough the DSP and the IP cloud.

The **dial-peer voice 3000 pots** forwards the incoming clear channel signaling to the correspondent signaling DS0 on the port E1 1/0 of the router . This is achieved leveraging on the voice-port 1/0:0 created with **ds0-group 0 timeslots 16 type ext-sig**.

The **dial-peer voice 5000 voip** is used to trunk the voice channels between routers. In this case, the codec used is the default G.729.

The **dial-peer voice 2001 pots** through **dial-peer voice 2010 pots** tie the VoIP legs of the trunked voice DS0s to the correspondent voice DS0's on the port E1 1/0 of the router.

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications and in Cisco IOS Release 12.1 feature modules.The following new or modified commands are used to configure the transparent CCS and CCS frame-forwarding features:

- **ccs connect**
- **ccs encap frf11**
- **mode ccs**

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* [*dlci* | **pvc** *vpi/vci* | **pvc** *name*] [*cidnumber*]

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

Syntax Description

The following parameters are used for a serial CCS configuration:

serial	Make a serial CCS connection.
dlci	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.

Defaults

No CCS connection is made.

Command Modes

Controller configuration mode

Command History

Release	Modification
12.0(2)T	This command was introduced for the Cisco MC3810.
12.0(7)XK	Added CID syntax, removed **dlci** keyword and **vcd** options.
12.1(2)T	This command was implemented in the 12.1(2)T release.
12.1(2)XH and 12.1(3)T	This command was supported on Cisco 2600 series, Cisco 3600 series, Cisco 7200 series, and Cisco 7500 series routers.

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 encap frf11** command, the *cidnumber* option allows you to specify any CID from 5 to 255. If you do not issue the **ccs encap 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
ccs encap frf11	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.

Defaults

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

Command Modes

Serial configuration mode

Command History

Release	Modification
12.0(7)XK	This command was introduced for the Cisco MC3810.
12.1(2)T	This command was implemented in the 12.1(2)T release.
12.1(2)XH and 12.1(3)T	This command was supported on Cisco 2600 series, Cisco 3600 series, Cisco 7200 series, and Cisco 7500 series routers.

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
mode ccs frame-forwarding	Set to forward frames on the controller.

mode ccs

To configure the T1/E1 controller to support CCS frame-forwarding, use the **mode ccs** controller configuration command. To disable support for CCS frame-forwarding on the controller, use the **no** form of this command.

mode ccs {**frame-forwarding**}

no mode ccs {**frame-forwarding**}

Syntax Description

frame-forwarding	Enables CCS frame forwarding on the controller.

Defaults

No CCS mode is configured.

Command Modes

Controller configuration mode

Usage Guidelines

This command first appeared in Cisco IOS Release 12.0(2)T.

Examples

To enable CCS frame-forwarding on controller T1 1, enter the following commands:

```
controller T1 1
 mode ccs frame-forwarding
```

Related Commands

ccs connect

Debug Commands

This section documents the new debug command related to the T-CCS feature. Note that important information appears in bold, and bold text preceded by the "<<" characters explains the process.

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.

Defaults

Disabled

Command Modes

EXEC

Command History

Release	Modification
Cisco IOS Release 12.0(6)T	This command was introduced.

Usage Guidelines

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

1. Observe the 'ccs connect' command when the setup takes place at configuration time.
2. Observe ccs traffic at run time:shows the actual ccs packets receiving at run time and the number of packets received and transmitted

Examples

See the following example to begin debugging transparent CCS connection entries:

```
Router# debug tccs signaling
```

The **debug tccs signaling** command shows information about the transparent CCS connection:

```
Router#debug tccs signaling
TCCS Domain packet debugging is on
Router#
3d01h: 619913 tccs packets received from the port.
3d01h: 619520 tccs packets received from the nework.
3d01h:pri_tccs_rx_intr:from port->send_sub_channel
3d01h:tccs_db->vcd = 231, tccs_db->cid = 10
3d01h:pak->datagramsize=8
3d01h:[0] 8A 0 C0 0
3d01h:[4] 0 1 1 5D
3d01h: 619913 tccs packets received from the port.
3d01h: 619521 tccs packets received from the nework.
3d01h:tx_tccs_fr_pkt:pkt rcvd from network->tx_start
3d01h:tx_tccs_fr_pkt:dlci=231, cid=10, payld-type =0,
                payld-length=136, cid_type=424
3d01h:datagramsize=8
3d01h:[0] 8A 0 C0 0
3d01h:[4] 2 1 1 AD
3d01h: 619913 tccs packets received from the port.
3d01h: 619522 tccs packets received from the nework.
3d01h:tx_tccs_fr_pkt:pkt rcvd from network->tx_start
3d01h:tx_tccs_fr_pkt:dlci=231, cid=10, payld-type =0,
                payld-length=136, cid_type=424
3d01h:datagramsize=8
3d01h:[0] 8A 0 C0 0
3d01h:[4] 0 1 1 AD
3d01h: 619914 tccs packets received from the port.
3d01h: 619522 tccs packets received from the nework.
3d01h:pri_tccs_rx_intr:from port->send_sub_channel
3d01h:tccs_db->vcd = 231, tccs_db->cid = 10
3d01h:pak->datagramsize=8
3d01h:[0] 8A 0 C0 0
3d01h:[4] 2 1 1 5D
```