IP over a CLNS Tunnel

This feature module describes the IP over a CLNS Tunnel feature and includes the following sections:

Feature Overview

The IP over a CLNS Tunnel feature lets you transport IP traffic over Connectionless Network Service (CLNS); for instance, on the data communications channel (DCC) of a SONET ring.

Benefits

IP over a CLNS tunnel is a virtual interface that enhances interactions with CLNS networks, allowing IP packets to be tunneled through the Connectionless Network Protocol (CLNP) to preserve TCP/IP services.

Configuring an IP over CLNS tunnel (CTunnel) allows you to Telnet to a remote router that has only CLNS connectivity. Other management facilities can also be used, such as Simple Network Management Protocol (SNMP) and TFTP, which otherwise would not be available over a CLNS network.

Related Features and Technologies

For information on configuring other types of interfaces, refer to the chapter "Configuring Logical Interfaces" of the *Cisco IOS Interface Configuration Guide,* Cisco IOS Release 12.1.

Related Documents

- *Cisco IOS Interface Configuration Guide,* Release 12.1
- *Cisco IOS Interface Command Reference,* Release 12.1

Supported Platforms

- Cisco 2500 series
- Cisco 2600 series
- Cisco 3600 series
- Cisco 4000 series
- Cisco 4500 series
- Cisco 4700 series
- Cisco 7200 series
- Cisco 7500 series

The IP over a CLNS Tunnel feature is supported on all platforms that support ISO CLNS.

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

No new or modified MIBs are supported by this feature.

To obtain lists of MIBs supported by platform and Cisco IOS release and to download MIB modules, go to the Cisco MIB web site on Cisco Connection Online (CCO) at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

RFCs

No new or modified RFCs are supported by this feature.

Configuration Tasks

See the following sections for configuration tasks for the IP over a CLNS Tunnel feature. Each task in the list is identified as either optional or required.

- Configuring IP over a CLNS Tunnel (Required)
- Verifying Configuration (Optional)

Configuring IP over a CLNS Tunnel

To configure IP over a CLNS Tunnel (CTunnel), use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface ctunnel** *interface-number*	Creates a virtual interface to transport IP over a CLNS tunnel and enters interface configuration mode. The interface number must be unique for each CTunnel interface.
Step 2	Router(config-if)# **ctunnel destination** *remote-nsap-address*	Configures the destination parameter for the CTunnel. Specifies the destination NSAP[1] address of the CTunnel, where the IP packets are extracted.
Step 3	Router(config-if)# **ip address** *ip-address mask*	Sets a primary or secondary IP address for an interface.

1. network service access point (NSAP) address

> **Note** To configure a CTunnel between a single pair of routers, you must enter the foregoing commands on each router. The destination NSAP address for Router A would be the NSAP address of Router B, and the destination NSAP address for Router B would be the NSAP address of Router A. Ideally, the IP addresses used for the virtual interfaces at either end of the tunnel should be in the same IP subnet.

Verifying Configuration

To verify correct configuration of the IP over a CLNS Tunnel feature, perform the following steps:

Step 1 On Router A, ping the IP address of the CTunnel interface of Router B.

Step 2 On Router B, ping the IP address of the CTunnel interface of Router A.

Troubleshooting Tips

If the CTunnel does not function, verify correct configuration on both routers as described in the section "Verifying Configuration".
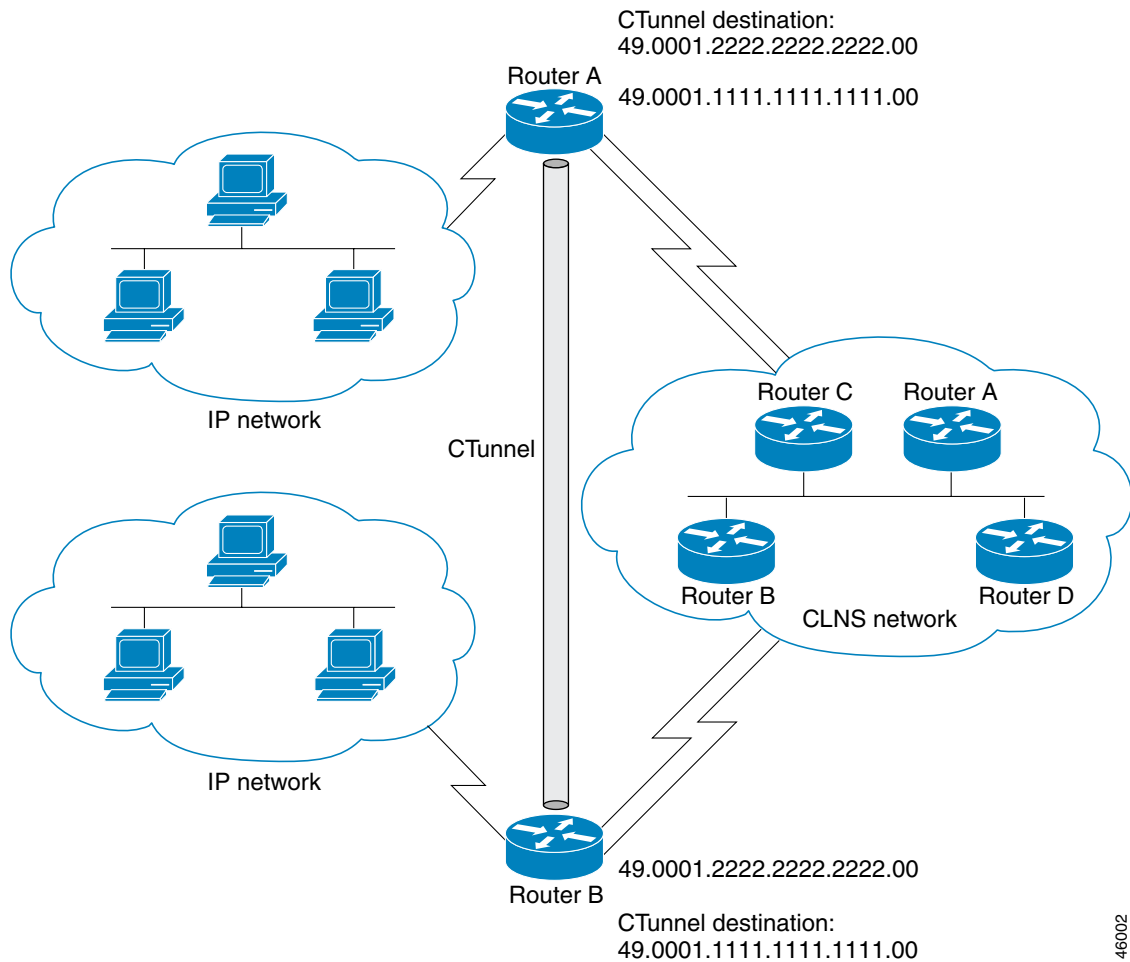
Monitoring and Maintaining IP over a CLNS Tunnel

To display the status of IP over CLNS tunnels, use the following command in privileged EXEC mode:

Command	Purpose
`Router# show interfaces ctunnel` *interface-number*	Displays information about an IP over CLNS tunnel.

Configuration Examples

Figure 1 illustrates the creation of a CTunnel between Router A and Router B, as accomplished in the configuration examples that follow for Router A and Router B:

Figure 1   Creation of a CTunnel

Router A

```
ip routing
clns routing

interface ctunnel 102
 ip address 10.0.0.1 255.255.255.0
 ctunnel destination 49.0001.2222.2222.2222.00

interface Ethernet0/1
 clns router isis

router isis
 net 49.0001.1111.1111.1111.00

router rip
 network 10.0.0.0
```

Router B

```
ip routing
clns routing

interface ctunnel 201
 ip address 10.0.0.2.255.255.255.0
 ctunnel destination 49.0001.1111.1111.1111.00

interface Ethernet0/1
 clns router isis

router isis
 net 49.0001.2222.2222.2222.00

router rip
 network 10.0.0.0
```

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.

- **ctunnel destination**
- **interface ctunnel**
- **show interfaces ctunnel**

ctunnel destination

To configure the destination parameter for an IP over Connectionless Network Service (CLNS) tunnel (CTunnel), use the **ctunnel destination** interface configuration command. To remove the destination parameter, use the **no** form of this command.

ctunnel destination *nsap-address*

no ctunnel destination *nsap-address*

Syntax Description

nsap-address	NSAP address for the CLNS tunnel (CTunnel) destination.

Defaults No default behavior or values.

Command Modes Interface configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines When creating an IP over CLNS tunnel, you must first create the virtual interface by using the **interface ctunnel** command. Once you have created the virtual interface, the order in which you configure the destination parameter by using the **ctunnel destination** command and set the IP address for that destination parameter by using the **ip address** command does not matter.

Addresses in the ISO network architecture are referred to as network service access point (NSAP) addresses and network entity titles (NETs). Each node in an OSI network has one or more NETs. In addition, each node has many NSAP addresses. Each NSAP address differs from one of the NETs for that node in only the last byte. This byte is called the *N-selector*. Its function is similar to the port number in other protocol suites.

When a CTunnel interface is being configured, the N-selector of the destination NSAP address is set automatically by the router. Regardless of the value you enter for the N-selector byte, the router will select the appropriate value. You will see the value that was chosen by the router when you enter the **show interfaces ctunnel** command.

Examples The following example configures a CTunnel from one router to another and shows the CTunnel destination set to 49.0001.1111.1111.1111.00.

```
interface ctunnel 301
 ip address 10.0.0.3 255.255.255.0
 ctunnel destination 49.0001.1111.1111.1111.00
```

Related Commands

Command	Description
clns routing	Enables routing of CLNS packets.
debug ctunnel	Displays debug messages for the IP over a CLNS Tunnel feature.
interface ctunnel	Creates a virtual interface to transport IP over a CLNS tunnel.
ip address	Sets a primary or secondary IP address for an interface.
ip routing	Enables IP routing.

interface ctunnel

To create a virtual interface to transport IP over a Connectionless Network Service (CLNS) tunnel (CTunnel), use the **interface ctunnel** global configuration command. To remove the virtual interface, use the **no** form of this command.

> **interface ctunnel** *interface-number*

> **no interface ctunnel** *interface-number*

Syntax Description

interface-number	CTunnel interface number (a number from 0 through 2,147,483,647).

Defaults No default behavior or values.

Command Modes Global configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines When configuring an IP over CLNS tunnel, you must first create a virtual interface. In the following example, the **interface ctunnel** command is used to create the virtual interface.

Examples The following example configures a CTunnel from one router to another and shows the CTunnel destination set to 49.0001.1111.1111.1111.00:

```
interface ctunnel 301
 ip address 10.0.0.3 255.255.255.0
 ctunnel destination 49.0001.1111.1111.1111.00
```

Related Commands

Command	Description
clns routing	Enables routing of CLNS packets.
ctunnel destination	Configures the destination parameter for a CLNS tunnel.
debug ctunnel	Displays debug messages for the IP over a CLNS Tunnel feature.
ip address	Sets a primary or secondary IP address for an interface.
ip routing	Enables IP routing.

show interfaces ctunnel

To display information about an IP over CLNS tunnel (CTunnel), use the **show interfaces ctunnel** privileged EXEC command.

show interfaces ctunnel *interface-number* [**accounting**]

Syntax Description

interface-number	Virtual interface number.
accounting	(Optional) Displays the number of packets of each protocol type that have been sent through the interface.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(5)T	This command was introduced.

Examples

The following is sample output from the **show interfaces ctunnel** command:

```
Router# show interfaces ctunnel 1

CTunnel1 is up, line protocol is up
  Hardware is CTunnel
  Internet address is 10.0.0.1/24
  MTU 1514 bytes, BW 9 Kbit, DLY 500000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation TUNNEL, loopback not set
  Keepalive set (10 sec)
  Tunnel destination 49.0001.2222.2222.2222.cc
  Last input never, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/0, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     0 packets input, 0 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     1 packets output, 104 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Table 1 describes the significant fields shown in the display.

Note   For the **show interfaces ctunnel** command, all output that relates to a physical medium is irrelevant and should be ignored because the CTunnel is a virtual interface.

Table 1 *show interfaces ctunnel Field Descriptions*

Field	Description
CTunnel is {up | down | administratively down}	Interface is currently active (up) or inactive (down). Shows interface is administratively down if disabled.
line protocol is {up | down}	Shows line protocol up if a valid route is available to the CLNS tunnel (CTunnel) destination. Shows line protocol down if no route is available, or if the route would be recursive.
Hardware	Type of interface, in this instance CTunnel.
Internet address	IP address of the interface.
MTU	Maximum transmission unit of the interface.
BW	Bandwidth, as specified by the user, that is available on the link.
DLY	Delay of the interface, in microseconds.
Encapsulation	Encapsulation method is always TUNNEL for tunnels.
Loopback	Shows whether loopback is set or not.
Keepalive	Shows whether keepalives are set or not.
Tunnel destination	The NSAP address of the tunnel destination. The N-Selector part of the displayed NSAP address is set by the router and cannot be changed.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface.
Last clearing	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates that the elapsed time is too large to be displayed. 0:00:00 indicates that the counters were cleared more than 2^{31} ms (and less than 2^{32} ms) ago.
Queueing strategy	Type of queueing active on this interface.
Output queue, drops Input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped because of a full queue.
Five minute input rate, Five minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of 4 time constants must pass before the average will be within 2 percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes in the error-free packets received by the system.
no buffer	Number of received packets discarded because there was no memory buffer available.

Table 1   show interfaces ctunnel Field Descriptions (continued)

Field	Description
broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	This field does not apply to the CTunnel virtual interface.
giants	This field does not apply to the CTunnel virtual interface.
throttles	This field does not apply to the CTunnel virtual interface.
input errors	This field does not apply to the CTunnel virtual interface.
CRC	This field does not apply to the CTunnel virtual interface.
frame	This field does not apply to the CTunnel virtual interface.
overrun	This field does not apply to the CTunnel virtual interface.
ignored	This field does not apply to the CTunnel virtual interface.
abort	This field does not apply to the CTunnel virtual interface.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes transmitted by the system.
underruns	This field does not apply to the CTunnel virtual interface.
output errors	This field does not apply to the CTunnel virtual interface.
collisions	This field does not apply to the CTunnel virtual interface.
interface resets	Number of times an interface has been reset. The interface may be reset manually by the administrator or automatically by the system when an internal error occurs.
output buffer failures	Number of buffer failures.
output buffers swapped out	Number of output buffer allocation failures.

Related Commands

Command	Description
show interfaces	Displays the statistical information specific to interfaces.
show ip route	Displays all static IP routes, or those installed using the AAA route download function.

Debug Commands

This section documents the new **debug ctunnel** command related to the IP over a CLNS Tunnel feature.

debug ctunnel

To display debug messages for the IP over a CLNS Tunnel feature, use the **debug ctunnel** privileged EXEC command. To disable the debug messages, use the **no** form of this command.

debug ctunnel

no debug ctunnel

Syntax Description   This command has no arguments or keywords.

Defaults   No default behavior or values.

Command History

Release	Modification
12.1(5)	This command was introduced.

Examples   As packets are sent over the virtual interface, the following type of output will appear on the console when the the **debug ctunnel** command is used:

```
4d21h: CTunnel1: IPCLNP encapsulated 49.0001.1111.1111.1111.00->49.0001.2222.2222.2222.00
(linktype=7, len=89)
```

Glossary

CLNP—Connectionless Network Protocol. OSI network layer protocol that does not require a circuit to be established before data is transmitted.

CLNS—Connectionless Network Service. OSI network layer service that does not require a circuit to be established before data is transmitted. CLNS routes messages to their destinations independently of any other messages.

CLNS tunnel—See CTunnel.

Connectionless Network Protocol—See CLNP.

Connectionless Network Service—See CLNS.

CTunnel—CLNS tunnel. A type of virtual interface that lets you transport IP traffic over a CLNS network.

data communications channel—See DCC.

DCC—data communications channel. An AT&T SONET term used to describe a channel contained within section and line overhead and used as an embedded operations channel to communicate to each network element.

Simple Network Management Protocol—See SNMP.

N-selector—A component of a Network Service Access Point (NSAP) address used to select the Network Layer service user. The N-selector is sometimes referred to as a transport-selector; however, a user of the Network Layer need not be a transport service.

SONET—Synchronous Optical Network. High-speed (up to 2.5 Gbps) synchronous network specification developed by Bellcore and designed to run on optical fiber. STS-1 is the basic building block of SONET. Approved as an international standard in 1988.

SNMP—Simple Network Management Protocol. Network management protocol used almost exclusively in TCP/IP networks. SNMP provides a means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.

Synchronous Optical Network—See SONET.

TFTP—Trivial File Transfer Protocol. Simplified version of FTP that allows files to be transferred from one computer to another over a network.

Trivial File Transfer Protocol—See TFTP.