C O N T E N T S

Overview

First Published: April 9, 2008

Contents

Note In the text of this document, the product name, Network Capacity Expansion, is abbreviated as NCE except in command names and command output examples.

Prerequisites for the Network Capacity Expansion Service Module

Router

Plan software upgrades or downgrades for times when you can take all applications that run on the host router out of service or off line.

Ensure that you have the appropriate Cisco access router to serve as the host router. The Network Capacity Expansion Service Module is supported on the Cisco access routers listed below:

Module	Platform
AIM - TPO - 1	Cisco 1841, 2801, 2811, 2821, 2851, 3825, 3845
AIM - TPO - 2	Cisco 1841, 2801, 2811, 2821, 2851, 3825, 3845
NME - TPO	Cisco 2811, 2821, 2851, 3825, 3845

Ensure that the host router is running the Cisco IOS release 12.4(20)T or later software. To learn which Cisco IOS release software your router is currently running, run the **show version** command.

Module

To install and remove a Network Capacity Expansion Advanced Integrated Module (AIM), see:

- *Installing and Upgrading Internal Modules in Cisco 1800 Series Routers (Modular)* in *Cisco 1800 Series Hardware Installation Guide (Modular)*.

- *Installing and Upgrading Internal Modules in Cisco 2800 Series Routers (Modular)* in *Cisco 2800 Series Hardware Installation*.

- *Installing and Upgrading Internal Modules in Cisco3800 Series Routers* in *Cisco 3800 Series Hardware Installation*.

To install and remove a Network Capacity Expansion Service Module (NME), see:

- *Network Capacity Expansion Enhanced Network Modules*

- *Installing Network Modules in Cisco 2800 Series Routers* in *Cisco 2800 Series Hardware Installation*.

- *Installing Network Modules in Cisco 3800 Series Routers* in *Cisco 3800 Series Hardware Installation*.

Run the **show running-config** command to obtain the slot and unit number of the service module in the host router. You need this information for the "Setting Up the Transport-opt Interface" section on page 2-1 and the "Software Upgrade or Downgrade" section on page 2-6.

From the host-router CLI, use the **show running-config** command as follows:

```
Router> enable
Router# show running-config
```

In the configuration output, the following line shows the NCE AIM (Transport-Opt-Service-Engine) in slot 0, unit 1:

```
interface Transport-Opt-Service-Engine0/1
```

The AIM is installed on the router motherboard and the motherboard is always installed in slot 0—so the AIM always shows that it is installed in slot 0. The AIM can be installed on the motherboard, as unit 0 or 1 and shows 0 or 1 for the unit number.

The NME can be installed in any network module slot on the router. The NME always shows 0 as the unit number:

```
interface Transport-Opt-Service-Engine2/0
```

File Server

Verify that your download FTP or TFTP server is accessible:

- FTP server—Use for installations, backups, and restores.

- TFTP server—Use (on the FTP server machine) for boothelper operations to recover from a failed installation.

Restrictions for the Network Capacity Expansion Service Module

Note   If a customer purchased modules before March 15 2009 and is using L2 mask-based load balancing, please make sure that all the boards on the headend side have unique MAC address. If not, please use the interim bootloader to upgrade the MAC address in the NCE module and then upgrade to 2.0.1 release.

Upgrade or Downgrade

You can perform a software upgrade or downgrade only on an inactive system. Plan upgrades or downgrades for times when you can take all the applications that run on the host router out of service or off line.

Configuration

You can check the software version running on the module by accessing the router's Cisco IOS command-line interface (CLI).

Information About the Network Capacity Expansion Service Module

The Network Capacity Expansion (NCE) is an application that resides on a module that plugs into a host Cisco router running Cisco IOS software. Table 1-1 lists and describes the three types of service modules that are available for the various system configurations.

Table 1-1   Network Capacity ExpansionService Modules

Module	Peers	TCP Connections
AIM-TPO-1	5	1024
AIM-TPO-2	10	2048
NME-TPO	50	12500

The service module is a standalone transport-optimization engine with own startup and run-time configurations. The module does not have an external console port. Instead, you launch and configure the module through the router, by means of a configuration session on the service module. After the session, you return to the router CLI and clear the session.

This arrangement—host router plus module (the module is sometimes referred to as an appliance or blade or, with installed software, a service engine)—provides a router-integrated application platform for accelerating data-intensive TCP-based applications.

Hardware Interfaces

The host router and service module use several interfaces for internal and external communication (see Figure 1-1). Each interface is configurable—the router is configured by using the Cisco IOS CLI, and the module is configured by using the module firmware's CLI.

Figure 1-1   Router and Module Interfaces
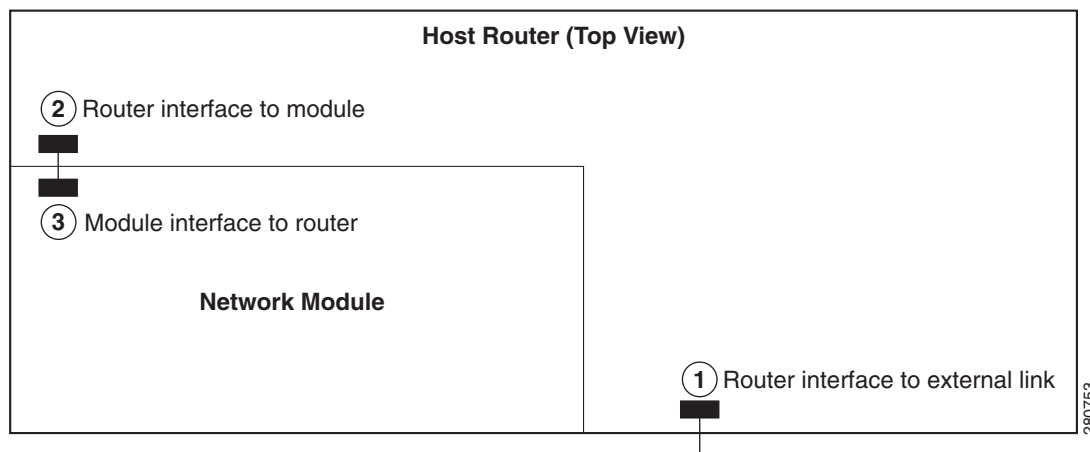
	On This Hardware Interface...	Configure These Settings...	Using This Configuration Interface
1	Router interface to external link (FastEthernet *slot/port*)	Standard router settings	Router's Cisco IOS CLI
2	Router interface to module (Transport-Opt-Service-Engine *slot/port*)	Module's IP address and default gateway router	
3	Module interface to router (GigaEthernet 0/1)	All other module and NCE application settings	Module's NCE CLI

Upgrading the NCE Software

Contents

- How to Upgrade or Downgrade the NCE Service Module, page 2-1
- How to Configure, Operate, and Administer the Network Capacity Expansion Service Module, page 2-9

How to Upgrade or Downgrade the NCE Service Module

This section contains the following procedures:

- Setting Up the Transport-opt Interface, page 2-1
- Opening and Closing a Session, page 2-4
- Check Software Version, page 2-5
- Software Upgrade or Downgrade, page 2-6
- First-time Bootup of a Service Module, page 2-7

Note
- If you lose power or connection during any of the procedures, the system usually detects the interruption and tries to recover. If it fails to recover, fully reinstall the service by using the boothelper.
- You can configure the module by using the CLI.

Setting Up the Transport-opt Interface

The first set-up task is to configure Cisco IOS on the NCE module.

Note Step 1 through Step 4 open the host-router CLI and access the router interface to the module. Step 5 through Step 9 configure the interface.

SUMMARY STEPS

From the Host-Router CLI

1. **enable**

2. **configure terminal**

3. **interface Transport-Opt-Service-Engine** *slot/port*

4. **ip address** *ip-address mask*

    or

    ip unnumbered *type number*

5. **service-module ip address** *nm-side-ip-address subnet-mask*

6. **service-module ip default-gateway** *gateway-ip-address*

7. **no shutdown**

8. **end**

9. **copy running-config startup-config**

10. **show running-config**

DETAILED STEPS

Command or Action	Purpose
From the Host-Router CLI	
Step 1 `enable` **Example:** `Router> enable`	Enters privileged EXEC mode on the host router. Enter your password if prompted.
Step 2 `configure terminal` **Example:** `Router# configure terminal`	Enters global configuration mode on the host router.

Step 3   `interface Transport-Opt-Service-Engine` `slot/port`
 	
 Example:
 `Router(config)# interface`
 `Transport-Opt-Service-Engine 1/0`
	Enters interface configuration mode for the module slot and port.

	Command or Action	Purpose
Step 4	`ip address` *ip-address mask* or `ip unnumbered` *type number* **Example:** Router(config-if)# ip address 10.0.0.20 255.255.255.0 or Router(config-if)# ip unnumbered Fastethernet 0	Specifies the router interface to the module. Arguments are as follows: • *ip-address* —IP address for the router interface to the module. • *mask*—Subnet mask for the router interface to the module. • *type number*—Type and number of another interface on which the router has an assigned IP address. It cannot be another assigned unnumbered interface.
Step 5	`service-module ip address` *nm-side-ip-address subnet-mask* **Example:** Router(config-if)# service-module ip address 10.0.0.40 255.255.255.0	Specifies the IP address for the module interface to the router. Arguments are as follows: • *nm-side-ip-address*—IP address for the interface. • *subnet-mask*—Subnet mask to append to the IP address; must be in the same subnet as the gateway router.
Step 6	`service-module ip default-gateway` *gateway-ip-address* **Example:** Router(config-if)# service-module ip default-gateway 10.0.0.20	Specifies the IP address for the default gateway router for the module. The argument is as follows: • *gateway-ip-address*—IP address for the gateway router.
Step 7	`no shut` **Example:** Router(config-if)# no shut	Brings up line interface.
Step 8	`end` **Example:** Router(config-if)# end	Returns to global configuration mode on the host router.
Step 9	`copy running-config startup-config` **Example:** Router# copy running-config startup-config	Saves the router's current running configuration.
Step 10	`show running-config` **Example:** Router# show running-config	Shows the router's running configuration, so that you can verify address configurations.

Examples

The following partial output from the **show running-config** command shows how the interfaces are configured.

```
interface Transport-Opt-Service-Engine0/0
 ip address 10.0.0.20 255.255.255.0
```

```
service-module ip address 10.0.0.40 255.255.255.0
 service-module ip default-gateway 10.0.0.20
end
ip route 10.0.0.40 255.255.255.255 Transport-Opt-Service-Engine 1/0
```

Opening and Closing a Session

You can now open and close a session on the module.

> **Note**   If you change the IP address before you disconnect the session, you must clear the users by using the
> CLI command:
>
> **service-module t0/0 session clear**
>
> If you issue a **disconnect** command after changing the IP address, the **disconnect** command clears only
> the active session, but not the users connected to it.

> **Note**   You can conduct only one session at a time.

Cisco IOS commands are entered from the host-router CLI. Application commands are entered from the
service module interface.

SUMMARY STEPS

From the Host-Router CLI

1. **enable**

2. **service-module Transport-Opt-Service-Engine** *slot/port* **status**

3. **service-module Transport-Opt-Service-Engine** *slot/port* **session**

From the Service-Module Interface

4. Perform configuration or other procedures.

5. To switch the session back to the Cisco IOS, press **Control+Shift+6 x**

From the Host-Router CLI

6. **service-module Transport-Opt-Service-Engine** *slot/port* **session clear**

DETAILED STEPS

Command or Action	Purpose
From the Host-Router CLI	
Step 1 **enable** **Example:** `Router> enable`	Enters privileged EXEC mode on the host router. Enter your password if prompted.

	Command or Action	Purpose

Step 2	`service-module Transport-Opt-Service-Engine` *slot/port* `status`
	
	Example:
	`Router# service-module`
	`Transport-Opt-Service-Engine 1/0 status`
		Shows the status and version of the application running on the specified module, so that you can ensure that the module is running (that is, in steady state).
		
		Note If the module is not running, start it with one of the startup commands listed in the "Shutting Down and Starting Up the Network Capacity Expansion Service Module" section on page 2-10.

Step 3	`service-module Transport-Opt-Service-Engine` *slot/port* `session`
	
	Example:
	`Router# service-module`
	`Transport-Opt-Service-Engine 1/0 session`
	
	`Trying 10.10.10.1, 2065 ... Open`
		Begins a session on the specified module. To start a configuration session, press **Enter**.

	From the Service-Module Interface	

Step 4	**Example (Configuration):**
	`SE-Module> configure terminal`
	`SE-Module(config)>`
	`.`
	`.`
	`.`
	`SE-Module(config)>exit`
	`SE-Module> write`
		Enter configuration commands on the module as needed.
		
		Configuration commands are similar to those that are available for the router. To access global configuration mode, use the **configure terminal** command. Enter configuration commands. To exit global configuration mode use the **exit** command. To save your new configuration, use the **write** command. Notice that you do not use the **enable** command and that the prompt does not change from **>**.

Step 5	Press **Control+Shift+6 x**.	Switches the service-module session back to Cisco IOS and returns to the router CLI. **Note** The service-module session stays up until you clear it in the next step. While it remains up, you can return to it from the router CLI by pressing **Enter**.
	From the Host-Router CLI	

Step 6	`service-module Transport-Opt-Service-Engine` *slot/port* `session clear`
	
	Example:
	`Router# service-module`
	`Transport-Opt-Service-Engine 1/0 session clear`
		Clears the service-module session for the specified module. When prompted to confirm this command, press **Enter**.

Check Software Version

Check software to determine if you should upgrade, downgrade, or install new software. Run Cisco IOS command **service-module Transport-opt slot/port status.**

Transport Optimization Module 2.0.1 is running on the service module if the output is similar to:

```
BRANCH-1-C3845-1#service-module t4/0 status
Service Module is Cisco Transport-Opt-Service-Engine4/0
Service Module supports session via TTY line 258
Service Module is in Steady state
Service Module heartbeat-reset is enabled
```

```
Getting status from the Service Module, please wait..
Transport Optimization Module 2.0.1
TPO Running on NM
BRANCH-1-C3845-1#.
```

Note   If there is an image installed on the service module, use the application command **software install clean url** *ftp://1.2.3.4/pub/filename.pkg* **user** *username* **password** *password* for any image upgrade or downgrade.

If there is no image installed on the service module, the output of the Cisco IOS command **service-module transport slot/port status** is similar to the output shown here. Follow the first-time installation instructions.

```
router#service-module t4/0 status
Service Module is Cisco Transport-Opt-Service-Engine4/0
Service Module supports session via TTY line 258
Service Module is trying to recover from error
Service Module heartbeat-reset is enabled
Service Module status is not available
```

Software Upgrade or Downgrade

Prerequisites

Have available the IP address of your download FTP file server.

SUMMARY STEPS

1. Download the required software from the Cisco Software Center web site.

From the Host-Router CLI

2. **service-module Transport-Opt-Service-Engine** *slot/port* **session**

From the Service-Module Interface

3. **software install clean url** *ftp://1.2.3.4/pub/filename.pkg* **user** *username* **password** *password*

4. **show software versions**

5. **Control+Shift+6 x**

From the Host-Router CLI

6. **service-module Transport-Opt-Service-Engine** *slot/port* **session clear**

DETAILED STEPS

Step 1   Download the NCE software (TPO Version 2.0.1 or later) as follows:

   a.   Go to the NCE page of the Cisco Software Center web site and download the following files to the FTP server (check that the files are downloaded to the same directory):

   TPO-AGGR

   –   tpo-k9-full.aggr.2.0.1.prt1

        – tpo-k9-installer.aggr.2.0.1.prt1

        – tpo-k9.aggr.2.0.1.pkg

    TPO-AIM-1/-2

        – tpo-k9-full.aim.2.0.1.prt1

        – tpo-k9-installer.aim.2.0.1.prt1

        – tpo-k9.aim.2.0.1.pkg

Step 2   Open a session and access the application.

```
SE-Module# service-module Transport-Opt-Service-Engine slot/port session
```

Step 3   Install the upgrade software. In the following command, specify the pkg file and the other *.prt1 files are downloaded automatically.

> ✎
>
> **Note**   An upgrade preserves configuration and user data. The following command presumes that you are performing an upgrade.

```
SE-Module> software install clean url ftp://1.2.3.4/filename.pkg user username password
password
```

Respond as directed to any system prompts.

Step 4   (Optional) Display your software version to ensure that the new version is installed:

```
SE-Module> show software versions
```

Step 5   For a clean installation only: restore the configuration and user data and reload the module again. For restore instructions, see the "Application-Level Troubleshooting" section on page 10-10.

Step 6   Close the session by pressing **Control+Shift+6 x**.

Step 7   From the host-router CLI, clear the session:

```
Router# service-module Transport-Opt-Service-Engine slot/port session clear
```

First-time Bootup of a Service Module

In the following example, requests for user input are shown in bold.

```
********** rc.post_install ****************
IMPORTANT::
IMPORTANT:: Welcome to Cisco Systems Service Engine
IMPORTANT:: post installation configuration tool.
IMPORTANT::
IMPORTANT:: This is a one time process which will guide
IMPORTANT:: you through initial setup of your Service Engine.
IMPORTANT:: Once run, this process will have configured
IMPORTANT:: the system for your location.
IMPORTANT::
IMPORTANT:: If you do not wish to continue, the system will be halted
IMPORTANT:: so it can be safely removed from the router.
IMPORTANT::
Do you wish to start configuration now (y,n)? y
Are you sure (y,n)? y
Enter Hostname
(my-hostname, or enter to use se-1-3-202-26): BRANCH
Enter Domain Name
```

```
(mydomain.com, or enter to use localdomain):
Using localdomain as default
IMPORTANT:: DNS Configuration:
IMPORTANT::
IMPORTANT:: This allows the entry of hostnames, for example foo.cisco.com, instead
IMPORTANT:: of IP addresses like 1.100.10.205 for application configuration. In order
IMPORTANT:: to set up DNS you must know the IP address of at least one of your
IMPORTANT:: DNS Servers.
Would you like to use DNS (y,n)?n
WARNING: If DNS is not used, IP addresses will be required.
Are you sure (y,n)? y
Enter IP Address of the Primary NTP Server
(IP address, or enter for 1.3.202.33):
**************************************************
I could not reach 1.3.202.33 using NTP.
1.3.202.33 might not have been configured as
NTP server.
**************************************************
Do you wish to continue with out Primary NTP server (y,n)? y
Enter IP Address of the Secondary NTP Server
(IP address, or enter to bypass):
Please identify a location so that time zone rules can be set correctly.
Please select a continent or ocean.
1) Africa 4) Arctic Ocean 7) Australia 10) Pacific Ocean
2) Americas 5) Asia 8) Europe
3) Antarctica 6) Atlantic Ocean 9) Indian Ocean
#? 2
Please select a country.
1) Anguilla 18) Ecuador 35) Paraguay
2) Antigua & Barbuda 19) El Salvador 36) Peru
3) Argentina 20) French Guiana 37) Puerto Rico
4) Aruba 21) Greenland 38) St Kitts & Nevis
5) Bahamas 22) Grenada 39) St Lucia
6) Barbados 23) Guadeloupe 40) St Pierre & Miquelon
7) Belize 24) Guatemala 41) St Vincent
8) Bolivia 25) Guyana 42) Suriname
9) Brazil 26) Haiti 43) Trinidad & Tobago
10) Canada 27) Honduras 44) Turks & Caicos Is
11) Cayman Islands 28) Jamaica 45) United States
12) Chile 29) Martinique 46) Uruguay
13) Colombia 30) Mexico 47) Venezuela
14) Costa Rica 31) Montserrat 48) Virgin Islands (UK)
15) Cuba 32) Netherlands Antilles 49) Virgin Islands (US)
16) Dominica 33) Nicaragua
17) Dominican Republic 34) Panama
#? 45
Please select one of the following time zone regions.
1) Eastern Time
2) Eastern Time - Michigan - most locations
3) Eastern Time - Kentucky - Louisville area
4) Eastern Time - Kentucky - Wayne County
5) Eastern Standard Time - Indiana - most locations
6) Eastern Standard Time - Indiana - Crawford County
7) Eastern Standard Time - Indiana - Starke County
8) Eastern Standard Time - Indiana - Switzerland County
9) Central Time
10) Central Time - Michigan - Wisconsin border
11) Central Time - North Dakota - Oliver County
12) Mountain Time
13) Mountain Time - south Idaho & east Oregon
14) Mountain Time - Navajo
15) Mountain Standard Time - Arizona
16) Pacific Time
17) Alaska Time
```

```
18) Alaska Time - Alaska panhandle
19) Alaska Time - Alaska panhandle neck
20) Alaska Time - west Alaska
21) Aleutian Islands
22) Hawaii
#? 16
The following information has been given:
United States
Pacific Time
Therefore TZ='America/Los_Angeles' will be used.
Is the above information OK?
1) Yes
2) No
#? 1
Local time is now:    Mon Sep 24 05:05:38 PDT 2007.
Universal Time is now: Mon Sep 24 12:05:38 UTC 2007.
No NTP servers configured.
Would you like to manually adjust the system time (y,n)? n
Configuring the system. Please wait...
Changing owners and file permissions.
Change owners and permissions complete.
INIT: Switching to runlevel: 4
INIT: Sending processes the TERM signal
STARTED: cli_server.sh
STARTED: ntp_startup.sh
STARTED: LDAP_startup.sh
STARTED: dwnldr_startup.sh
STARTED: HTTP_startup.sh
STARTED: probe
STARTED: superthread_startup.sh
STARTED: /bin/products/wpo/wanopt_startup.sh
```

How to Configure, Operate, and Administer the Network Capacity Expansion Service Module

This section contains the following procedure:

- Shutting Down and Starting Up the Network Capacity Expansion Service Module, page 2-10

Note
- The tables in these sections show only common router and module commands.

- To view a complete list of command keyword options, type **?** at the end of the command (Example: `Router# service-module Transport-Opt-Service-Engine ?`).

- The tables group commands by the configuration mode in which they are available. If the same command is available in more than one mode, it may act differently in each mode.

Shutting Down and Starting Up the Network Capacity Expansion Service Module

To shut down or start up the service module, use common router and module commands that are listed in Table 1 as needed.

Note Some shutdown commands can potentially disrupt service. If command output for such a command shows a confirmation prompt, confirm by pressing **Enter** or cancel by typing **n** and pressing **Enter**.

Table 1   Common Shutdown and Startup Commands

Configuration Mode	Command	Purpose
Router#	**service-module Transport-Opt-Service-Engine** *slot/port* **reload**	Shuts down the module operating system gracefully and then restarts it from the bootloader.
Router#	**service-module Transport-Opt-Service-Engine** *slot/port* **reset**	Resets the hardware on a module. Use only to recover from shutdown or a failed state. ⚠ **Caution** Use this command with caution. It does *not* provide an orderly software shutdown and consequently may impact file operations that are in progress.
Router#	**service-module Transport-Opt-Service-Engine** *slot/port* **session**	Accesses the specified service engine and begins a module configuration session.
Router#	**service-module Transport-Opt-Service-Engine** *slot/port* **shutdown**	Shuts down the module operating system gracefully. Use when removing or replacing a hot-swappable module during online insertion and removal (OIR).
Router#	**service-module Transport-Opt-Service-Engine** *slot/port* **status**	Shows configuration and status information for the module hardware and software.
SE-Module>	**reload**	Shuts down the NCE Service Module gracefully and reboots it from the bootloader.
SE-Module>	**shutdown**	Shuts down the NCE Service Module application gracefully and shuts down the module.

Configuring the Cisco IOS WAN Interface

Contents

Configuring the Transport-opt Service Engine on a WAN Interface

In a point-to-point WAN interface configuration, the Network Capacity Expansion identifier (tpo ID) that is specified on the CLI is used for all destination hardware.

In a multipoint WAN interface configuration, the **bind** command on Network Capacity Expansion Service Module determines which tpo ID is used for a given destination network.

There are two ways of redirecting TCP packets to the NCE application:

1. Inline interception - recommended at the branch office.

2. WCCP-based redirection - Configuring TCP Redirection Using WCCP, page 6-1.

	Command or Action	Purpose
	From the Host-Router CLI	

Step 1	`enable`
	
	Example:
	`Router> enable`
		Enters privileged EXEC mode on the host router. Enter your password if prompted.

Step 2	`configure terminal`
	
	Example:
	`Router# configure terminal`
		Enters global configuration mode on the host router.

	Command or Action	Purpose
Step 3	**Interface serial** *slot / module / port* **Example:** Router(config)# Int serial 0/0/0	Enters the serial interface mode (WAN interface) Serial, ATM, Frame-relay, GE/FE WAN interfaces, and GRE-tunnel interfaces are supported.
Step 4	**Transport-opt** *transport-opt id / multipoint* **interface transport-opt-Service-Engine** *slot/port* **Example:** Router(config-if)# Transport-opt {transport-opt id / multipoint} interface transport-opt-Service-Engine 4/0	Configures TCP redirection on the WAN interface. Traffic is redirected to the service module and is optimized and sent out on the WAN interface. The multipoint keyword is currently supported only on GE/FE interfaces. When the multipoint keyword is selected, the tpo ID is not required to be configured in the Cisco IOS command.

Example:
```
interface GigabitEthernet0/3/0
ip address 10.10.10.11 255.255.0.0
load-interval 30
negotiation auto
transport-opt 1 interface Transport-Opt-Service-Engine4/0
end
```

To verify that redirection is occurring on the WAN interface, check that there are adjacencies created for the main NCE Service Module interface and for every tpo ID defined on the WAN interface.

```
CA-3845-1#show adjacency detail | begin Transport
IP Transport-Opt-Service-Eng 1.3.202.26(6)
69255907 packets, 90732988194 bytes
epoch 0
sourced in sev-epoch 0
Encap length 14
00DEAD1075010016C82071FF0800
ARP
IP Transport-Opt-Service-Eng 1.3.202.26(4)
connectionid 1 ← for each transport-opt id
81183499 packets, 7603329060 bytes
epoch 0
sourced in sev-epoch 2
Encap length 14
00DEAD1075010016C82071010800
Wan Optimization
CA-3845-1#
```
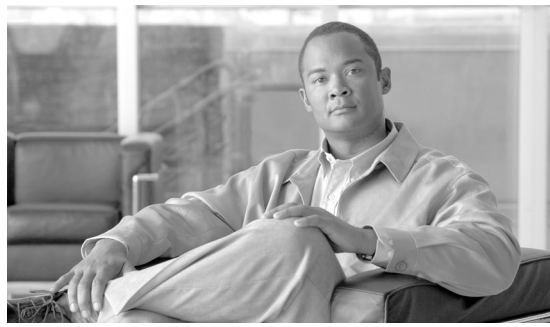
Configuring NCE for Point-to-Point Interfaces

Contents

Configuring Point-to-Point Interfaces

The tpo ID configuration forms an SCTP peering between two peers to transport optimized TCP traffic over the WAN link.

The following are important points to remember when configuring the tpo ID:

- The tpo ID configuration is done in the configuration mode.

- A tpo ID is configured with an integer from 1 to 64.

- Different NCE service modules have different platform capabilities. Use the **show tpo module-capacity** command to see the maximum number of peers supported for a specific module.

- Only one SCTP peer IP address can be configured within a tpo ID.

- A tpo ID has "default policy action compress-sctp" configured if no service policy is associated with the tpo ID.

- Only one service policy can be configured within a tpo ID, to associate a policy map with the tpo ID.

- The same SCTP-peer IP address cannot be configured within different tpo IDs.

Example:

```
service-module(config)# tpo id 1
Configuring  TPO_config
service-module(config-tpo-id)# sctp-peer 12.2.2.2
service-module(config-tpo-id)# default policy action compress-sctp
service-module(config-tpo-id)#
```

Configuration Example

Use the following configuration examples when referring to routers A and B in Figure 4-1.

Router A

```
interface Transport-Opt-Service-Engine0/1
  ip unnumbered GigabitEthernet0/1
```

```
    service-module ip address 1.100.70.189 255.255.0.0
    service-module ip default-gateway 1.100.70.188
!
interface Serial0/0/0
    ip address 2.1.1.1 255.255.255.0
    transport-opt 3 interface Transport-Opt-Service-Engine0/1
```

Router B

```
interface Transport-Opt-Service-Engine0/1
    ip unnumbered GigabitEthernet0/1
    service-module ip address 10.1.1.102 255.255.255.0
    service-module ip default-gateway 10.1.1.101
!
interface Serial0/0/0
    ip address 2.1.1.2 255.255.255.0
    transport-opt 3 interface Transport-Opt-Service-Engine0/1
!
```

Figure 4-1   *Point-to-Point Configuration Example*
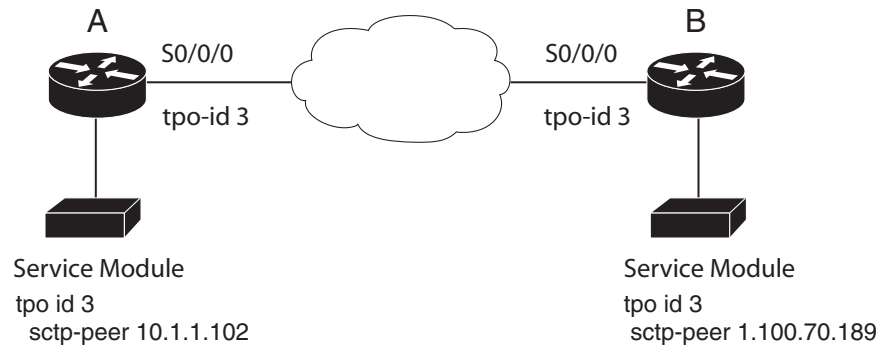
C H A P T E R 5

Configuring NCE for Multipoint Interfaces

Contents

- Configuring NCE for Multipoint Interfaces, page 5-1

Configuring NCE for Multipoint Interfaces

Use the following configuration examples when referring to routers A, B, and C in Figure 5-1.

Router A

```
interface Transport-Opt-Service-Engine 0/1
 ip unnumbered g0/1
 service-module ip address 10.1.1.102 255.255.255.0
 service-module ip default-gateway 10.1.1.101
!
interface GigabitEthernet 0/0/1
 ip address 2.1.1.1 255.255.255.0
 transport-opt multipoint interface Transport-Opt-Service-Engine 0/1
!
interface GE 0/1
 ip address 10.1.1.101 255.255.255.0
```

Router B

```
interface Transport-Opt-Service-Engine 0/1
 ip unnumbered GigabitEthernet 0/1
 service-module ip address 10.10.10.1 255.255.255.0
 service-module ip default-gateway 10.10.10.2
!
interface GigabitEthernet 0/0/1
 ip address 2.1.1.3 255.255.255.0
 transport-opt 5 interface Transport-Opt-Service-Engine 0/1
!
interface GE 0/1
 ip address 10.10.10.2 255.255.255.0
```

Router C

```
interface Transport-Opt-Service-Engine 0/1
 ip unnumbered GigabitEthernet 0/1
 service-module ip address 11.11.11.1 255.255.255.0
 service-module ip default-gateway 11.11.11.2
```
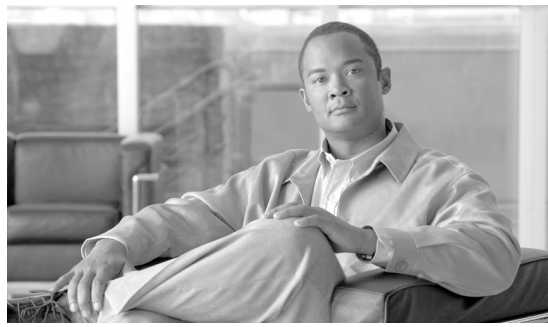
```
!
interface GigabitEthernet 0/0/1
 ip address 2.1.1.2 255.255.255.0
 transport-opt 5 interface Transport-Opt-Service-Engine 0/1
!
interface GE 0/1
 ip address 11.11.11.2 255.255.255.0
```

Figure 5-1   Multipoint Configuration Example
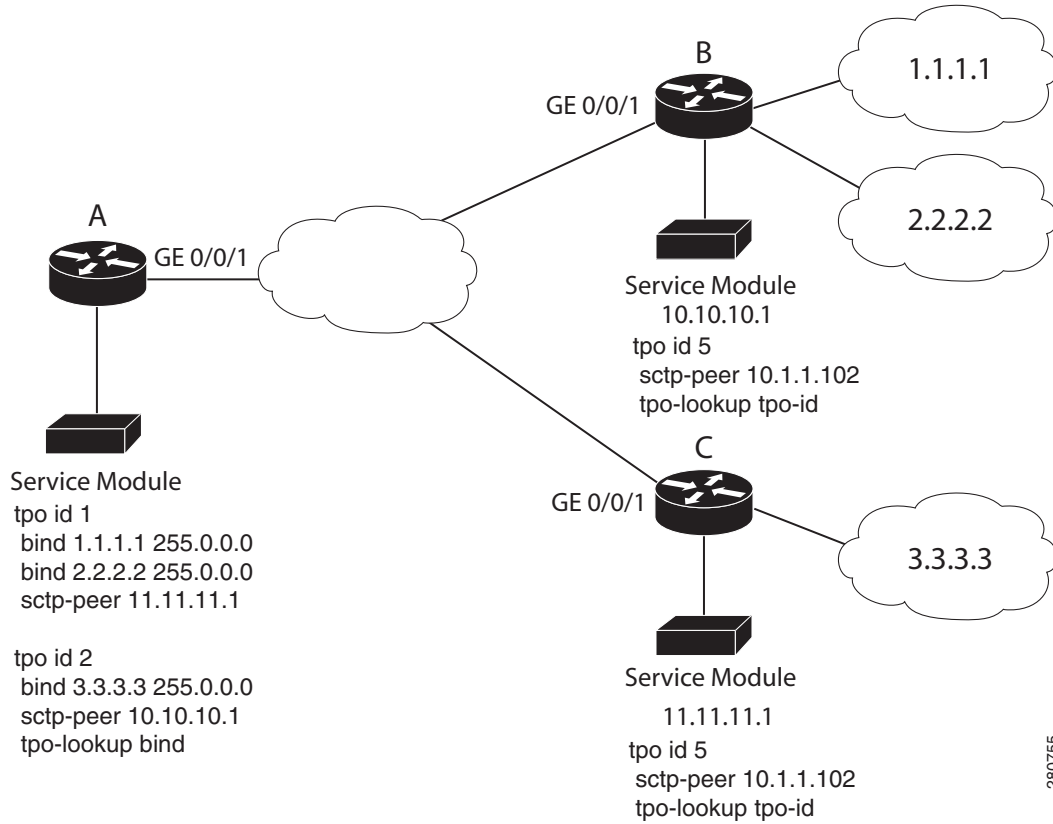
Configuring TCP Redirection Using WCCP

Contents

WCCP on Data Centers

This section contains the following:

Note Only WCCP version 2 is supported.

Web Cache Communication Protocol (WCCP) provides a mechanism to redirect traffic flows in real-time. It involves the transparent interception and redirection of traffic to one or more web caches by a router or switch to the end points of the traffic flow.

WCCP provides transparent interception and redirection of TCP traffic between the WCCP router and NCE modules. Multiple routers and NCE modules can be part of a WCCP service group. The NCE module supports TCP promiscuous service (61) to intercept the TCP traffic going through the head end router. A single NCE module within a service group is selected as the designated NCE module. It is the responsibility of the designated NCE module to provide WCCP routers with the data which determines how redirected traffic is distributed among the NCE modules in the service group.

WCCP also provides a mechanism for high availability (fail safe) and load balancing features. It has built-in load balancing, scaling, fault tolerance, and service-assurance (fail-safe) mechanisms.

High Availability

High availability is fail-safe recovery when the active ISR or NCE module fails. When the primary ISR/NCE fails, thebackup ISR/NCE continues to optimize traffic between the branch and data center locations.

WCCP version 2.0 must be enabled at the head end side to support high availability.

Multiple NCE modules are configured at the data center, forming a WCCP service group. All these modules are configured with WCCP to redirect TCP traffic from the WCCP router to the NCE modules.

The NCE module with the lowest IP address works as the designated module within the service group. The router periodically reports all NCE modules seen into a service group. Whenever there is any change in service group membership, such as the WCCP router or module comes up or goes down, the designated NCE module election process occurs again, if required.

> **Note**   Whenever there is a change in the redirection table, existing connections on the module see a reset. The router starts redirecting the TCP packets based on the new hash for all new incoming connections.

Figure 6-1 shows a typical topology for WCCP on data centers.

Figure 6-1   **WCCP on Data Centers**
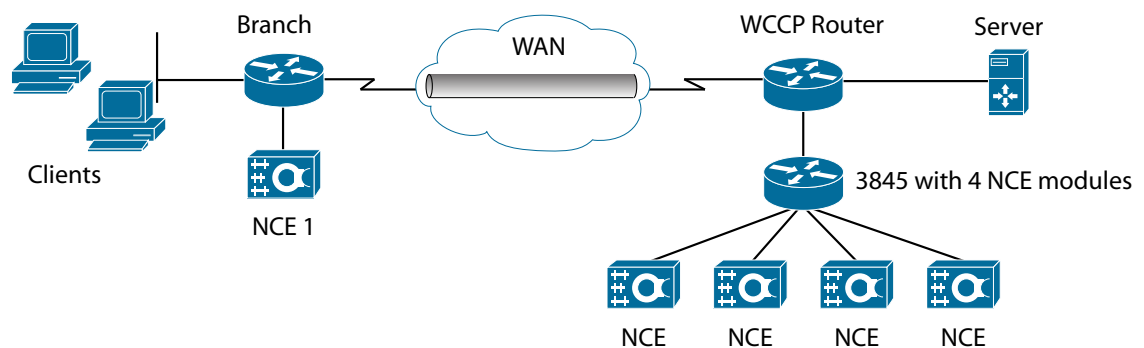
Configuring WCCP

This section contains the following procedures:

Enabling WCCP on an NCE Module

```
NCE-HQ(config)# [no] tpo wccp 61 ?
  <cr>
61 – TCP Promiscuous mode, to intercept TCP traffic
```

Note   When you enable WCCP on NCE, configure TPO lookup as bind using the **tpo lookup bind** command on the NCE module. Add branch networks under the respective tpo ID using the **bind** command.

Configuring WCCP Routers on NCE Modules

Up to 32 WCCP routers can be configured in a service group.

The **no** form of this command deletes the IP addresses specified from the existing list.

```
NCE-HQ(config)# tpo wccp router-list ?
  A.B.C.D      Router's IP Address
NCE-HQ(config)# tpo wccp router-list <wccp-router1-ip> <wccp-router2-ip>
<wccp-router32-ip>
```

Verifying WCCP Service Status on NCE

To verify WCCP status, use the **show tpo wccp status** command.

```
NCE-HQ> show tpo wccp status
 WCCP Service ID: 61, Version: 2.0
 *****************************************
 Router IP: 90.0.0.1, Status: ACTIVE, Recv-ID: 6320, ID: 90.0.0.1
 NCE Status: ACTIVE, Service Flags: 0x1
 Redirection: GRE, Packet Return: GRE, Assignment: HASH
 NCE Modules in this service group: 1.3.252.111
 *****************************************
```

Field	Description
WCCP Service ID	61, NCE supports WCCP service 61(TCP promiscuous Mode).
Router IP	IP address of the WCCP router configured on the NCE module.

Field	Description
NCE Status	Shows NCE status. If the NCE is successfully registered with WCCP router, it is Active, otherwise it is Inactive.
Redirection	GRE or L2 Redirection. Default is GRE.
Assignment	Mask or Hash. Default is Hash.
NCE Modules in the same WCCP group	The NCE module IP address which is registered with the same WCCP group.

Show TPO WCCP Statistics

Use the **show tpo wccp statistics** command to check WCCP traffic statistics.

```
NCE-HQ> show tpo wccp statistics
    WCCP Statistics:
     Transparent GRE packets received: 5346715
     Transparent non-WCCP packets received: 0
     Transparent non-TCP packets received: 0
     Total packets accepted: 5346715
     Invalid packets received: 0
     Packets received with invalid service: 0
     Packets received on a disabled service: 0
     Packets dropped due to zero TTL: 0
     Packets sent back to router: 0
     GRE fragments redirected: 0
     Packets dropped due to invalid fwd method: 0
     Packets w/WCCP GRE received too small: 0
     Packets dropped due to received on loopback: 0
     Packets fragmented for bypass: 0
     Packet pullups needed: 0
     Packets dropped due to no route found: 0
     NCE-HQ>
```

The *packets received* and *packets accepted* counters show the number of packets redirected to this NCE module from the Cisco IOS WAN interface and accepted by the module. *Packets sent back to router* is the total number of packets bypassed and not optimized.

Configuring WCCP Group on Branch NCE

Use the **tpo wccp group-id** *id bind/map-tpo-id* command to configure a WCCP group ID.

A WCCP group ID is a collection of multiple or single tpo IDs that redirect the packets to the multiple modules on the data center router, which is based on the redirection table transmitted from the data center service-modules.

WCCP BRANCH Point-To-Point Configuration (map-tpo-id)

With the **tpo wccp group-id** *id map-tpo-id* command, mapping is based on the tpo ID configured in the Cisco IOS.

Use the map argument when WCCP is enabled at the data center with a single NCE module, and the branch NCE is connecting with a single peer over the same WAN link.

WCCP BRANCH Point-To-Multipoint Configuration

Use the **tpo wccp group-id** *id bind ip-address mask* command to configures a WCCP group ID, which includes the destination network configured as part of bind to be routed, based on the WCCP redirection table. This command is recommended when the branch NCE is connecting with multiple peers at the data center over the same WAN link. WCCP must be enabled at the data center.

![Note icon]

Note   The WCCP group ID number has to be different than tpo ID number and unique. Use the WCCP group ID number as the tpo ID number when configuring the interception in the Cisco IOS configurations.

```
NCE-BRANCH(config)> tpo wccp group-id  <id>  ?
  bind            Based on Binding
  map-tpo-id      Based on Transport-opt TPO ID configured on IOS
NCE-BRANCH(config)> tpo wccp group-id <id> bind ?
  A.B.C.D     Destination Network IP address
NCE-BRANCH(config)> tpo wccp group-id <id> bind <ip address> <subnet mask>
```

Configuring a WCCP Group on a Branch NCE Module

Use the group ID map-tpo ID command where the WCCP group has been mapped to the tpo ID configured for Intercept on the IOS WAN Interface using the **transport-opt** *tpo-id* **interface transport** *slot/port* command. This group ID is then attached to a configured tpo ID. This command works when WCCP is enabled on the Data Center module with a single NCE module configured in a WCCP service group.

All of the intercept traffic from the configured WAN interface is optimized regardless of the destination network address.

```
NCE-BRANCH(config)> tpo wccp group-id  <id>  ?
  bind            Based on Binding
  map-tpo-id      Based on Transport-opt TPO ID configured on IOS

NCE-BRANCH(config)> tpo wccp group-id 1 map-tpo-id ?
  <cr>
NCE-BRANCH(config)> tpo wccp group-id 1 map-tpo-id
        <cr>


CLI - "Sh tpo ID"
 NCE> sh tpo id 60
  ================================================================
  TPO-ID: 60, SCTP Peer: 1.3.252.210, Peer Relationship: Acceptor
   Capability Exchange: Compatible, Negotiated Version: 2.0
   Default Policy-action: compress-sctp, Service Policy: <not configured>
   Bandwidth Profile: default-sctp,  TCP Connections: 0/10240 (active/max)
   10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
   10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
     sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
      tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
     ──────────────────────────────────────────────────────────
    TOS: 0, DSCP: 0, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 1, DSCP: 8, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 2, DSCP: 16, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 3, DSCP: 26, TCP Connections: 0
```

```
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 4, DSCP: 32, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 5, DSCP: 46, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 6, DSCP: 48, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
    TOS: 7, DSCP: 56, TCP Connections: 0
      Status: UP, DOWN -> UP at Thu Jan 22 13:11:27 2009
  ================================================================
NCE>
```

Configuring Load Balancing Using WCCP on Data Centers

Contents

- Load Balancing with WCCP on Data Centers, page 7-1

Load Balancing with WCCP on Data Centers

To load balance traffic across multiple NCE modules, assignment methods are defined in each service group. WCCP v2.0 protocol allows either hash or mask as the assignment method.

The designated NCE module provides the redirection table to the WCCP router based on the load balance configuration. The designated NCE module also passes the redirection table to all the available branches to transport TCP traffic to the correct SCTP tunnel.

Note Whenever there is a change in the redirection table, the existing connections may be reset. The WCCP router starts redirecting the TCP packets based on the updated redirection table.

Masking must be explicitly specified. You can specify up to four mask values based on the source or destination IP address of the packet. The mask value is specified using a maximum of seven bits.

Note The masking method can only be used for load balancing with the Catalyst 6500 /3750 series switches and Cisco 7600 series routers. Cisco recommends L2 masking on switches and GRE/hash on routers.

The following example shows how load balancing is configured on the data center service module:

```
CA-2821-1(config)> tpo wccp load-balance ?
  hash        Hash Parameters
  mask        Mask Parameters
CA-2821-1(config)> tpo wccp load-balance hash ?
  dst-ip      Destination ip address
  src-ip      Source ip address
CA-2821-1(config)> tpo wccp load-balance hash dst-ip ?
  <cr>
  src-ip      Source ip address
CA-2821-1(config)> tpo wccp load-balance hash dst-ip src-ip ?
  <cr>
CA-2821-1(config)> tpo wccp load-balance hash dst-ip src-ip
```

7-2

```
CA-2821-1(config)> tpo wccp load-balance mask src-ip-mask ?
  Hexadecimal  Mask in Hexadecimal number (0x0 - 0xFE000000)
CA-2821-1(config)> tpo wccp load-balance mask src-ip-mask 0xFE000000 ?
  <cr>
  dst-ip-mask  Specify sub-mask used in packet destination-IP address
CA-2821-1(config)> $ask src-ip-mask 0xFE000000 dst-ip-mask 0xFE000000
```

Configuring NAT for NCE

Contents

- Configuring Network Address Translation (NAT) with NCE, page 8-1
- Configuring NAT for NCE with Public IP Addresses, page 8-3

Configuring Network Address Translation (NAT) with NCE

The goal of NAT is to provide functionality as if the private network had globally unique addresses and the NAT device was not present. RFC 1631 represents a subset of Cisco IOS NAT functionality. Several internal addresses can be translated to only one or a few external addresses by using a feature called Port Address Translation (PAT), also referred to as *overload*, a subset of NAT functionality.

The following sample configuration uses these IP addresses:

- Public IP: 10.x.x.x
- Transport-local IP address 7.x.x.x
- Lan (local Client IP): 11.x.x.x

Figure 8-1   Topology for NAT with NCE
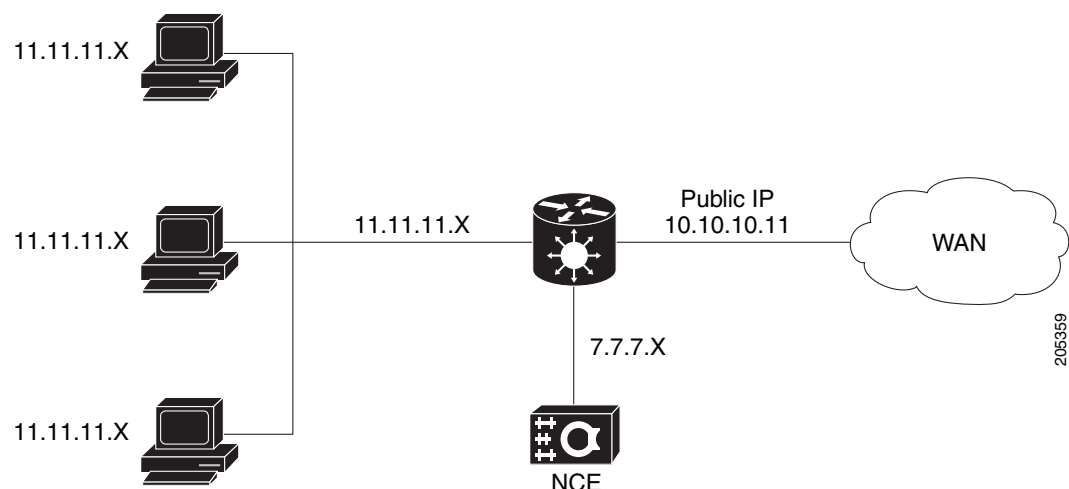
Configure the Cisco IOS

Note   The NCE module is configured in the private domain.

Configure NAT on the Cisco IOS side as follows:

Step 1   Configure the transport-opt interface and Cisco IOS WAN as the NAT outside interface; configure the LAN interface as the inside interface.

```
interface Serial0/2/0
 ip address 10.10.10.11 255.255.0.0  (public side ip address)
 ip nat outside
 ip virtual-reassembly
 load-interval 30
 clock rate 8000000
 transport-opt 3 interface Transport-Opt-Service-Engine4/0
!

interface Transport-Opt-Service-Engine4/0  (configured as an outside interface)
 ip address 7.7.7.7 255.255.0.0
 ip nat outside
 ip virtual-reassembly
 load-interval 30
 service-module ip address 7.7.7.8 255.255.0.0
 service-module ip default-gateway 7.7.7.7
 hold-queue 60 out

interface GigabitEthernet0/0  ( Inside LAN interface)
 no ip address
 ip virtual-reassembly
 load-interval 30
 duplex auto
 speed auto
 media-type rj45
!
interface GigabitEthernet0/0.1
 encapsulation dot1Q 2
 ip address 11.11.11.11 255.255.0.0
 ip nat inside
 ip virtual-reassembly
```

Step 2   Configures a static NAT entry mapping the transport-opt service module IP address to the public IP address.

```
ip nat pool test 10.10.10.11 10.10.10.11 prefix-length 24
ip nat inside source list 100 pool test overload
ip nat inside source static 7.7.7.8 10.10.10.11
```

Step 3   Capture all the TCP traffic using an access-list on the input LAN interface and change the src-ip to the public IP address.

```
access-list 100 permit ip 11.11.11.0 0.0.0.255 any
```

Step 4   Allow ICMP traffic in the access-list configured for NAT.

```
access-list 100 permit icmp any any
```

Configure NCE

Configure NAT on the NCE service module as follows:

Step 1   Configure **NAT inside src** as the global address for all the networks that needs to be reached from the service module.

This example shows the server network and other side TPO network.

```
tpo id 3
 bandwidth 7900 7500
 default policy-action  compress-sctp
 sctp-peer 14.14.14.15
 exit

tpo ip nat inside source 10.10.10.11 14.14.14.0 255.255.255.0
```

Step 2   After configuring the client side, login into the server side module. The remote end SCTP peer IP now needs to be mapped to the NAT Global IP address on the client end.

The remote side configuration should look like this:

```
tpo id 3
 bandwidth 7900 7500
 default policy-action  optimize
 sctp-peer 10.10.10.11
```

In the following output, protocol 132 are SCTP packets. Others are TCP packets captured at the LAN side and the address is changed to a global address.

```
CA-3845-1#sh ip nat translations
Pro Inside global     Inside local      Outside local      Outside global
132 10.10.10.11:0     7.7.7.8:0         1.3.202.97:0       1.3.202.97:0
132 10.10.10.11:0     7.7.7.8:0         14.14.14.15:0      14.14.14.15:0
--- 10.10.10.11       7.7.7.8           ---                ---
tcp 10.10.10.11:35286 11.11.11.12:35286 9.9.9.10:143       9.9.9.10:143
tcp 10.10.10.11:35797 11.11.11.12:35797 9.9.9.10:143       9.9.9.10:143
tcp 10.10.10.11:35808 11.11.11.12:35808 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:35846 11.11.11.12:35846 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:35866 11.11.11.12:35866 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:35936 11.11.11.12:35936 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:35984 11.11.11.12:35984 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:35985 11.11.11.12:35985 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:36014 11.11.11.12:36014 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:36027 11.11.11.12:36027 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:36049 11.11.11.12:36049 9.9.9.10:110       9.9.9.10:110
tcp 10.10.10.11:36050 11.11.11.12:36050 9.9.9.10:110       9.9.9.10:110
```

Configuring NAT for NCE with Public IP Addresses

This section describes how to configure NAT with NCE when NCE is also configured with public IP addresses.

Note When the NCE module is configured with public address, no NAT-specific configuration is required on the service module.

```
crypto isakmp policy 5
 authentication pre-share
crypto isakmp key 6 cisco address 10.10.10.10 no-xauth
!
!
!
crypto map TPO-TEST 5 ipsec-isakmp
 set peer 10.10.10.10
 match address 100
!

interface GigabitEthernet0/0
 ip address 11.11.11.11 255.255.0.0
 ip nat inside
 duplex auto
 speed auto

interface GigabitEthernet0/1/0
 ip address 10.10.10.11 255.255.0.0
 ip nat outside
 ip virtual-reassembly
 load-interval 30
 negotiation auto
 transport-opt 10 interface Transport-Opt-Service-Engine4/0
 crypto map TPO-TEST

interface Transport-Opt-Service-Engine4/0
 ip address 10.10.10.12 255.255.0.0
 ip nat outside
 ip virtual-reassembly
 load-interval 30
 service-module ip address 10.10.10.13 255.255.0.0
 service-module ip default-gateway 10.10.10.12
 hold-queue 60 out

ip route 0.0.0.0 0.0.0.0 10.10.10.10
ip route 10.10.10.13 255.255.255.255 Transport-Opt-Service-Engine4/0


ip nat pool test 10.10.10.11 10.10.10.11 prefix-length 24
ip nat inside source list 100 pool test overload
!
access-list 100 permit ip 10.10.0.0 0.0.255.255 any
access-list 100 permit 132 any any
access-list 100 permit icmp any any
access-list 100 permit tcp any any
!
```

Sample Configuration

Figure 9-1shows the topology for the configuration examples in this section.

Figure 9-1   **WCCP Topology**
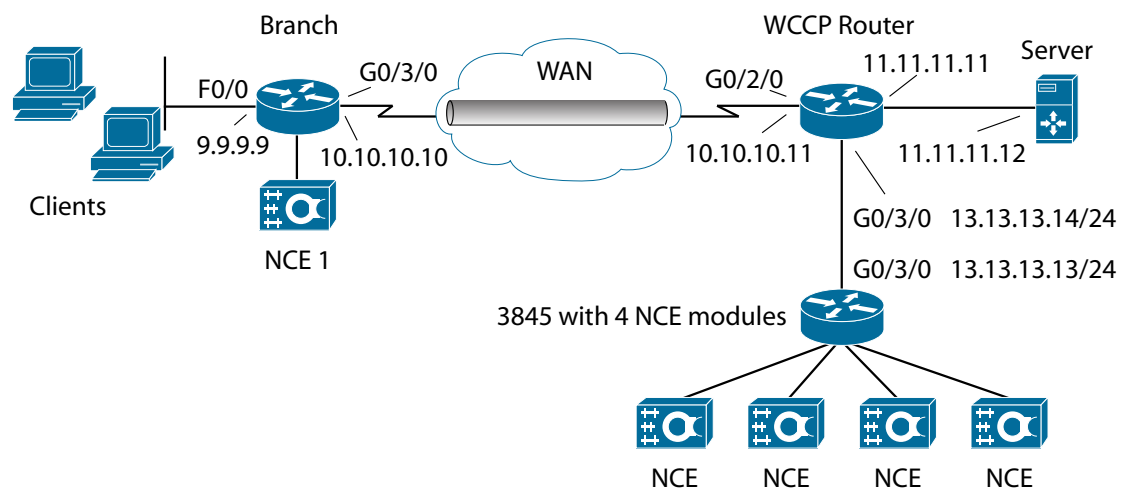
Other IP addresses

2811- SM IP address: 7.7.7.8   Transport opt IP address: 7.7.7.7

3845 - SM1 IP address 14.14.14.15   Transport opt IP address 14.14.14.14

3845 - SM2 IP address 16.16.16.17   Transport opt IP address 16.16.16.16

Sample Configurations for Hash-based Load Balancing

Branch-side Configuration

NCE Module Configuration

```
tpo wccp group-id 3 bind map-tpo-id

tpo id 4
 default policy-action  compress-sctp
 bandwidth-profile default-sctp
 wccp group-id 3
 sctp-peer 14.14.14.15 tos 0
 exit
tpo id 6
 bandwidth 3000 2000
 default policy-action  compress-sctp
 bandwidth-profile rate-control
 wccp group-id 3
 sctp-peer 16.16.16.17 tos 0
 sctp-peer 16.16.16.17 tos 1
 sctp-peer 16.16.16.17 tos 2
 sctp-peer 16.16.16.17 tos 3
 sctp-peer 16.16.16.17 tos 4
 sctp-peer 16.16.16.17 tos 5
 sctp-peer 16.16.16.17 tos 6
 sctp-peer 16.16.16.17 tos 7
 exit

tpo lookup tpo-id
```

Cisco IOS Configuration

Note TPO ID in Cisco IOS should be same as the WCCP group ID in the NCE configuration.

```
interface Tunnel0
 ip address 100.100.100.100 255.255.0.0
 transport-opt 3 interface Transport-Opt-Service-Engine4/0
 tunnel source GigabitEthernet0/1/0
 tunnel destination 10.10.10.10
```

Data Center Configuration

The following example shows the Cisco IOS configuration on the NCE router with two NCE service modules.

```
interface GigabitEthernet0/2/0
 ip address 13.13.13.14 255.255.0.0

interface Transport-Opt-Service-Engine0/1
 ip address 14.14.14.14 255.255.0.0
 load-interval 30
 service-module ip address 14.14.14.15 255.255.0.0
 service-module ip default-gateway 14.14.14.14
 hold-queue 60 out
end


interface Transport-Opt-Service-Engine1/0
 ip address 16.16.16.16 255.255.0.0
```

```
 load-interval 30
 service-module ip address 16.16.16.17 255.255.0.0
 service-module ip default-gateway 16.16.16.16
 hold-queue 60 out

ip route 0.0.0.0 0.0.0.0 13.13.13.13

ip route 14.14.14.15 255.255.255.255 Transport-Opt-Service-Engine0/1
ip route 16.16.16.17 255.255.255.255 Transport-Opt-Service-Engine1/0
```

NCE Configurations on Modules 1 and 2

Configuration is the same for both modules.

```
tpo wccp 61

tpo wccp load-balance hash src-ip dst-ip

tpo wccp router-list 13.13.13.13

tpo id 1
 default policy-action  compress-sctp
 bandwidth-profile high-speed-sctp
 bind 0.0.0.0 0.0.0.0
 sctp-peer 7.7.7.8 tos 0
 sctp-peer 7.7.7.8 tos 1
 sctp-peer 7.7.7.8 tos 2
 sctp-peer 7.7.7.8 tos 3
 sctp-peer 7.7.7.8 tos 4
 sctp-peer 7.7.7.8 tos 5
 sctp-peer 7.7.7.8 tos 6
 sctp-peer 7.7.7.8 tos 7
 exit

tpo lookup bind
```

WCCP Router

```
ip wccp 61

interface Tunnel0
 ip address 100.100.100.101 255.255.0.0
ip wccp 61 redirect out     //To redirect packets on WAN to NCE modules.
 tunnel source GigabitEthernet0/3/0
 tunnel destination 10.10.10.11
 crypto map MAP

interface GigabitEthernet0/1/0
 description CONNECTED TO Data Center Module Router
 ip address 13.13.13.13 255.255.0.0
 load-interval 30
 negotiation auto


ip route 0.0.0.0 0.0.0.0 Tunnel0

ip route 14.14.14.0 255.255.255.0 13.13.13.14
ip route 16.16.16.0 255.255.255.0 13.13.13.14
```

Configuration for Mask-based Load Balancing

Branch router configurations are similar to hash-based configurations.

For the Data Center router housing the NCE service modules, you must configure the concurrent routing and bridging (CRB) in Cisco IOS.

```
bridge crb
!
interface GigabitEthernet0/0
 ip address 13.13.13.14 255.255.0.0
 duplex auto
 speed auto
 bridge-group 1
!
!
interface Transport-Opt-Service-Engine1/0
 ip unnumbered GigabitEthernet0/0
 service-module ip address 13.13.13.15 255.255.0.0
 service-module ip default-gateway 13.13.13.14
 bridge-group 1
 hold-queue 60 out
!
interface Transport-Opt-Service-Engine0/0
 ip unnumbered GigabitEthernet0/0
 service-module ip address 13.13.13.16 255.255.0.0
 service-module ip default-gateway 13.13.13.14
 bridge-group 1
 hold-queue 60 out


ip route 0.0.0.0 0.0.0.0 50.50.50.50
ip route 13.13.13.15 255.255.255.255 Transport-Opt-Service-Engine1/0
ip route 13.13.13.16 255.255.255.255 Transport-Opt-Service-Engine0/0

bridge 1 protocol ieee
```

NCE Configuration on the Head-end Module

Configuration is the same on both modules in the router.

```
tpo wccp 61

tpo wccp load-balance mask src-ip-mask 0x0 dst-ip-mask 0x1741 src-port-mask 0x0
dst-port-mask 0x0

tpo wccp router-list 13.13.13.13

tpo id 1
 default policy-action  compress-sctp
 bandwidth-profile high-speed-sctp
 bind 0.0.0.0 0.0.0.0
 sctp-peer 7.7.7.8 tos 0
 sctp-peer 7.7.7.8 tos 1
 sctp-peer 7.7.7.8 tos 2
 sctp-peer 7.7.7.8 tos 3
 sctp-peer 7.7.7.8 tos 4
```

```
sctp-peer 7.7.7.8 tos 5
sctp-peer 7.7.7.8 tos 6
sctp-peer 7.7.7.8 tos 7
exit

tpo lookup bind
```

How to Maintain and Troubleshoot the Network Capacity Expansion Service Module

Contents

NCE service module uses the module's CLI, which you access through the host-router console. The module CLI is similar but not identical to the router CLI:

- Similarities—Standard Cisco IOS navigation and command-completion conventions apply (for example, entering **?** lists options, pressing the **TAB** key completes a command, and entering a pipe [|] directs **show** command output).
- Differences—Standard command names and options do *not* necessarily apply. A notable example is the command for accessing global configuration mode: the Cisco IOS command is **configure terminal**; the module command is **configure terminal**.

The NCE service module uses a last-one-wins rule. For example, if George and Frank both try to set the IP address for the same entity at the same time, the system starts and completes one operation before it starts the next. The last IP address set is the final result.

The NCE service module uses a data-preservation rule in the event of software or hardware failure. During subsequent bootstrap, each user is prompted to examine data that was preserved from the previous boot and to resolve inconsistencies with data from other users. Repair operations reconstruct missing data wherever feasible and notify you when reconstruction is impossible.

Restoring NCE Software

If NCE software fails to bootup, use the following procedure to restore the module to factory settings.

> **Note** If you are upgrading or downgrading an existing system, do not use this procedure. Instead, use the procedure in the "Software Upgrade or Downgrade" section on page 2-6.

Prerequisites

Have available the IP address of your TFTP and FTP file servers and download the required software from the Cisco Software Center website.

SUMMARY STEPS

From the Host-Router CLI

1. **service-module Transport-Opt-Service-Engine** *slot/port* **reset**

2. **service-module Transport-Opt-Service-Engine** *slot/port* **session**

From the Service-Module Interface

3. Enter *******

4. **config**

5. **show config**

6. **boot helper**

7. Follow boothelper instructions for installing software.

8. **Control+Shift+6 x**

From the Host-Router CLI

9. **service-module Transport-Opt-Service-Engine** *slot/port* **session clear**

DETAILED STEPS

Step 1 Download the NCE installation-package files (containing a kernel image, a boothelper image, and the NCE application software files, TPO Version 2.0.1 or later) as follows:

  a. Go to the NCE page of the Cisco Software Center website and locate the following files:

  NME-TPO

  – tpo-k9-full.aggr.2.0.1.prt1

  – tpo-k9-installer.aggr.2.0.1.prt1

  – tpo-k9.aggr.2.0.1.pkg

  – tpo-boothelper.aggr.2.0.1

  AIM-TPO-1/2

  – tpo-k9-full.aim.2.0.1.prt1

  – tpo-k9-installer.aim.2.0.1.prt1

  – tpo-k9.aim.2.0.1.pkg

  – tpo-boothelper.aim.2.0.1

> **Note**   Download the boothelper image to the TFTP server and the NCE module application software (pkg, prt1) to the FTP server.

Step 2 Reset the NCE module:

```
Router> enable
```

```
Router# service-module Transport-Opt-Service-Engine slot/port reset
```

Step 3 Open a session.

```
Router# service-module Transport-Opt-Service-Engine slot/port session
```

Step 4 As soon as you have completed Step 3, enter ******* to interrupt the automatic boot sequence and access the bootloader:

```
Router# ***
```

Step 5 Configure the bootloader to load and launch the boothelper:

```
SE-Module bootloader> config
```

Prompts for the following appear in the order listed. For each, enter a value or accept the previously stored input that appears inside square brackets by pressing **Enter**.

- Service-module IP address

- Subnet mask

- TFTP file-server IP address

- Gateway-router IP address (normally the IP address for the ISR)

- Default boothelper image filename

- Ethernet interface: internal

- Default boot option: USB (Table 10-1)

Table 10-1   Default Boot Options

Boot Option	Function	
	Loads This Software...	From This Location
helper	Boothelper image	TFTP file server
none	Starts the bootloader by default	—
usb	NCE image	USB flash memory

- Default bootloader file to be used on subsequent boot: primary or secondary.

> **Note** Make sure the TFTP and FTP servers are accessible from the bootloader prompt.
>
> Make sure that there is a route configured in the Cisco IOS to access the service module.

Example:
```
boot-loader > config

  IP Address [1.3.202.203] >
  Subnet Mask [255.255.0.0] >
  TFTP Server [1.3.202.250] >
  Gateway [1.3.202.100] >
  Default Helper-file [tpo-boothelper.aim.2.0.1] >
  Ethernet Interface [internal] [internal] >
  Default Boot [none|helper|usb] [helper] >
  Default Bootloader [primary|secondary] [primary] >
boot-loader >
```

Step 6   (Optional) Verify your bootloader configuration settings:

```
SE-Module bootloader> show config
IP Address: 1.3.202.26
Subnet Mask: 255.255.0.0
TFTP Server: 1.3.202.250
Gateway: 1.3.202.33
Default Helper-file: aesop_helper_cachaggr
Ethernet Interface: internal
Default Boot: usb
Default Bootloader: primary
Bootloader Version: 1.0.4
boot-loader >
```

Step 7   Start the boothelper:

```
SE-Module bootloader> boot helper
```

Step 8   Follow boothelper for installing software:

    a. Install the NCE software (choose option 1 and follow the instructions).

    b. Use the **pkg** file as the file name - the rest of the files are downloaded automatically.

    c. If the module does not automatically reboot after the software is installed, reload it (choose option 2).

Step 9   Close the session by pressing **Control+Shift+6 x**.

Step 10   From the host-router CLI, clear the session:

```
Router# service-module Transport-Opt-Service-Engine slot/port session clear
```

Image Recovery Using Boothelper

Boothelper Install Log

In the following example, requests for user input are shown in bold.

Note   Parts of the boothelper install log in this example have been removed to show only specific sections.

```
A-3845-1#
.
.
.
Removed
.
.
.
ServicesEngine boot-loader > boot helper
max_sdram_size = 0x40000000 = 1024 MEG
bl_boot_helper_cmd tftpboot 0x4000000 /tpo-boothelper.aim.2.0.1
Using octeth1 device
TFTP from server 1.3.202.250; our IP address is 1.3.202.26
Filename '/aesop_helper_cachnm+aim'.
Load address: 0x4000000
Loading: ##############################################################
```

```
###############################################################
###############################################################
.
.
.
Removed
.
.
.

done
Bytes transferred = 20926969 (13f51f9 hex)
argv[2]: rw
argv[3]: rdinit=/sbin/init
argv[4]: plat=cachnm
argv[5]: mem=1024M
ELF file is 64 bit
Allocated memory for ELF segment: addr: 0x1100000, size 0x1357110
Loading .text @ 0x81100000 (0x3903e8 bytes)
Loading __ex_table @ 0x814903f0 (0x7660 bytes)
Loading .rodata @ 0x81497a50 (0x4d5a8 bytes)
Loading .pci_fixup @ 0x814e4ff8 (0x600 bytes)
Loading __ksymtab @ 0x814e55f8 (0x86b0 bytes)
Loading __ksymtab_gpl @ 0x814edca8 (0x1530 bytes)
Loading __ksymtab_strings @ 0x814ef1d8 (0xc470 bytes)
Loading __param @ 0x814fb648 (0x14f0 bytes)
Loading .data @ 0x81500000 (0x73c00 bytes)
Loading .data.cacheline_aligned @ 0x81574000 (0x4a00 bytes)
Loading .init.text @ 0x81579000 (0x302f8 bytes)
Loading .init.data @ 0x815a92f8 (0x7068 bytes)
Loading .init.setup @ 0x815b0360 (0x588 bytes)
Loading .initcall.init @ 0x815b08e8 (0x420 bytes)
Loading .con_initcall.init @ 0x815b0d08 (0x10 bytes)
Loading .init.ramfs @ 0x815b1000 (0xe65d36 bytes)
.
.
.
Removed
.
.
.

Router communications servers initializing...complete.
rsrcmgr: module/platnm: cachnm
IOS IP Address Registration complete.
Kernel IP routing table
Destination Gateway Genmask Flags MSS Window irtt Iface
1.3.0.0 * 255.255.0.0 U 0 0 0 eth1
default 1.3.202.33 0.0.0.0 UG 0 0 0 eth1
RDBL: Module 8 Type 3 Loc 0 Offset 8
Size of buff is: 65536
65536 bytes written
Reading License... Valid License file not found: Using default values
done
Reading Limits...
Processing: /lib/python2.3/startup/limits.xml
done
INIT: Entering runlevel: 2
********** rc.post_install ****************
rsrcmgr: module/platnm: cachnm
Changing owners and file permissions.
Change owners and permissions complete.
INIT: Switching to runlevel: 4
INIT: Sending processes the TERM signal
```

```
STARTED: dwnldr_startup.show
Welcome to Cisco Systems Service Engine Helper Software
Please select from the following
1 Install software
2 Reload module
3 Disk cleanup
4 Linux shell
(Type '?' at any time for help)
Choice: q
Choice: 1
Package name: tpo-k9.aggr.2.0.1.pkg
Server url: ftp://1.3.202.250/pub/
Username:
Password:
Downloading ftp tpo-k9.aggr.2.0.1.pkg
Bytes downloaded : 61548
Validating package signature ... done
WARNING:: Software installation will clear disk contents
Continue [n]? y
cleaning fs
prepfs.sh: cachnm reiser /mnt clean
hd_name: /dev/sda
hd_part: /dev/sda1
umount: /dev/sda1: not mounted
check_partition_count: 1
Command (m for help): Selected partition 1
Command (m for help): Command action
.
.
.
Removed
.
.
.
System Now Booting ... test-base=0xbfc40000
Booting from flash...please wait.
Please enter '***' to change boot configuration:
0
ServicesEngine boot-loader Version : 1.0.3
boot-loader > boot usb
kernel size: 0x37863000
Decompressing image. 931540992 bytes from Address 0xbf580008 to adress 0x86400000 .....
...............................................................................................
...............................................................................................
...............................................................................................
...............................................................................................
.
.
.
Removed
.
.
.
Creating /dev/ciscofilter
254
INIT: Entering runlevel: 2
********** rc.post_install ****************
IMPORTANT::
IMPORTANT:: Welcome to Cisco Systems Service Engine
IMPORTANT:: post installation configuration tool.
IMPORTANT::
IMPORTANT:: This is a one time process which will guide
IMPORTANT:: you through initial setup of your Service Engine.
IMPORTANT:: Once run, this process will have configured
```

```
IMPORTANT:: the system for your location.
IMPORTANT::
IMPORTANT:: If you do not wish to continue, the system will be halted
IMPORTANT:: so it can be safely removed from the router.
IMPORTANT::
Do you wish to start configuration now (y,n)? y
Are you sure (y,n)? y
Enter Hostname
(my-hostname, or enter to use se-1-3-202-26): BRANCH
Enter Domain Name
(mydomain.com, or enter to use localdomain):
Using localdomain as default
IMPORTANT:: DNS Configuration:
IMPORTANT::
IMPORTANT:: This allows the entry of hostnames, for example foo.cisco.com, instead
IMPORTANT:: of IP addresses like 1.100.10.205 for application configuration. In order
IMPORTANT:: to set up DNS you must know the IP address of at least one of your
IMPORTANT:: DNS Servers.
Would you like to use DNS (y,n)?n
WARNING: If DNS is not used, IP addresses will be required.
Are you sure (y,n)? y
Enter IP Address of the Primary NTP Server
(IP address, or enter for 1.3.202.33):
**************************************************
I could not reach 1.3.202.33 using NTP.
1.3.202.33 might not have been configured as
NTP server.
**************************************************
Do you wish to continue with out Primary NTP server (y,n)? y
Enter IP Address of the Secondary NTP Server
(IP address, or enter to bypass):
Please identify a location so that time zone rules can be set correctly.
Please select a continent or ocean.
1) Africa 4) Arctic Ocean 7) Australia 10) Pacific Ocean
2) Americas 5) Asia 8) Europe
3) Antarctica 6) Atlantic Ocean 9) Indian Ocean
#? 2
Please select a country.
1) Anguilla 18) Ecuador 35) Paraguay
2) Antigua & Barbuda 19) El Salvador 36) Peru
3) Argentina 20) French Guiana 37) Puerto Rico
4) Aruba 21) Greenland 38) St Kitts & Nevis
5) Bahamas 22) Grenada 39) St Lucia
6) Barbados 23) Guadeloupe 40) St Pierre & Miquelon
7) Belize 24) Guatemala 41) St Vincent
8) Bolivia 25) Guyana 42) Suriname
9) Brazil 26) Haiti 43) Trinidad & Tobago
10) Canada 27) Honduras 44) Turks & Caicos Is
11) Cayman Islands 28) Jamaica 45) United States
12) Chile 29) Martinique 46) Uruguay
13) Colombia 30) Mexico 47) Venezuela
14) Costa Rica 31) Montserrat 48) Virgin Islands (UK)
15) Cuba 32) Netherlands Antilles 49) Virgin Islands (US)
16) Dominica 33) Nicaragua
17) Dominican Republic 34) Panama
#? 45
Please select one of the following time zone regions.
1) Eastern Time
2) Eastern Time - Michigan - most locations
3) Eastern Time - Kentucky - Louisville area
4) Eastern Time - Kentucky - Wayne County
5) Eastern Standard Time - Indiana - most locations
6) Eastern Standard Time - Indiana - Crawford County
7) Eastern Standard Time - Indiana - Starke County
```

```
8) Eastern Standard Time - Indiana - Switzerland County
9) Central Time
10) Central Time - Michigan - Wisconsin border
11) Central Time - North Dakota - Oliver County
12) Mountain Time
13) Mountain Time - south Idaho & east Oregon
14) Mountain Time - Navajo
15) Mountain Standard Time - Arizona
16) Pacific Time
17) Alaska Time
18) Alaska Time - Alaska panhandle
19) Alaska Time - Alaska panhandle neck
20) Alaska Time - west Alaska
21) Aleutian Islands
22) Hawaii
#? 16
The following information has been given:
United States
Pacific Time
Therefore TZ='America/Los_Angeles' will be used.
Is the above information OK?
1) Yes
2) No
#? 1
Local time is now: Mon Sep 24 05:05:38 PDT 2007.
Universal Time is now: Mon Sep 24 12:05:38 UTC 2007.
No NTP servers configured.
Would you like to manually adjust the system time (y,n)? n
Configuring the system. Please wait...
Changing owners and file permissions.
Change owners and permissions complete.
INIT: Switching to runlevel: 4
INIT: Sending processes the TERM signal
telnet>
STARTED: cli_server.sh
STARTED: ntp_startup.sh
STARTED: LDAP_startup.sh
STARTED: dwn1dr_startup.sh
STARTED: HTTP_startup.sh
STARTED: probe
STARTED: superthread_startup.sh
STARTED: /bin/products/wpo/wanopt_startup.sh
```

System-Level Troubleshooting

To verify the status of an installation, upgrade, or downgrade or to troubleshoot problems, use commands as needed from the following list of common router and module commands (Table 10-2).

Note   Among keyword options for many **show** commands is the provision to display diagnostic output on your screen or to pipe it to a file or a URL.

Table 10-2   Common Verification and Troubleshooting Commands

Command	Configuration Mode	Purpose
ping	`Router#` `SE-Module>`	Pings a specified IP address to check network connectivity (does not accept a hostname as destination).
show arp	`Router#` `SE-Module>`	Shows the current Address Resolution Protocol (ARP) table.
show clock	`Router#` `SE-Module>`	Shows the current date and time.
show controller transport-opt-Service-Engine slot/port	`Router#`	Shows interface debug information.
show diag	`Router#`	Shows standard Cisco IOS diagnostics information, including information about the NCE service module.
show hardware	`Router#`	Shows information about module and host-router hardware.
show hosts	`Router#`	Shows the default domain name, style of name lookup, list of name-server hosts, and cached list of hostnames and addresses
show interfaces	`Router#`	Shows information about the module interfaces.
	`SE-Module>`	Shows information about all hardware interfaces, including network and disk.
show interfaces transport-opt-Service-engine	`Router#`	Shows information about the module side of the router-module interface.
show ntp status	`Router#` `SE-Module>`	Shows information about Network Time Protocol (NTP).
show processes	`Router#` `SE-Module>`	Shows a list of the running application processes.
show running-config	`Router#` `SE-Module>`	Shows the configuration commands that are in effect.
show startup-config	`Router#` `SE-Module>`	Shows the startup configuration.
show tech-support	`Router#` `SE-Module>`	Shows general information about the module that is useful to Cisco technical support for problem diagnosis.
show version	`Router#` `SE-Module>`	Shows information about the loaded router, software or module, bootloader version, and hardware and device information.
test scp ping	`Router#`	Pings the module to check network connectivity.
show running-config	`SE-Module>`	Shows the configuration commands that are in effect.
show software packages	`SE-Module>`	Shows package information for installed packages.
show software versions	`SE-Module>`	Shows version information for installed software.

Troubleshooting the NCE module from the Cisco IOS

To troubleshooting the TPO service module:

- Make sure the interception or redirection is configured on outgoing WAN interface.
- Adjacencies are created for the TPO module and for each tpo ID configured on the WAN interface.
- Use commands for troubleshooting the Cisco IOS:
  - **show adjacency** (detail)
  - **debug tpo packets**
  - **debug tpo errors**
  - **debug ip wccp** (*events/packets*)
- Use **show ip wccp** commands to check the WCCP status.
- Use the **show ip wccp 61 bucket** command to match to redirection table on the NCE.

Application-Level Troubleshooting

To configure logging options for the NCE service module, use commands from the following list of common module commands (Table 10-3).

> **Note**   Among keyword options for many **log** and **trace** commands is provision to display diagnostic output on your screen or to pipe it to a file or a URL.

Table 10-3   Common Logging Commands

Configuration Mode	Command	Purpose
SE-Module>	**log console monitor**	Cofigures error logging by means of the console. The following are the different severity levels: • errors - Error messages, severity=3 • info - Information messages, severity=6 • notice - Notice messages, severity=5 • warning - Warning messages, severity=4

There are two types of diagnostics:

- System log (syslog)—Syslog is an industry-standard protocol for capturing the following events:
  - Fatal exceptions that cause an application or system crash, during which normal error-handling paths are typically nonfunctional.
  - Application run-time errors that cause unusual conditions and configuration changes.

  The syslog file size is fixed at 1 MB for an AIM and 10 MB for an NME. Syslog configurations survive a power failure.

- Traces—Trace logs capture events related to the progress of a request through the system.

  Trace logs survive a CPU reset; trace configurations survive a power failure. To log and display these, use the **trace** commands.

To generate and display syslog and trace diagnostics, use commands as needed from the lists of common router and module commands in Table 10-4 and Table 10-5.

Use the trace command to help in debugging issues: **trace tpo cli inout/debug/error**.

Trace TPO gateway [**ogw / tgw**] errors.

If you are troubleshooting tpo ID configuration, turn on **trace tpo jni gw-int.** If you are troubleshooting policy map configuration, turn on **trace tpo jni pm-int**.

If the **show** command results in an error message from the CLI, it is likely that a process is not running. Check the messages log. See the "Messages Log" section on page 10-15.

Table 10-4   Common Syslog Commands

Configuration Mode	Command	Purpose
Router#	**show log**	Shows the contents of the specified log.
SE-Module>	**copy log**	Saves the syslog to a destination that you choose.
SE-Module>	**show log**	Shows the contents of the specified log.
SE-Module>	**show logs**	Shows a list of the available log files.

Table 10-5   Common Trace Commands

Configuration Mode	Command	Purpose
SE-Module>	**clear trace**	Clears the logged trace events for specified modules.
SE-Module>	**log trace**	Logs the configured traces to the module (can be done locally or remotely).
SE-Module>	**no trace**	Disables the tracing for specified modules, entities, or activities.
SE-Module>	**show errors**	Shows error statistics by module, entity, or activity.
SE-Module>	**show trace**	Shows the trace settings.
SE-Module>	**show trace buffer**	Shows the contents of the trace buffer.
SE-Module>	**show trace store**	Shows the contents of the traced messages that are stored.
SE-Module>	**trace**	Enables tracing (that is, generates error reports) for specified modules, entities, or activities.

Troubleshooting the NCE Module

When troubleshooting the NCE module, check the following:

1. SCTP pipe not coming up.

   – Ping the IP route to the peer IP address.

   – Check if the keepalives are received and sent out to the other end in gateway statistics using the **show tpo statistics gateway** command.

2. Traffic is not getting optimized.

   – Check the service policy / default policy on the tpo interface.

   – Check the SYNs statistics are getting bypassed using the **show tpo stat filter** command.

   – Use **show** commands to check the state of the incoming connections.

   – Check for tpo-lookup type.

3. WCCP debugging.

   – Check the redirection table on the Branch to make sure it's the same as the one populated on the Data Center side.

   – Check if the load balancing is configured correctly on all the modules which are part of the WCCP group.

   – Check the WCCP status on the Data Center NCE modules and WCCP router.

   – Check if the modules are registered correctly with the WCCP router on the Data Center side.

   – Check if the WCCP updates from the Data Center are received on the branch in the gateway statistics using the **show tpo statistics gateway** command.

   – Use error logging on the NCE console for error messages.

Debugging Cisco IOS

- Make sure the interception or redirection is configured on the WAN interface

- Adjacencies must be created for the TPO module and for each tpo ID configured on the WAN interface

Commands generally used for debugging the Cisco IOS

- **show adjacency** (detail)

- **debug tpo packets**

- **debug tpo errors**

- **debug ip wccp** (*events/packets*)

- Use **show ip wccp** commands to check the WCCP status

- **show ip wccp 61 bucket** - match to redirection table on the NCE

Common scenarios

1. SCTP pipe does not come up

- Ping the IP route to peer IP address.

- Check if the keepalives are received and sent out to the other end in gateway statistics using the **show tpo statistics gateway** command.

2. Traffic does not get optimized

- Check the service policy / default policy on the tpo interface.
- Check the SYNs statistics using the **show tpo stats filter** command - they should be getting bypassed.
- Use **show** commands to check the state of the incoming connections.
- Check for the tpo-lookup type.

WCCP debugging.

- Check the redirection table on the Branch to make sure it is the same as the one populated on the Data Center side.
- Check if the load-Balancing is configured correctly on all the modules which are part of the WCCP group.
- Check WCCP status on HQ NCE modules and WCCP router.
- Check if the modules are registered correctly with the WCCP router on the Data Center side.
- Check if the WCCP updates from HQ are received on the branch in the gateway statistics using the **show tpo statistics gateway** command.
- Use error logging on linux console for error messages.

Debugging commands

Use the **tpo debug packets** command to debug traffic by filtering based on the protocol type.

all	All packets
ip	All IP packets
sctp	SCTP packets
tcp	TCP packets

Use the **tpo debug filter-events** command to debug all the events and errors at the filter level.

all	View all details
detailed-trace	View detailed trace
errors	View error details
events	View event details
informational	View informational details
nat	View NAT details

Use the **show packets** command debug connection issues. This command uses tcpdump on the NCE application to sniff the packets on the Ethernet interfaces.

Using Trace

Tracing can be enabled for different individual processes and for specific levels.

Use **trace tpo [option]** to turn on trace activity. The arguments for **option** are:
cli | gateway | statistics | cli | policymanager | procmanager | jni | all

To display the trace options that are set and the activity level, use the **show trace** command. To display the trace log, use the **show trace buffer [option]** command. The trace log can be saved to a file and decoded later. The following sample configuration lists available trace options:

```
service-module> trace tpo ?
  all        Every entity and activity
  cli        Command-Line-Interface Entity
  gateway    Gateway Entity [to debug gateway, such as issues with pipe status]
  jni        Entity
  policymgr  Policy Manager Entity [to debug service-policy issues]
  procmgr    Entity         [to debug process manager issues]
  statsmgr   Entity                           [to debug statistics issues]
```

The following sample configuration lists available trace activity levels for each preceding option:

```
service-module> trace tpo gateway ?
  all          Every activity
  cli          command-line-interface
  control      control activity
  control-msg  control-messages activity
  data-msg     data-message related activity
  error        errors
  event        events
  inout        all incoming/outgoing messages

se-1-3-252-181> trace tpo gateway all
se-1-3-252-181> show trace
MODULE          ENTITY          SETTING
tpo             gateway         ffffffff  {activity level - all: is for enabled tpo
[option] all]

LOG NAME                        STATUS
atrace.log                      disabled
```

How to Read the Trace Buffer

To examine the trace buffer, first enable trace. For example:

- **trace tpo gateway event**
- **show trace**

Pass traffic; then do the following:

1. To display the trace buffer, enter the **show trace buffer** command.

2. To show the latest 10 events, enter the **show trace buffer tail 10** command.

3. to save trace buffer to a file (/var/log/atrace_save.log), enter the **log trace buffer save** command.

Example:

```
Service-module>  show trace
MODULE          ENTITY          SETTING
No tracing active
LOG NAME                        STATUS
atrace.log                      disabled
```

```
se-1-3-252-181> show trace ?
  <cr>
  buffer      Print recent system event messages
  store       Print system event messages from hard-drive store
  store-prev  Print system event messages from previous hard-drive store
  |           Pipe output to another command
```

In the following example, the messages with the keyword tpo *gw* are **trace gateway all** messages.

Messages with **tpo cli** keyword are the messages related to CLI messages.

> **Note**   Using the **show trace buffer tail command** creates a CPU-intensive process. We recommended that you
> use this command in troubleshooting issues when there is minimal traffic.

```
se-1-3-252-181> show trace buff
Press <CTRL-C> to exit...
1444 09/11 01:09:39.905 tpo *gw* 2 gw_sctp_conn_req():2804 will let 1.3.252.190 (peer) be
the initiator
1444 09/11 01:09:39.905 tpo *gw* 2 gw_sctp_cfg_timer():1005 Retry interface 3 config tos 1
status tos 0
1444 09/11 01:09:39.905 tpo *gw* 2 gw_sctp_conn_req():2794 Start: request to connect to
1.3.252.191 tos 1 intf_id 3
1444 09/11 01:09:39.905 tpo *gw* 2 gw_sctp_conn_req():2802 this node 1.3.252.181
1444 09/11 01:10:15.547 tpo *gw* 2 gw_sctp_peer_cfg_hdlr():800 inserting in tree
1444 09/11 01:10:15.547 tpo *gw* 2 gw_sctp_peer_cfg_hdlr():811 insert SUCCESS
1444 09/11 01:10:15.547 tpo *gw* 2 gw_sctp_conn_req():2794 Start: request to connect to
11.11.11.11 tos 1 intf_id 5
1444 09/11 01:10:15.547 tpo *gw* 2 gw_sctp_conn_req():2802 this node 1.3.252.181
1444 09/11 01:10:15.547 tpo *gw* 2 gw_sctp_conn_req():2804 will let 11.11.11.11 (peer) be
the initiator
1444 09/11 01:10:15.547 tpo *gw* 2 rearm_event():136 event added successfully
2071 09/11 01:10:15.547 tpo *gw* 2 gwlib_cli_intf_cfg: sendto done; fd= 64 toPort= 9990
2071 09/11 01:10:15.547 tpo cli 1 JNI: (AddPeerToInterface) Ret val: 0
2071 09/11 01:10:15.547 tpo cli 1 ===============================
ConfigSubmodeHandler/eval END.
2071 09/11 01:10:17.522 tpo cli 1 ===============================
EndMode/eval START.
2071 09/11 01:10:17.522 tpo cli 1 dirpath: /sw/apps/wpo/wpoIntDir/wpoIntDir11
2071 09/11 01:10:17.522 tpo cli 1 Utils/get_dir_count: next dir: sctpPeerDir0
2071 09/11 01:10:17.522 tpo cli 1 substring: wpoIntDir11
2071 09/11 01:10:17.522 tpo cli 1 last index 0
begin index 9
Dir ID: 11
2071 09/11 01:10:17.522 tpo cli 1 Interface ID: 11
2071 09/11 01:10:17.522 tpo cli 1 subdir count is: 1
2071 09/11 01:10:17.522 tpo cli 1 Utils/configure_default_peer START
2071 09/11 01:10:17.522 tpo cli 1 Utils/get_configured_tosbits START.
2071 09/11 01:10:17.522 tpo cli 1 dirPath: /sw/apps/wpo/wpoIntDir/wpoIntDir11/sctpPeerDir
2071 09/11 01:10:17.522 tpo cli 1 got sdir:
/sw/apps/wpo/wpoIntDir/wpoIntDir11/sctpPeerDir/sctpPeerDir0
```

Messages Log

By default, all error messages and important events are written to the messages.log file.

To examine the contents of the file, use the **show log name messages.log** command.

The messages.log file has a file size limit of 5 MB. When the file reaches the file size limit, the messages
are copied to messages.log.prev and cleaned from the messages.log file.

New messages are then written to the messages.log file.

The following is sample output of the messages.log file:

```
<4>Sep 11 11:53:00 localhost kernel: Opened (pid 1528) Filter Device
<27>Sep 11 11:53:00 localhost Transport-Opt:  setpriority successful
<27>Sep 11 11:53:00 localhost Transport-Opt:  Starting process: (/bin/gateway): pid = 1537
<27>Sep 11 11:53:00 localhost Transport-Opt:  number of restarts = 1
<27>Sep 11 11:53:00 localhost Transport-Opt:  setpriority successful
<27>Sep 11 11:53:00 localhost Transport-Opt:  Starting process: (/bin/statsmgr): pid =
1538
<27>Sep 11 11:53:00 localhost Transport-Opt:  number of restarts = 1
<27>Sep 11 11:53:00 localhost gateway: Alert: appmain():719 GATEWAY STARTING
<27>Sep 11 11:53:00 localhost Transport-Opt:  setpriority successful
<27>Sep 11 11:53:00 localhost Transport-Opt:  Closing the file descriptors for process
manager
<27>Sep 11 11:53:00 localhost Transport-Opt:  startup_sync: APP_ONLINE
<27>Sep 11 11:53:00 localhost gateway: gw_stats_startup: GW STATS INIT. fname(gw_stats)
pid(1554)
```

Command Reference

Contents

This section describes application-specific commands for the NCE Service Module.

✎

Note All other Cisco IOS software commands are documented in the Cisco IOS command reference publications at Cisco.com, http://www.cisco.com/en/US/products/ps6441/index.html.

Cisco IOS Commands

Application Commands

interface transport-opt-service-engine

To enter the interface configuration mode for a Network Capacity Expansion (NCE) service module, use the **interface Transport-Opt-Service-Engine** command in global configuration mode.

interface Transport-Opt-Service-Engine *slot*/*unit*

Syntax Description

slot	Number of the router chassis slot for the service module. The slash (/) mark is required when specifying the *slot* and *unit* argument.
unit	Interface number where the NCE service module resides in the router. The slash mark (/) is required between the *slot* argument and the *unit* argument.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
12.4(20)T	This command was introduced.

Usage Guidelines   This command may be used only for NCE service modules. If your system does not have this hardware, then you will not be able to enter this command.

A **no** form of this command is not available. To exit the interface configuration mode, use the **exit** command.

Examples   The following example shows the command for entering configuration mode for NCE service modules located in slot 1, unit 1:

```
Router (config)# interface Transport-Opt-Service-Engine 1/1
Router (config-if)# exit
```

Related Commands

Command	Description
service-module Transport-Opt-Service-Engine	Manipulates the NCE service module operating system.
show transport-opt-interface Transport-Opt-Service-Engine stats	Shows basic interface configuration statistics for NCE service modules.
transport-opt	Configures the NCE service module for NCE over WAN.

service-module transport-opt-service-engine

To manipulate the NCE service module, use the **service-module Transport-Opt-Service-Engine** command in privileged EXEC mode.

service-module Transport-Opt-Service-Engine *slot/unit command*

Syntax Description		
	slot	Number of the router chassis slot for the service module.
	unit	Interface number where the NCE resides in the router. The slash mark (**/**) is required between the *slot* argument and the *unit* argument.
	command	Can be any one of the following:

- reload—Performs a graceful shutdown and reboot of the NCE service module operating system.
- reset—Resets the hardware on NCE service modules.
- session [**clear**]—Opens or closes NCE service module session. [**clear**] clears the NCE configuration session.
- shutdown —Gracefully shuts down NCE service modules.
- statistics—Shows NCE service module statistics.
- status—Shows NCE service module status.

Command Default   If no command is entered, the help screen appears:

```
router# service-module transport-Opt-Service-Engine 0/0
  reload      Reload service module
  reset       Hardware reset of Service Module
  session     Service module session
  shutdown    Shutdown service module
  statistics  Service Module Statistics
  status      Service Module Information
```

Command Modes   Privileged EXEC

Command History	Release	Modification
	12.4(20)T	This command was introduced.

Usage Guidelines   **reload and reset**

⚠️
Caution   Because you may lose data, use the **reset reload** command only to recover from a shutdown or failed state.

At the confirmation prompt, press **Enter** to confirm the action or press **n** to cancel.

session

Only one session at a time is allowed into the service module from the internal NCE service module–side interface.

After starting a session, you can perform any NCE configuration task. You first access the NCE console in a user-level shell. To access the privileged EXEC command shell, where most commands are available, use the **enable** command.

After you finish NCE configuration and exit the NCE console session, use this command with the **clear** keyword to clear the session. At the confirmation prompt, press **Enter** to confirm the action or press **n** to cancel.

shutdown

At the confirmation prompt, press **Enter** to confirm the action or **n** to cancel.

To protect the hard drive, the **service-module Transport-Opt-Service-Engine shutdown** command brings down the operating system of the specified NCE service module in an orderly fashion. When the system is shut down, you can remove the module from the router.

status

Use the **service-module Transport-Opt-Service-Engine status** command to:

- Display the NCE service module's software release version

- Check the NCE service module status (steady or down)

- Display hardware information for the NCE service module, including CPU, memory, interface, and disk drive information

Examples

reload

```
Router# service-module Transport-Opt-Service-Engine 1/0 reload

Do you want to proceed with reload?[confirm]
```

reset

```
Router# service-module Transport-Opt-Service-Engine 1/0 reset

Use reset only to recover from shutdown or failed state
Warning: May lose data on the hard disk!
Do you want to reset?[confirm]
```

session

```
Router# service-module Transport-Opt-Service-Engine 2/0 session

CA-2811#service-module transport-Opt-Service-Engine 0/0 session
Trying 1.4.1.52, 2194 ... Open
se-1-4-1-53>
se-1-4-1-53>
```

The following example clears the session that had been used to configure the NCE in the service module in slot 2:

```
Router# service-module Transport-Opt-Service-Engine 1/0 session clear
```

```
[confirm]
 [OK]
```

shutdown

Router# **service-module Transport-Opt-Service-Engine 1/0 shutdown**

```
Shutdown is used for Online removal of Service Module.
Do you want to proceed with shutdown?[confirm]
Use service module reset command to recover from shutdown.
```

statistics

Router# **service-module Transport-Opt-Service-Engine 2/0 statistics**

```
Module Reset Statistics:
  CLI reset count = 1
  CLI reload count = 0
  Registration request timeout reset count = 0
  Error recovery timeout reset count = 0
  Module registration count = 2

The last IOS initiated event was a cli reset at *13:34:33.847 UTC Sun Dec 18 2005

Router# service-module t4/0 status
Service Module is Cisco Transport-Opt-Service-Engine4/0
Service Module supports session via TTY line 258
Service Module is in Steady state
Getting status from the Service Module, please wait..

Transport Optimization Module 0.0.0.230
TPO Running on NM
```

	Command	Description
Related Commands	**interface Transport-Opt-Service-Engine**	Configures an interface for NCE service module and enters interface configuration mode.
	transport-opt	Configures the NCE service module for NCE over WAN.

show interfaces transport-opt-service-engine

To display the status of the interfaces of the NCE service module, use the **show interfaces transport-opt-Service-Engine** command in Global configuration mode.

show interface Transport-Opt-Service-Engine *slot/unit all*

Syntax Description

slot	Number of the router chassis slot for the service module.
unit	Number of the interface where the NCE module resides in the router. The slash mark (/) is required between the *slot* argument and the *unit* argument.
all	All the specified WAN interfaces with tpo IDs configured.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
12.4(20)T	This command was introduced.

Usage Guidelines   Use the **show interfaces transport-opt-Service-Engine** command to display details about the NCE service module interface.

Examples   The following example shows interface information for a NCE service module's counters in router slot 0 and unit 0:

```
Router# show interfaces transport-opt-service-engine 0/0 counters all

   tpo-id     WAN interface         Packets             Bytes
     41          ATM0/1/0                 0                 0
     50           Tunnel0           6752887         580748282
     64         Serial0/0/0               0                 0
```

Table 11-1 describes the significant fields shown in the display.

Table 11-1   show interfaces transport-opt-Service-Engine Field Descriptions

Field	Description
tpo-id	Defines the tpo ID number configured for the WAN interface.
WAN interfaces	Describes the physical WAN interface configured on the router.
Packets	Number of TCP packets sent to the NCE service module.
Bytes	Total data bytes sent to the NCE service module.

Related Commands	Command	Description
	show adjacency detail	Shows the adjacency for tpo ID being created for the main interface and for each tpo ID configured for the Wan interface.
	transport-opt	Configures the NCE service module for NCE on a WAN interface through TCP packet interception and optimization.

show running-config interface serial

To display current configuration information of the running NCE side of a service module, use the **show running-config interface serial** command in privileged EXEC mode.

show running-config interface serial *slot/unit*

Syntax Description		
slot	Number of the router chassis slot for the service module.	
unit	Number of the interface where the NCE module resides in the router. The slash mark (/) is required between the *slot* argument and the *unit* argument.	

Command Default   None

Command Modes   Privileged EXEC

Command History

Release	Modification
12.4(20)T	Transport Performance Optimization was added.

Usage Guidelines   Use the **show running-config interface serial** command to:

- Display the NCE service module's current configuration
- Check the NCE service module status
- Display hardware information for the NCE service module, including interface, IP address, load interval and clock rate

Examples   The following example shows configuration information for a NCE service module:

```
Router# show running-config interface serial 0/0/0
Building configuration...

Current configuration : 197 bytes
!
interface Serial0/0/0
 ip address 30.0.0.1 255.255.255.0
 load-interval 30
 no fair-queue
 clock rate 8064000
transport-opt 64 interface Transport-Opt-Service-Engine0/0
end
```

Related Commands

Command	Description
transport-opt	Configures the NCE service module for NCE on a WAN interface through TCP packet interception and optimization.

transport-opt

To configure the NCE service module for NCE on a WAN interface through TCP packet interception and optimization, use the **transport-opt** command in EXEC mode.

To block reception of NCE signaling messages on a particular socket, use the **no** form of this command.

transport-opt *transport-opt id / multipoint* **interface transport-opt-service-engine** *slot/port*

no transport-opt

Syntax Description

transport-opt id/multipoint	TPO IDs are identification numbers for tpo interfaces configured on the application. the tpo IDs should be the same as the tpo ID configured in the application for the point-to-point configurations. The multipoint option is currently supported only on GE interfaces. When the multipoint option is selected, the transport-opt id is not required to be configured in the IOS CLI command. TPO IDs range from 1 to 64. The tpo ID is constructed into the destination MAC when the intercepted packet is forwarded to the NCE service module.
slot	Number of the router chassis slot for the NCE service module.
port	Interface number where the NCE service module resides in the router.

Command Default   TCPs are enabled.

Command Modes   EXEC

Command History

Release	Modification
12.4(20)T	This command was introduced.

Usage Guidelines   This command controls whether to allow TCP packet interception and optimization to be applied to NCE devices across the network.

To block NCE message formatting on a specific interface, use the **no** form of this command.

To reset this command to the default value, use the **default** command.

Examples   The following example sets the NCE service module on a PVC under a point-to-point subinterface:

```
uut1(config)#int s2/0/0
uut1(config)#encapsulation frame-relay

uut1(config)#int s2/0 /0.1 point-to-point
uut1(config-subif)#frame-relay interface-dlci 65
uut1(config-fr-dlci)# "transport-opt <tpo-id> interface Transport-Opt-Service-Engine
<x/y>"
```

The following example sets the NCE service module on PVC's for a multipoint subinterface:

```
uut1(config)#int s2/0/0
uut1(config)#encapsulation frame-relay

uut1(config)#int s2/0 /0.1multipoint
uut1(config-subif)#frame-relay interface-dlci 150
uut1(config-fr-dlci)# "transport-opt <tpo-id> interface Transport-Opt-Service-Engine
<x/y>"
```

Configure an ATM multipoint interface under ATM PVC.

Related Commands	Command	Description
	show transport-opt-interface transport-opt-service-engine stats	Shows basic interface configuration statistics for NCE service modules.

bandwidth

To configure the bandwidth specific to a particular NCE (WAN), use the **bandwidth** command.

As multiple TCP connections are multiplexed into a single Stream Control Transmission Protocol (SCTP) session, it becomes essential for the NCE service module to ensure smooth SCTP flow control.

The NCE Service Module programs the SCTP flow control parameters. With bandwidth configuration, the NCE Service Module controls flooding of data packets on the WAN and eventually this helps the NCE to efficiently regulate WAN usage and packet drops.

Bandwidth can be configured for the NCE Service Module by using the **bandwidth** command. By default, the NCE Service Module assumes an 8 Mbps WAN link, which may not always be the case. Particularly for the links below 8 Mbps, we strongly recommend bandwidth configuration.

bandwidth *peak-bandwidth guaranteed-bandwidth* **tos** *TOS*

Syntax Description

peak bandwidth	Integer value for bandwidth, in kbps.
guaranteed bandwidth	Integer value for bandwidth, in kbps.
TOS	Type of service (TOS) attached to this NCE.

Command Default

Bandwidth is not configured on an NCE service module.

Command Modes

NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines

This command is useful for avoiding traffic burst and WAN output packet drops. For better throughput and latency mitigation, we advise configuring the bandwidth if the WAN link is 8 Mbps or less.

Configure the bandwidth based on the actual WAN bandwidth available to NCE. If you configure multiple SCTP pipes to differentiate service, configure the bandwidth for each TOS pipe; otherwise, set TOS to 0.

It is recommended to configure the guaranteed bandwidth to a maximum of 80% of peak bandwidth even when total WAN bandwidth is available for NCE and the particular TOS pipe. Depending upon the traffic profile, the peak bandwidth can be configured to the overall WAN speed, for example, if there is no significant non-NCE traffic.

Sets maximum bandwidth and guaranteed bandwidth available on a WAN link

This command takes effect only when the bandwidth-profile is configured as rate-contro.l

If guaranteed bandwidth is configured as part of the main command, it is distributed equally among all the TOS pipes.

Guaranteed bandwidth can also be configured for an individual TOS pipe which will be applicable only when qos-dscp is enabled.

Examples   The following example shows how to configure WAN bandwidth where WAN speed is 8 Mbps, 6 Mbps is dedicated to NCE, and NCE traffic is divided into two profiles:

- 4-Mbps WAN bandwidth for high priority traffic, TOS is 0x7

- The rest of the traffic is default traffic.

```
branch-office(config> conf t
branch-office(config)> tpo id 1
branch-office(config)> bandwidth 8000 2000 tos 0
branch-office(config)> bandwidth 8000 4000 tos 7
branch-office(config)> default policy-action all
branch-office(config)> sctp-peer 1.100.70.123
branch-office(config)> exit


branch-office> show tpo id
Number of TPO-ID: 3
===================================================================
TPO-ID: 4, SCTP Peer: 14.14.14.15, Peer Relationship: Acceptor
Capability Exchange: Not Available, Native Version: 2.0
Default Policy-action: compress-sctp, Service Policy: <not configured>
Bandwidth Profile: high-speed-sctp
TCP Connections: 0/0 (active/max)
WCCP Branch Group ID: 3, Assigning Peer: 16.16.16.17
10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
_____
TOS: 0, DSCP: 0, TCP Connections: 0
Status: DOWN, Waiting for Peer to Initiate Connection
===================================================================
===================================================================
TPO-ID: 10, SCTP Peer: 2.2.2.3, Peer Relationship: Initiator
Capability Exchange: Compatible, Negotiated Version: 2.0
Default Policy-action: compress-sctp, Service Policy: <not configured>
Press Enter for More or [q] Quit:
Bandwidth Profile: high-speed-sctp
TCP Connections: 0/12496 (active/max)
10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
_____
TOS: 0, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 1, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 2, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 3, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 4, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 5, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 6, DSCP: 0, TCP Connections: 0
Press Enter for More or [q] Quit:
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 7, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
===================================================================
```

Related Commands

Command	Description
show tpo id	Shows detailed configuration and status information for the specified NCE.

bandwidth-profile

To configure bandwidth profile under a specific TPO ID, use the **bandwidth-profile** command. To remove the command setting, use the **default bandwidth-profile** command.

bandwidth-profile *hs-sctp rate-control default-sctp*

default bandwidth-profile

Syntax Description

hs-sctp	High-speed sctp flow and congestion control (default).
rate-control	Static configuration of peak and guaranteed bandwidth.
default-sctp	Standards-compliant SCTP flow and congestion control.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   When the rate-control is configured, peak and guaranteed bandwidth should be configured.

If you are configuring a point-to-point link and you know the maximum bandwidth, configure the rate-control or use the default hs-sctp for better performance.

Examples   The following example shows:

```
branch-office>#config t
branch-office>(config)# tpo id 1
branch-office>(config-tpo-id)#bandwidth-profile rate-control
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

bind

To binds the specific network to a particular NCE for multipoint deployment, use the **bind** command.

> **bind** *network-address network-mask*

Syntax Description		
	network address	Network IP address.
	network mask	Network subnet mask.

Command Default   None.

Command Modes   NCE specific

Command History	Release	Modification
	2.0.1	This command was introduced.

Usage Guidelines   This command is useful for binding a specific network to a particular tpo ID for multipoint deployment where the specific tpo ID is not known.

Examples   The following example shows how to bind network 192.168.1.0 to tpo ID 1, using the **bind** command.

```
branch-office(config)> tpo id 1
branch-office(config-tpo-id)> bind ?
  A.B.C.D      IP address
branch-office(config-tpo-id)> bind 192.168.1.0 ?
  A.B.C.D      Subnet mask
branch-office(config-tpo-id)> bind 192.168.1.0 255.255.255.0
branch-office(config-tpo-id)>
```

clear tpo id statistics

To clear interface level statistics, use the **clear tpo id statistics** command.

clear tpo id statistics

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows how to clear tpo ID statistics at the interface level:

```
se-1-3-252-180> show tpo id 10 stat
Interface Statistics (since last cleared) for tpo id 10
==============================
        Total Connections: 22838
      Deflate Connections: 22838
      TCP Received (in MB): 4.225323
         SCTP Sent (in MB): 4.138203
  Compression Ratio (in %): 2.061859
     SCTP Received (in MB): 76.934978
           TCP Sent (in MB): 1431.528112
Decompression Ratio (in %): 94.625671

se-1-3-252-180> clear tpo id statistics

se-1-3-252-180> show tpo id 10 statistics
Interface Statistics (since last cleared) for tpo id 10
==============================
        Total Connections: 0
      Deflate Connections: 0
      TCP Received (in MB): 0.000000
         SCTP Sent (in MB): 0.000000
  Compression Ratio (in %): 0.000000
     SCTP Received (in MB): 0.000000
           TCP Sent (in MB): 0.000000
Decompression Ratio (in %): 0.000000
==============================
se-1-3-252-180>
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

clear tpo id traffic-profile

To clear a tpo ID traffic profile, use the **clear tpo id traffic-profile** command. To remove the command setting, use the **no** form of this command.

clear tpo id *id* **traffic-profile**

no clear tpo *id* **traffic-profile**

Syntax Description	*id*	Unique TPO identification number in the range 1 to 64

Command Default   None

Command Modes   Exec

Command History	Release	Modification
	2.0.1	This command was introduced.

Examples   The following example shows the traffic profile for tpo id 1 is cleared:

```
branch-office> show tpo id 1 traffic-profile
----------------------------------------------------------------------
  APPLICATION    ACCEPT    BYPASSED   CONNECT   DENIED    TCP-Tx     TCP-Rx
----------------------------------------------------------------------
        ftp        0          0          1         0        102        522
        ssh        0          0          0         0          0          0
     telnet        0          0          0         0          0          0
       smtp        0          0          0         0          0          0
 print_serv        0          0          0         0          0          0
        rlp        0          0          0         0          0          0
   graphics        0          0          0         0          0          0
 nameserver        0          0          0         0          0          0
        dns        0          0          0         0          0          0
        mtp        0          0          0         0          0          0
       http        0          0          0         0          0          0
       pop3        0          0          0         0          0          0
        ntp        0          0          0         0          0          0
       snmp        0          0          0         0          0          0
  https/ssl        0          0          0         0          0          0
       cifs        0          0          0         0          0          0
     others        0          0          3         0          0        408

branch-office> clear tpo id 1 traffic-profile

branch-office> show tpo id 1 traffic-profile
----------------------------------------------------------------------
  APPLICATION    ACCEPT    BYPASSED   CONNECT   DENIED    TCP-Tx     TCP-Rx
----------------------------------------------------------------------
        ftp        0          0          0         0          0          0
        ssh        0          0          0         0          0          0
```

```
      telnet        0         0         0         0         0         0
        smtp        0         0         0         0         0         0
  print_serv        0         0         0         0         0         0
         rlp        0         0         0         0         0         0
    graphics        0         0         0         0         0         0
  nameserver        0         0         0         0         0         0
         dns        0         0         0         0         0         0
         mtp        0         0         0         0         0         0
        http        0         0         0         0         0         0
        pop3        0         0         0         0         0         0
         ntp        0         0         0         0         0         0
        snmp        0         0         0         0         0         0
   https/ssl        0         0         0         0         0         0
        cifs        0         0         0         0         0         0
      others        0         0         0         0         0         0
```

Related Commands	Command	Description
	clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

clear tpo statistics

To clear global statistics for all interfaces for the filter, gateway, and protocol, use the **clear tpo statistics** command.

clear tpo statistics

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows how to clear global tpo ID statistics:

```
se-1-3-252-180> show tpo stat fil
Filter Information:
Unresetable counters - entries used: 6098 (Get 2384939/Free 2378841), reload 0
In trans: 320996, Out trans: 315853, Err Cnt: 0
GW TCP close: 0, OGW notified: 124685, TGW connect: 0
OGW SYN bypass: 118587, accept: 6078, reject: 0, dup syn drop: 2233
GW Tx: SYN 0, SYNACK 6078, RST 0, FIN 0
GW Rx: SYN 126918, SYNACK 0, RST 97081, FIN 0
Pkt bypass with entry: 0, w/o entry in/out: 4506358/0, inv peer_id: 0
    global/peer bypass: 0/0, ssh,bgp bypass: 0
Throttle on/off: 0/0, throttled connections: 0

se-1-3-252-180> clear tpo statistics

se-1-3-252-180> show tpo statistics filter
Filter Information:
Unresetable counters - entries used: 7110 (Get 2385971/Free 2378861), reload 0
In trans: 13083, Out trans: 12748, Err Cnt: 0
GW TCP close: 0, OGW notified: 250, TGW connect: 0
OGW SYN bypass: 0, accept: 250, reject: 0, dup syn drop: 0
GW Tx: SYN 0, SYNACK 250, RST 0, FIN 0
GW Rx: SYN 250, SYNACK 0, RST 250, FIN 0
Pkt bypass with entry: 0, w/o entry in/out: 0/0, inv peer_id: 0
    global/peer bypass: 0/0, ssh,bgp bypass: 0
Throttle on/off: 0/0, throttled connections: 0
se-1-3-252-180>
```

Related Commands

Command	Description
show tpo id statistics	Shows limited information for all the configured NCEs.

default policy-action

To reconfigure the current default policy, use the **default policy-action** command.

default policy- action [*compress-sctp* | *bypass* | *default-sctp*]

Syntax Description

compress-sctp	All traffic is compressed and optimized.
bypass	All traffic is bypassed. No optimization or compression is applied.
default-sctp	Standards-compliant SCTP flow and congestion control.

Command Default   The *compress-sctp* argument is applied.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   If there is no service-policy configured within a WAN interface, the existing default policy is applied.

Examples   The following example shows how to set the default policy to *compress-sctp*:

```
branch-office(config)> tpo id 1
branch-office(config-tpo-id)> default policy-action compress-sctp
```

Related Commands

Commands	Description
match	Configures a policy match within a policy map.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces.

description

To reconfigure the description for a tpo ID, use the **description** command.

description *tpo-ID-description*

Syntax Description

tpo-ID-description	NCE description string.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command assigned meaningful name to a particular tpo ID. It is mainly useful for administrative purposes.

Examples   The following example shows how to set the description as "Cisco Systems" for tpo ID 1:

```
branch-office(config)> tpo id 1
branch-office(config-tpo-id)> description "Cisco Systems"
branch-office(config-tpo-id)>
```

Related Commands

Command	Description
show tpo id	Shows detailed configuration and status information for a specific NCE.

match

To configure a policy match within a policy-map, use the **match** command. The **match** command has the flexibility to configure any kind of match using the **any** keyword within the IP address and the port number configurations or you can set a specific policy match type. To disable, use the **no** form of this command.

> **match** *any | src-ip [any | ip_address] dest-ip [any | ip_address]*
> *any | src-port [any | port-number] dest-port [any | port-number]]*
> *action* [*compress-sctp | bypass | default-sctp*]

Syntax Description

any	Match all available IP addresses or port numbers.
src-ip	Specifies that the following field contains the IP address to match. Alternatively, **any** can be used to match all available IP addresses. If configured on OGW, src-ip is the address of the client and if configured on TGW, src-ip is the address of the server.
dst-ip	Specifies that the following field contains the IP address to match. Alternatively, **any** can be used to match all available IP addresses. If configured on OGW, dst-ip is the address of the server and if configured on TGW, dst-ip is the address of the client
src-port	The source port number from the direction of connection. In the OGW, it is the client port.
dst-port	The destination port of the server.
action	The action of the policy on the connection (optimize, bypass, all).
any	Any source port, destination port, source IP, or destination IP.
ip_address	IP v4 address.
port-number	Specifies the TCP port-number to which the traffic is destined.
compress-sctp	All traffic is compressed and optimized.
bypass	Traffic is bypassed. No optimization or compression is applied.
default-sctp	Standards-compliant SCTP flow and congestion control.
?	Provides a list of all possible responses.

Command Default   This command defaults to applying **All** optimizations.

Command Modes   Policy map configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   The **any** keyword can be used to match any source or destination IP address or port number.

All of the match qualifiers are optional, however to configure a match at least one of the qualifier is required.

Instead of a subnet mask, a wildcard bit is used. To specify a range of IP addresses, for example, from 10.1.1.5 to 10.1.1.15, use the command:

match src_ip 10.1.1.5 0.0.0.15

Because the software stops testing conditions after it encounters the first match, wisely configuring the most likely matches or more frequently queried matches before the less frequent conditions will help reduce the processing time and resources used on the system.

Examples

The following example shows how to enter a match sequence using the **?** help feature:

```
(config-policymap)# match  ?
     src-ip              Source ip address
     dest-ip             Destination ip address
     any                  Match any source or destination ip
```

Here's a sample sequence:

```
----------------------
(config-policymap)> match ?
    any          Match any source or destination ip address
    dst-ip       Destination ip address
    move         Move a match up or down from current position
    src-ip       Source ip address
(config-policymap)> match src-ip ?
    A.B.C.D      IP address
    any          Match any source ip address
(config-policymap)> match src-ip any ?
    dst-ip       Destination ip address
(config-policymap)> match src-ip any dst-ip ?
    A.B.C.D      IP address
    any          Match any destination ip address
(config-policymap)> $st-ip 12.12.12.12 255.255.255.140 ?
    any          Match any source or destination port number
    dst-port     Destination port number
    src-port     Source port number
(config-policymap)> $12.12.12 255.255.255.140 dst-port ?
    NUMBER       Port number
    any          Match any destination port number
(config-policymap)> $2.12 255.255.255.140 dst-port any ?
    src-port     Source port number
(config-policymap)> $255.140 dst-port any src-port any ?
    action       Action to perform on match
(config-policymap)> $ dst-port any src-port any action
    % Incomplete command.
(config-policymap)> $ dst-port any src-port any action ?
    all          (TCP Optimization + Deflate)
    bypass       Bypass any optimization
    optimize     TCP optimization
```

The following example are complete **match** commands:

```
(config-policymap)# match any any action all
(config-policymap)# match any dst-port 80 src-port 80 action all
(config-policymap)# match dst-ip 12.12.12.12 255.255.255.240 src-ip any dst-port 80
src-port any action deflate
(config-policymap)# match src-ip 12.13.13.13. 255.255.255.255 dst-ip any dst-port any
src-port 80 action all
```

match move

To move matches within a policy-map, use the **match move** command. Moves across policy-maps are not be supported.

> **match move** *from-location to-location*

Syntax Description

from-location	Policy map *from* location number.
to-location	Policy map *to* location number.

Command Default   Matches are ordered in the order in which they are entered.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   This example swaps the matches in position 1 and position 5.

```
Example:
(config-policymap)# match move 5 to 1
```

Related Commands

Command	Description
match	Configures a policy match within a policy-map.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces.

maximum-sessions

To configures the maximum allowed sessions for a specific peer, use the **maximum-sessions** command.

maximum-sessions *max sessions*

Syntax Description		
	max sessions	Maximum number of sessions allowed.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   Depending on the hardware module there are a fixed number of total maximum TCP sessions

- For AIM-TPO-1, 1023 sessions are the maximum allowed.
- Total active sessions supported: 2048 for AIM-TPO-2, 4096 for NM-AGGR.

Once the limit is reached, further sessions are bypassed even if the policy is not configured as "bypass".

This command is useful for putting a logical limit for a specific NCE for the maximum allowed sessions so that it can avoid reaching the global limit and thus avoid bypassing the sessions for all the NCEs.

Examples   The following example shows how to set 512 maximum allowed sessions for tpo ID 1:

```
branch-office(config)> tpo ID 1
branch-office(config-tpo-id)> maximum-sessions ?
  INTEGER     Max sessions (Range: 1 - (1023 AIM-TPO-1)(4096 AIM-TPO-2/NME-TPO)
branch-office(config-tpo-id)> maximum-sessions 512
branch-office(config-tpo-id)>
```

policy-map

To create or modify a policy map that can be attached to one or more interfaces to specify a service policy, use the **policy-map** command in global configuration mode. To delete a policy map, use the **no** form of this command. The **policy-map** command enters policy-map configuration mode, in which you can configure or modify the class policies for that policy map. To delete a policy map, use the **no** form of this command.

policy-map *id-string*

no policy-map

Syntax Description

id-string	Unique string identifier.

Command Default   None

Command Modes   Policy map configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   You can define one or more policies by using this command in global configuration mode. Policies are independent of NCE service engine configuration. To delete a policy map, use the **no** form of this command A control policy is made of one or more control policy rules. A control policy rule is an association of a control class and one or more actions. The control class defines the conditions that must be met before the actions will be executed. The **policy-map** command enters policy-map configuration mode, in which you can configure or modify the class policies for that policy map.

Examples   The following commands create the policy map, which is defined to contain policy specification for class1 and the default class:

```
policy-map one
 match any dst-port 21 src-port any action bypass
 match any dst-port 80 src-port any action bypass
 match any dst-port 110 src-port any action bypass
 match any dst-port 25 src-port any action sctp-only
 exit
policy-map two
 exit
policy-map four
 match dst-ip any src-ip 11.11.11.0 0.0.0.255 any action bypass
 match dst-ip any src-ip 11.11.11.0 255.255.255.0 any action bypass
 exit
```

Related Commands	Command	Description
	match	Configures a policy match within a policy map.
	match move	Facilitates match ordering within a policy map.

qos-dscp

To configure DSCP marking on SCTP packets based on the incoming TCP connections, use the **qos-dscp** command. To delete scp marking, use the **no** form of this command.

qos-dscp [*dscp1*][*dscp2*][*dscp3*][*dscp4*][*dscp5*][*dscp6*][*dscp7*][*dscp8*]

no qos-dscp

Syntax Description	*dscp 1 - 8*	Differentiated services code point value (0-63). One value per SCTP pipe with a max of 8 pipes.

Command Default DSCP is not configured.

Command Modes NCE specific

Command History	Release	Modification
	2.0.1	This command was introduced.

Examples The following example shows how qos-dscp is configured on the NCE module:

```
CA-2821-1(config)> tpo id 10
CA-2821-1(config-tpo-id)> qos-dscp ?
  <cr>
  INTEGER     Differentiated services codepoint value (0-63)

tpo id 10
 qos-dscp  0 8 16 26 32 46 48 56   < Default values >
 default policy-action  compress-sctp
 bandwidth-profile default-sctp
```

sctp-peer

To configure the maximum Stream Control Transmission Protocol (SCTP) peer address, use the **sctp-peer** command.

> **sctp-peer** *IP Address*

Syntax Description	*IP address*	The IP address of the peer.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   NCE is a synchronous solution and the user needs to know the peer at the destination end. At present, automatic SCTP peer discovery is not supported. This command configures the destination SCTP peer statically.

Examples   The following example shows how to set SCTP peer as 192.168.1.1.

```
branch-office(config-tpo-id)> sctp-peer ?
  A.B.C.D     IP address
branch-office(config-tpo-id)> sctp-peer 192.168.1.1
branch-office(config-tpo-id)>
```

Related Commands

Command	Description
show tpo id	Shows sctp information at the interface level.

sctp-peer tos

To configure maximum Stream Control Transmission Protocol (SCTP) parameters, use the **sctp-peer tos** command.

sctp-peer *IP Address* **tos** *tos*

Syntax Description

IP address	The IP address of the peer.
tos	Service level.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   NCE is a synchronous solution and the user needs to know the peer at the destination end. At present, automatic SCTP peer discovery is not supported. This command configures the destination SCTP peer statically.

Examples   The following example shows how to set SCTP peer as 192.168.1.1.

```
branch-office(config-tpo-id)> sctp-peer ?
  A.B.C.D      IP address
branch-office(config-tpo-id)> sctp-peer 192.168.1.1 tos 0
branch-office(config-tpo-id)>
```

Related Commands

Command	Description
show tpo id	Shows sctp information at the interface level.

service-policy

To configures the specific policy map to NCE, use the **service-policy** command.

service-policy *service-policy-identifier-name*

Syntax Description

service-policy-identifier-name	A unique policy name created by using the **policy-map** command.

Command Default   None

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   The service policy applies to a tpo ID.

The service policy that is configured takes precedence over the default policy. The default policy is used when no service policy is configured.

The user can configure multiple policies by using the **policy-map** command. These policies are independent of the NCE. Each policy is identified by a unique word. Multiple actions can be attached to the policy. The command is useful for attaching one of the policies to a specific tpo ID.

Examples   The following example shows how to attach policy "test" to tpo ID 1.

```
branch-office(config)> tpo id 1
branch-office(config-tpo-id)> service-policy ?
  WORD        Service Policy identifier name
branch-office(config-tpo-id)> service-policy test
branch-office(config-tpo-id)>
```

Related Commands

Command	Description
show policy-map	To display a specific policy map, use the **show policy-map** command in global configuration mode.

show policy-map (all)

To display the policy maps that have been configured, use the **show policy-map** command in Global configuration mode.

show policy-map

Syntax Description
This command has no arguments or keywords.

Command Default
The configuration information for all the policy maps is displayed.

Command Modes
Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines
Use the **show policy-map** command to check the current configurations of the policy maps.

Examples
The following example shows all the policy map configurations, listed by name:

```
show policy-map
============================================================================================
Policy-Map: one
Number of Associations: 0, Match Count: 4
--------------------------------------------------------------------------------------------
     src ip    src wildcard   dst ip    dst wildcard   src port   dst port   action hit
--------------------------------------------------------------------------------------------
1:   any       any            any       any            0          21         Bypass [0]
2:   any       any            any       any            0          80         Bypass [0]
3:   any       any            any       any            0          110        Bypass [0]
4:   any       any            any       any            0          25         TCP Optimization [0]
============================================================================================
Policy-Map: four
Number of Associations: 0, Match Count: 2
--------------------------------------------------------------------------------------------
     src ip    src wildcard   dst ip    dst wildcard   src port   dst port    action hit
--------------------------------------------------------------------------------------------
1: 11.11.11.0  0.0.0.255      any       any            0          0 Bypass           [0]
2: 11.11.11.0  255.255.255.0  any       any            0          0 Bypass           [0]
============================================================================================
Policy-Map: five
Number of Associations: 0, Match Count: 1
--------------------------------------------------------------------------------------------
Press Enter for More or [q] Quit:
     src ip    src wildcard    dst ip    dst wildcard   src port   dst port   action   hit
--------------------------------------------------------------------------------------------
1: 11.11.11.0  0.0.0.255  9.9.9.0 0.0.0.255        0          0 Bypass           [0]
branch-office>
```

```
branch-office> show policy-map one
========================================================================================
Policy-Map: one
Number of Associations: 0, Match Count: 4
----------------------------------------------------------------------------------------
     src ip   src wildcard   dst ip     dst wildcard   src port   dst port   action    hit
----------------------------------------------------------------------------------------
1:   any      any            any        any            0          21 Bypass            [0]
2:   any      any            any        any            0          80 Bypass            [0]
3:   any      any            any        any            0          110 Bypass           [0]
4:   any      any            any        any            0          25 TCP Optimization  [0]
```

The following example shows all the policy map configurations, listed by name:

```
show policy-map http-sj
policy-map : http-sj
match src-ip 12.22.23.3 255.255.255.254 dst-ip any any action deflate
match dst-ip 124.34.36.12 255.255.255.254 dst-port 80 action bypass
```

Table 11-2 describes the significant fields shown in the display.

Table 11-2   show policy-map Field Descriptions

Field	Description
src ip	Source IP address.
src wildcard	Source IP address is ANY.
dst ip	Destination IP address.
dst wildcard	Destination IP address is ANY.
src port	Source TCP port.
dst port	Destination TCP port.
action hit	The number of times the specific match (src IP and dst IP and src port and dst port) has been made.

	Command	Description
Related Commands	**policy-map**	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

show policy-map

To display a specific policy map, use the **show policy-map** command in global configuration mode.

show policy-map *policy-map-name*

Syntax Description	*policy-map-name* Shows a specific policy map configuration.

Command Default   Shows the configuration information for the named policy map.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   Use this command to check the current configurations of the policy maps.

Examples   The following example shows all the policy map configurations, listed by name:

```
show policy-map one
=================================================================================================
Policy-Map: one
Number of Associations: 0, Match Count: 4
-------------------------------------------------------------------------------------------------
     src ip    src wildcard    dst ip    dst wildcard    src port    dst port    action hit
-------------------------------------------------------------------------------------------------
1:   any       any             any       any             0           21          Bypass [0]
2:   any       any             any       any             0           80          Bypass [0]
3:   any       any             any       any             0           110         Bypass [0]
4:   any       any             any       any             0           25          TCP Optimization [0]
=================================================================================================
branch-office>
```

Table 11-3 describes the significant fields shown in the display.

Table 11-3   show policy-map Field Descriptions

Field	Description
src ip	Source IP address.
src wildcard	Source IP address is ANY.
dst ip	Destination IP address.
dst wildcard	Destination IP address is ANY.
src port	Source TCP port.

Table 11-3   show policy-map Field Descriptions (continued)

Field	Description
dst port	Destination TCP port.
action hit	The number of times a specific match (src Ip and dst IP and src port and dst port) has been made.

Related Commands	**Command**	**Description**
	policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

show running config

To show the running configuration on the NCE service module, use the **show running config** command.

show running-config

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command is used to show the complete running config on the service module.

Examples   The following example shows the complete configuration on the service module:

```
Router> show running-config
Generating configuration:


clock timezone America/Los_Angeles

hostname branch-office

ip domain-name (none)

software download server url "ftp://127.0.0.1/ftp" credentials hidden
"6u/dKTN/hsEuSAEfw40XlF2eFHnZfyUTSd8ZZNgd+Y9J3xlk2B35j0nfGWTYHfmPSd8ZZNgd+Y9J3xlk2B35j0nfG
WTYHfmPSd8ZZNgd+Y9J3xlk2B35j0nfGWTYHfmP"

groupname Administrators create
groupname Broadcasters create

username admin create
username adin create
username yadmin create
username cisco create

groupname Administrators member admin
groupname Administrators member adin
groupname Administrators member yadmin
groupname Administrators member cisco
groupname Administrators privilege superuser
groupname Broadcasters privilege broadcast
groupname Administrators privilege ManagePrompts
groupname Administrators privilege broadcast
```

```
        groupname Administrators privilege local-broadcast
        groupname Administrators privilege ManagePublicList
        groupname Administrators privilege ViewPrivateList
        groupname Administrators privilege vm-imap
        groupname Administrators privilege ViewHistoricalReports
        groupname Administrators privilege ViewRealTimeReports

        backup server url "ftp://127.0.0.1/ftp" credentials hidden
        "EWlTygcMhYmjazXhE/VNXHCkplVV4KjescbDaLa4fl4WLSPFvv1rWUnfGWTYHfmPSd8ZZNgd+Y9J3xlk2B35j0nfG
        WTYHfmPSd8ZZNgd+Y9J3xlk2B35j0nfGWTYHfmP"

        log console errors

        policy-map one
         match any dst-port 21 src-port any action bypass
         match any dst-port 80 src-port any action bypass
         match any dst-port 110 src-port any action bypass
         match any dst-port 25 src-port any action sctp-only
         exit
        policy-map two
         exit
        policy-map four
         match dst-ip any src-ip 11.11.11.0 255.255.255.0 any action bypass
         match dst-ip any src-ip 11.11.11.0 0.0.0.255 any action bypass
         exit
        policy-map five
         match dst-ip 9.9.9.0 0.0.0.255 src-ip 11.11.11.0 0.0.0.255 any action bypass
         exit


        tpo id 1
         bandwidth 2000 1000 tos 0
         default policy-action  compress-sctp
         bandwidth-profile rate-control
         sctp-peer 20.20.20.20 tos 0
         sctp-peer 20.20.20.20 tos 1
         sctp-peer 20.20.20.20 tos 2
         sctp-peer 20.20.20.20 tos 3
         sctp-peer 20.20.20.20 tos 4
         sctp-peer 20.20.20.20 tos 5
         sctp-peer 20.20.20.20 tos 6
         sctp-peer 20.20.20.20 tos 7
         exit
        tpo id 2
         default policy-action  compress-sctp
         sctp-peer 9.9.9.9 tos 0
         exit

         tpo lookup tpo-id
        end
```

Related Commands	Command	Description
	tpo	Create or modify a NCE.

show software version

To show shows version and serial number information for different components on the NCE service module, use the **show software version** command.

show software version

Syntax Description	This command has no arguments or keywords.

Command Default	None

Command Modes	Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples

The following example shows version information:

```
#show software version
Installed Packages:
Software Version: 2.0.1.2

 - Installer  2.0.1.2
 - Bootloader (Primary)  2.1.14
 - Infrastructure  2.3.2.0
 - Global  2.0.1.2
 - Bootloader (Secondary)  2.1.14
 - Core  2.3.0.2
 - WAN Optimization  0.0.0.1
 - GPL Infrastructure  2.2.1.0
```

Related Commands

Command	Description
transport-opt	Configures the NCE service module for NCE on a WAN interface through TCP packet interception and optimization.

show tpo buffers

To display buffer information for all TPOs, use the **show tpo buffers** command. To remove the command setting, use the no form of this command.

> **show tpo buffers**

> **no show tpo buffers**

Syntax Description	This command has no arguments or keywords.

Command Default	None

Command Modes	Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples

The following example shows the tpo buffers:

```
router> show tpo buffers
Hardware Buffer Pool Status:
128K Buffer Pool: total 16 buffers, 16 buffers free
64K Buffer Pool: total 1500 buffers, 600 buffers free
32K Buffer Pool: total 32 buffers, 32 buffers free
16K Buffer Pool: total 32 buffers, 32 buffers free
8K Buffer Pool: total 32 buffers, 32 buffers free
4K Buffer Pool: total 1500 buffers, 1499 buffers free
2K Buffer Pool: total 32 buffers, 32 buffers free
1K Buffer Pool: total 1024 buffers, 1021 buffers free
Total Session Buffers: 5120
Session Buffers Allocated: 4003
Max Concurrent Sessions Allocated: 4056  Run Out of HW buffers: 0
64K alloc to stream: 4 Len: 59859
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

show tpo id (all)

To display configurations and status information for all configured NCEs, use the **show tpo id** command.

show tpo id

Syntax Description   This command has no arguments or keywords.

Command Default   Shows the configuration information for all the NCE service modules.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command shows the configurations of all NCE service modules and the status of the individual SCTP associations. Also includes WCCP group ID, assigning WC, and CoS DSCP.

Examples   The following example shows status and configuration information for all configured NCE service modules:

```
branch-office> show tpo id
Number of TPO-ID: 3
================================================================
TPO-ID: 4, SCTP Peer: 14.14.14.15, Peer Relationship: Acceptor
Capability Exchange: Not Available, Native Version: 2.0
Default Policy-action: compress-sctp, Service Policy: <not configured>
Bandwidth Profile: high-speed-sctp
TCP Connections: 0/0 (active/max)
WCCP Branch Group ID: 3, Assigning Peer: 16.16.16.17
10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
_____
TOS: 0, DSCP: 0, TCP Connections: 0
Status: DOWN, Waiting for Peer to Initiate Connection
================================================================
================================================================
TPO-ID: 10, SCTP Peer: 2.2.2.3, Peer Relationship: Initiator
Capability Exchange: Compatible, Negotiated Version: 2.0
Default Policy-action: compress-sctp, Service Policy: <not configured>
Press Enter for More or [q] Quit:
Bandwidth Profile: high-speed-sctp
TCP Connections: 0/12496 (active/max)
10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
```

```
tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
_____
TOS: 0, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 1, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 2, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 3, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 4, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 5, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 6, DSCP: 0, TCP Connections: 0
Press Enter for More or [q] Quit:
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 7, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
==============================================================
```

Table 11-4 describes the significant fields shown in the display.

Table 11-4   show tpo id Field Descriptions

Field	Description
Number of NCE-IDs	Total number of NCEs configured.
NCE-ID	Unique tpo identification number.
Bandwidth	Configured bandwidth in bits/second.
Policing Rate	SCTP packet sending rate from GW prospective.
Service Policy	Unique Service Policy name applied to this NCE.
Default Policy Action	Policy action applied to this NCE, all, optimize or bypass.
Description	Description string for this NCE.
Cap Exchange Status	This is mainly to ensure compatibility between two NCE systems shows the capability exchange status and negotiated version number.
Peer Address	IP address of the destination SCTP peer NCE.
TOS	Type of Service (TOS) attached to this NCE.
Status	Current status of SCTP association, UP, Down or Going UP.
Streams Used	Total number of TCP sessions on this NCE.
Max Stream Allowed	Maximum number of TCP sessions allowed on this NCE.
Role	Role of this NCE, "acceptor" or "initiator".

Related Commands	Command	Description
	tpo	Create or modify a NCE.

show tpo id

To show detailed configuration and status information for a specific tpo ID, use the **show tpo id** command.

show tpo id *tpo-id*

Syntax Description

tpo-id	Unique TPO identification number in the range of 1 to 64.

Command Default   Shows the configuration information for all NCE modules.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows all the configuration information:

```
BRANCH-1-C3845-1> show tpo id 10
================================================================
TPO-ID: 10, SCTP Peer: 2.2.2.3, Peer Relationship: Initiator
Capability Exchange: Compatible, Negotiated Version: 2.0
Default Policy-action: compress-sctp, Service Policy: <not configured>
Bandwidth Profile: high-speed-sctp
TCP Connections: 0/12496 (active/max)
10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes
_____
TOS: 0, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 1, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 2, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 3, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 4, DSCP: 0, TCP Connections: 0
Press Enter for More or [q] Quit:
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 5, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 6, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
TOS: 7, DSCP: 0, TCP Connections: 0
Status: UP, going down -> UP at Fri Mar 27 14:41:31 2009
================================================================
```

Table 11-5 describes the significant fields shown in the display.

Table 11-5   show tpo id Field Descriptions

Field	Description
tpo ID	Unique TPO identification number.
Bandwidth	Configured bandwidth in bits per second.
Policing Rate	SCTP packet sending rate from GW prospective.
Service Policy	Unique Service Policy name applied to this tpo ID.
Default Policy Action	Policy action applied to this NCE, all, optimize or bypass.
Description	Descriptive string for this tpo ID.
Cap Exchange Status	Ensures compatibility between two NCE systems. Shows the capability exchange status and negotiated version number.
Peer Address	IP address of the destination SCTP peer NCE.
TOS	Type of service (TOS) attached to this tpo ID.
Status	Current status of SCTP association, UP, Down or Going UP.
Streams Used	Total number of TCP sessions on this NCE.
Max Stream Allowed	Maximum number of TCP sessions allowed on this NCE.
Role	Role of this NCE: "acceptor" or "initiator." Role is used to decide who starts the SCTP association. The rule is that whoever has a higher IP address starts and is the Initiator — the other end is the Acceptor.

Related Commands

Command	Description
tpo	Create or modify a NCE.

show tpo id brief

To show limited configuration and status information for a specific NCE, use the **show tpo id brief** command.

show tpo id *tpo-id* **brief**

Syntax Description		
	tpo-id	Unique TPO identification number in the range of 1 to 64.

Command Default   Shows the configuration information for all NCE modules.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command is useful for NCE monitoring purpose. It gives brief details of the control and data plane for a specific NCE.

Examples   The following example shows all the configuration information:

```
#branch-office> show tpo id 1 brief

TPO-ID: 1    Peer-IP: 10.1.1.22
************************************
        TOS     Streams      Status
         0          0          UP

TPO-ID: 2, Peer: 10.1.1.25, WCCP: group-id:1, Assigning WC:10.1.1.40
***************************************************
    TOS    COS    Streams    Status
     0      0       0          UP

branch-office>
```

Table 11-5 describes the significant fields shown in the display.

Table 11-6   show tpo id {tpo-id} Field Descriptions

Field	Description
tpo ID	Unique TPO Identification number.
Peer IP	IP address of the destination SCTP peer NCE.
TOS	Type of service (TOS) attached to this NCE.

Table 11-6   show tpo id {tpo-id} Field Descriptions (continued)

Field	Description
Status	Current status of SCTP association: UP, Down, or Going UP.
Streams Used	Total number of TCP sessions on this NCE.

Related Commands

Command	Description
tpo id	Creates or modifies a NCE.

show tpo id connection

To show detailed connection information for a specific NCE, use the **show tpo id connection** command.

show tpo id *tpo-id* **connection**

Syntax Description

tpo-id	Unique tpo identification number in the range of 1 to 64.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command is useful for connection monitoring purpose. It gives complete details about all the connections established on a specific NCE.

Examples   The following example shows all the configuration information:

```
#branch-office> show tpo id 1 connection

Pipe 0 Connections:
DA          SA          DP  SP  SS RS  FD Role State fc_flags Action Ttx  Trx  Stx  Srx
TxTcpQ TxSctpQ Duration
================================================================================
9.1.1.2   8.1.1.2    80 34907 43 42 37 OGW  0x100011 0x1  ALL  17191368 177  173  17208272
0 0 26s
9.1.1.2   8.1.1.2    80 34908 45 44 36 OGW  0x100011 0x1  ALL  11558636 177  173  11570004
0 0 26s
9.1.1.2   8.1.1.2    80 34909 47 46 35 OGW  0x100011 0x1  ALL  17069328 177  173  17086112
0 0 26s
9.1.1.2   8.1.1.2    80 34910 49 48 38 OGW  0x100011 0x1  ALL  11862288 177  173  11873952
0 0 26s
9.1.1.2   8.1.1.2    80 34911 51 50 39 OGW  0x100011 0x1  ALL  11809404 177  173  11821016
0 0 26s
9.1.1.2   8.1.1.2    80 34912 53 52 41 OGW  0x100011 0x1  ALL  11577528 177  173  11588912
0 0 26s
9.1.1.2   8.1.1.2    80 34913 55 54 40 OGW  0x100011 0x1  ALL  13029804 177  173  13042616
0 0 26s
9.1.1.2   8.1.1.2    80 34914 57 56 42 OGW  0x100011 0x1  ALL  15466536 177  173  15481744
0 0 26s
9.1.1.2   8.1.1.2    80 34915 59 58 44 OGW  0x100211 0x1  ALL  12175524 177  173  12187496
0 0 26s
9.1.1.2   8.1.1.2    80 34916 61 60 43 OGW  0x100011 0x1  ALL  16926948 177  173  16943592
0 0 26s
Total Connections for tpo-id 1, pipe 0: 10
branch-office>
```

Table 11-7 describes the significant fields shown in the display.

Table 11-7   *show tpo id {tpo-id} connection Field Descriptions*

Field	Description
DA	Destination Address
SA	Source Address
DP	Destination Port.
SP	Source Port.
SS	Send Stream Number.
RS	Receive Stream Number.
FD	TCP FD number.
Role	Role as Originating Gateway (OGW) or Terminating Gateway (TGW).
State	Session's Control Flag, useful only for debugging.
Fc_flags	Pipe's Control Flag, useful only for debugging.
Action	Policy Action, "ALL" or "optimize".
Ttx	Total number of TCP bytes sent.
Trx	Total number of TCP bytes Received.
Stx	Total number of SCTP bytes Sent.
Srx	Total number of SCTP bytes Received.
TxTcpQ	Total number of TCP bytes pending for transmit.
TxSctpQ	Total number of SCTP Bytes pending for transmit.
Duration	Duration of TCP connection.

> **Note**   TxTcpQ and TxSctpQ have non-zero values when there is congestion at the TCP and SCTP side.

The show tpo id {tpo id} connection shows status flags. The top 16 bits are used for the control plane

- SESS_CP_TCP_CONN_INIT_SENT_TO_TGW = 0x10000,
- SESS_CP_TCP_CONN_INIT_RESP_SENT = 0x20000,
- SESS_CP_TCP_CONN_INIT_SUCCESSFUL = 0x40000,
- SESS_CP_TCP_CONN_INIT_FAILED = 0x80000,
- SESS_CP_TCP_CONN_UP_TCP = 0x100000, // TCP is up
- SESS_CP_TCP_CONN_CLOSE_ONEWAY = 0x200000, // TCP socket closed
- SESS_CP_TCP_CONN_SYSTEM_ERROR = 0x400000,
- SESS_CP_TCP_LOCAL_CONNECT_IN_PROGRESS = 0x800000,
- SESS_CP_TCP_LOCAL_CONNECT_FAILED = 0x1000000,
- SESS_CP_TCP_LOCAL_CONNECT_SUCCESS = 0x2000000,
- SESS_CP_TCP_CONN_LOCAL_FIN = 0x4000000,
- SESS_CP_TCP_CONN_INIT_RESP_RECVD = 0x8000000,

Related Commands	Command	Description
	tpo id	Create or modify a NCE.

show tpo id sctp

To show SCTP information at the interface level, use the **show tpo id sctp** command.

show tpo id *tpo-id* **sctp**

Syntax Description	*tpo-id*	A number in the range of 1 to 64.

Command Default   None

Command Modes   Exec

Command History	Release	Modification
	2.0.1	This command was introduced.

Examples   The following example shows all the configuration information:

```
BRANCH-1-C3845-1> sh tpo id 10 sctp
SCTP Socket Status:
- - - - - - - - - - TOS 0 - - - - - - - - - - - - - - - - - - - - - - - - - -
Local
assoc id: 2, state ESTABLISHED, rwnd 2047984, uacked 0, pend 0 snd_buf 1024000
in streams 25000, out streams 25000
rto_initial 3000, rto_max 5000, rto_min 1000
max_rxt 10, no_peer_destination 1
peer_rwnd: 2047984, local_rwnd 2047980, cookie_life 60000
Remote
assoc id 2, address 2.2.2.3/9540, state ACTIVE
cwnd 36864, srtt 247, rto 1000, mtu 9216, Flight Size:0
cwnd_buffer_low: 0, cwnd_fast_xmit: 0, cwnd_t3_xmit: 2, cwnd_inactive: 0
tpo_peak: 0, tpo_ssthresh: 36864/<not configured> (current/configurued)
Total Packets Seen: 0, Nagle Delayed: 74
SCTP Socket Status:
- - - - - - - - - - TOS 1 - - - - - - - - - - - - - - - - - - - - - - - - - -
Local
assoc id: 1, state ESTABLISHED, rwnd 2047984, uacked 0, pend 0 snd_buf 1024000
in streams 25000, out streams 25000
rto_initial 3000, rto_max 5000, rto_min 1000
Press Enter for More or [q] Quit:
max_rxt 10, no_peer_destination 1
peer_rwnd: 2047984, local_rwnd 2047980, cookie_life 60000
Remote
assoc id 1, address 2.2.2.3/9541, state ACTIVE
cwnd 36864, srtt 247, rto 1000, mtu 9216, Flight Size:0
cwnd_buffer_low: 0, cwnd_fast_xmit: 0, cwnd_t3_xmit: 2, cwnd_inactive: 0
tpo_peak: 0, tpo_ssthresh: 36864/<not configured> (current/configurued)
Total Packets Seen: 0, Nagle Delayed: 69
SCTP Socket Status:
```

Related Commands

Command	Description
sctp-peer	Configures the maximum SCTP peer IP.

show tpo id statistics

To show connection statistics for a particular tpo ID, use the **show tpo id statistics** command.

show tpo id *tpo-id* **statistics**

Syntax Description

tpo-id	Unique TPO identification number in the range of 1 to 64.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   This command includes the number of the optimized connections and compression ratios.

Examples   The following example shows the output on the NCE module:

```
BRANCH-1-C3845-1> sh tpo id statistics
Statistics for all active interfaces (since last cleared)
==============================
Statistics for tpo-id: 10, TOS: 0
Total Connections: 0
Optimized Connections: 0
TCP Received (in MB): 0.00
SCTP Sent (in MB): 0.00
Average Compression Over Past 10 Sec (in %): 0.00
SCTP Received (in MB): 0.00
TCP Sent (in MB): 0.00
Average Decompression Over Past 10 Sec (in %): 0.00
Statistics for tpo-id: 10, TOS: 1
Total Connections: 0
Optimized Connections: 0
TCP Received (in MB): 0.00
SCTP Sent (in MB): 0.00
Average Compression Over Past 10 Sec (in %): 0.00
SCTP Received (in MB): 0.00
TCP Sent (in MB): 0.00
Average Decompression Over Past 10 Sec (in %): 0.00
Press Enter for More or [q] Quit:
Statistics for tpo-id: 10, TOS: 2
Total Connections: 0
Optimized Connections: 0
TCP Received (in MB): 0.00
SCTP Sent (in MB): 0.00
Average Compression Over Past 10 Sec (in %): 0.00
SCTP Received (in MB): 0.00
```

```
TCP Sent (in MB): 0.00
Average Decompression Over Past 10 Sec (in %): 0.00
```

Table 11-8 describes the significant fields shown in the display.

Table 11-8   show tpo id statistics Field Descriptions

Field	Description
Total Connections	Total number of TCP connections created on this NCE.
Deflate Connections	Total TCP connections where compression is applied.
TCP Received	Total data (in MB) received on all TCP connections on this NCE.
SCTP Sent	SCTP data (in MB) sent to other end on this NCE.
Compression Ratio	Overall compression ratio.
SCTP Received	SCTP data received (in MB) from other end on this NCE.
TCP Send	Total data (in MB) sent on all TCP connections on this NCE.
Decompression Ratio	Overall decompression ratio.

Note   Compression and decompression ratios mainly signify how well the data can be compressed, higher ratios mean better throughput.

Related Commands

Command	Description
tpo id	Create or modify a NCE.

show tpo id statistics (all)

To shows limited information for all the configured NCEs, use the **show tpo id statistics** command.

show tpo id statistics

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows all the configuration information:

```
branch-office> show tpo id statistics

Interface Statistics for all active interfaces (since last cleared)
======================================================================
Interface Statistics for tpo-id: 1
        Total Connections: 20
      Deflate Connections: 20
      TCP Received (in MB): 0.003376
          SCTP Sent (in MB): 0.003300
  Compression Ratio (in %): 2.259888
     SCTP Received (in MB): 907.646774
           TCP Sent (in MB): 906.755150
Decompression Ratio (in %): 0.098244
==============================
Interface Statistics for tpo-id: 2
        Total Connections: 0
      Deflate Connections: 0
      TCP Received (in MB): 0.000000
          SCTP Sent (in MB): 0.000000
  Compression Ratio (in %): 0.000000
     SCTP Received (in MB): 0.000000
           TCP Sent (in MB): 0.000000
Decompression Ratio (in %): 0.000000
======================================================================

branch-office>
```

Table 11-9 describes the significant fields shown in the display.

Table 11-9   show tpo id statistics Field Descriptions

Field	Description
Total Connections	Total number of TCP connections created on this NCE.
Deflate Connections	Total TCP connections where compression is applied.
TCP Received	Total data (in MB) received on all TCP connections on this NCE.
SCTP Sent	SCTP data (in MB) sent to other end on this NCE.
Compression Ratio	Overall compression ratio.
SCTP Received	SCTP data received (in MB) from other end on this NCE.
TCP Send	Total data (in MB) sent on all TCP connections on this NCE.
Decompression Ratio	Overall decompression ratio.

Note   Compression and decompression ratios mainly signify how well the data can be compressed, higher ratios mean better throughput.

Related Commands

Command	Description
tpo id	Create or modify a NCE.

show tpo id statistics history

To display NCE historical statistics for each peer level use the **show tpo id statistics history** command.

show tpo id *tpo-id* **statistics history** *minute*

Syntax Description

tpo-id	NCE service module identification number.
minute	Optional. Request detailed status information.

Command Default   Shows the statistics for all the NCE modules.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   Use the **show tpo id statistics history** command to monitor the system performance and usage. The statistics are created and updated by the Statistics Manager for each system. The historical statistics are provided only for configured interfaces. They are not be reset when the interface level statistics are cleared.

Examples   This example display the historical statistics for the specified time:

```
# Service-module> show tpo id 10 statistics history ?
  10          Historical stats for past 10 minutes
  120         Historical stats for past 120 minutes
  150         Historical stats for past 150 minutes
  180         Historical stats for past 180 minutes
  30          Historical stats for past 30 minutes
  5           Historical stats for past 5 minutes
  60          Historical stats for past 60 minutes
  90          Historical stats for past 90 minutes

se-1-3-252-180> show tpo id 10 statistics history 10   [ for Past 10 minutes]
Historical Statistics for tpo id 10
===============================
Total Connections: 47722
Deflated Connections: 47722
Bytes Received (in MB): 8.874693
Bytes Sent (in MB): 8.692648
Used Memory (in KB): 183736
Free Memory (in KB): 634056
Stats Last Updated at: Tue Sep 11 07:02:10 2007
Current System Time: Tue Sep 11 07:03:44 2007
===============================
```

Table 11-10 describes the significant fields shown in the display.

Table 11-10   *show tpo id statistics history Field Descriptions*

Field	Description
Total Connections	Total number of connections established
Deflated Connections	Total number of deflate connections
Bytes Received (in MB)	Total number of bytes received
Bytes Sent (in MB)	Total number of bytes sent
Used Memory (in KB)	Memory used
Free Memory (in KB)	Memory available
Stats Last Updated at	Tue Sep 11 07:02:10 2007
Current System Time	Tue Sep 11 07:03:44 2007

Related Commands	Command	Description
	show tpo id *tpo-id* **statistics**	Shows brief control and data plane information for a specific NCE.

show tpo id traffic profile

To show the traffic profile for each tpo ID, use the **show tpo id traffic profile** command. To remove the command setting, use the **no** form of this command.

show tpo id *id* **traffic profile**

Syntax Description	*id*	Unique TPO identification number in the range 1 to 64

Command Default   None

Command Modes   Exec

Command History	**Release**	**Modification**
		This command was introduced.

Examples

The following example shows a traffic profile for tpo id 1:

```
branch-office> show tpo id 1 traffic-profile
-----------------------------------------------------------------------
  APPLICATION    ACCEPT   BYPASSED   CONNECT   DENIED   TCP-Tx    TCP-Rx
-----------------------------------------------------------------------
          ftp         0          0         1        0      102       522
          ssh         0          0         0        0        0         0
       telnet         0          0         0        0        0         0
         smtp         0          0         0        0        0         0
   print_serv         0          0         0        0        0         0
          rlp         0          0         0        0        0         0
     graphics         0          0         0        0        0         0
   nameserver         0          0         0        0        0         0
          dns         0          0         0        0        0         0
          mtp         0          0         0        0        0         0
         http         0          0         0        0        0         0
         pop3         0          0         0        0        0         0
          ntp         0          0         0        0        0         0
         snmp         0          0         0        0        0         0
    https/ssl         0          0         0        0        0         0
         cifs         0          0         0        0        0         0
       others         0          0         3        0        0       408

branch-office>
```

show tpo module-capacity

To shows module capabilities, use the **show tpo module-capacity** command.

show tpo module-capacity

Syntax Description   This command has no arguments or keywords.

Command Default   Shows module capabilities.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows module capabilities:

```
#branch-office> show tpo module-capacity
=====================================
Module Capacity Info:
---------------------
Module Type: NME-TPO
Maximum no of Matches: 1024
Maximum no of Interfaces: 50
Maximum no of Policy Maps: 64
=====================================

branch-office>
```

Table 11-11 describes the significant fields shown in the display.

Table 11-11   show tpo module-capacity Field Descriptions

Field	Description
Module Type	Type of hardware.
Maximum no of Matches	Total number of matches, which can be configured on this module.
Maximum no of Interfaces	Total number of NCEs, which can be configured on this module.
Maximum no of Policy Maps	Total number of Policy maps, which can be configured on this module.

Note   Compression and Decompression ratios mainly signify how well the data can be compressed, higher ratios mean better throughput.

Related Commands	Command	Description
	transport-opt	Configures the NCE service module for NCE on a WAN interface through TCP packet interception and optimization.

show tpo policy-manager

To display policy configurations, use the **show tpo policy-manager** command.

show tpo policy-manager

Syntax Description   This command has no arguments or keywords.

Command Default   Shows information about the NCE policy.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows information about the NCE policy configuration:

```
# se-1-100-70-117# show tpo policy-manager
Number of configured tpo-id with policy maps: 0
Number of configured Policy Maps: 1
Number of configured Matches: 1
Number of activated statistical records: 0
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.

show tpo statistics

To display the status of the NCE service module directly connected to the current router, use the **show tpo statistics** command.

show tpo statistics

Syntax Description   This command has no arguments or keywords.

Command Default   Display limited information about the NCE application.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows NCE statistics:

```
branch-office> show tpo statistics
System Statistics
==============================
Gateway Process: Is Running
Process Manager: Is Running
Statistics Manager: Is Running
Total Memory (in KB): 362112
Free Memory (in KB): 223488
Used Memory (in KB): 138624
==============================
branch-office>
```

Related Commands

Command	Description
show tpo id *tpo-id* **statistics**	Shows brief control and data plane information for a specific NCE.

show tpo statistics filter

To display detailed status information about the filter module, use the **show tpo statistics filter** command.

show tpo statistics filter

Syntax Description	This command has no arguments or keywords.

Command Default	None

Command Modes	Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines	This command is useful for diagnostic purpose. It gives detailed control and data plane information.

Examples

The following example shows detailed status information about the filter module:

```
# BRANCH-1-C3845-1> show tpo statistics filter
Filter Information:
===================
Unresetable counters - entries used: 0 (Get 323/Free 323), reload 0
In trans: 0, Out trans: 0, Err Cnt: 0
GW TCP close: 0, OGW notified: 0, TGW connect: 0
OGW SYN bypass: 0, accept: 0, reject: 0, dup syn drop: 0
GW Tx: SYN 0, SYNACK 0, RST 0, FIN 0
GW Rx: SYN 0, SYNACK 0, RST 0, FIN 0
TCP Shutdown: Graceful 0, Aborts 0
Pkt bypass with entry: 0, w/o entry in/out: 0/0, inv peer_id: 0
global/peer bypass: 0/0, ssh,bgp bypass: 0
IP Fragments stats:
Frag-seen:0, Translated:0, Dropped:0, Bypassed:0, out-of-order: 0
Flow-created:0, deleted:0, Create-Error:0, expired:0
Fragment route-error:0 sent-error:0, corrupted:0, share-error:0
```

Table 11-12 describes the significant fields shown in the display.

Table 11-12   show tpo statistics filter Field Descriptions

Field	Description
Entries Used	Total number of filter table entries.
Reload	Filter Module reload count.
In trans	Total number of input translations.

Table 11-12   show tpo statistics filter Field Descriptions (continued)

Field	Description
Out trans	Total number of output translations.
Err Cnt	Total errors occurred.
GW TCP Close	Total number of times, GW called TCP close.
OGW notified	Total number of times, filter notified GW for incoming TCP connections.
TGW connect	Total number of times, GW called TCP connect.
OGW SYN bypass	Total number of times, filter module bypassed the new incoming TCP connections.
Accept	Total number of TCP connections accepted by the filter module.
Reject	Total number of TCP connections rejected by the filter module.
Dup syn drop	Total number of duplicate TCP SYN dropped by filter module.
GW Tx SYN	Total number of TCP SYN originated by the GW application.
GW Tx SYNACK	Total number of TCP SYNACK originated by the GW application.
GW Tx FIN	Total number of TCP FIN originated by the GW application.
GW Tx RST	Total number of TCP RST originated by the GW application.
GW Rx SYN	Total number of TCP SYN received by the GW application.
GW Rx SYNACK	Total number of TCP SYNACK received by the GW application.
GW Rx FIN	Total number of TCP FIN received by the GW application.
GW Rx RST	Total number of TCP RST received by the GW application.
Pkt bypass with entry	Total number of packet bypassed due to "bypass" policy.
Pkt bypass without entry	Total number of packet bypassed due to invalid filter entry.
Inv Peer ID	Total number of packets bypassed due to invalid Peer ID.
Global bypass	Total number of packets bypassed due to global bypass policy.
Peer bypass	Total number of packets bypassed due to peer level bypass policy.
IP Fragments seen	Total number of IP fragments processed by filter module.
IP Fragments translated	Total number of IP Fragments translated by filter module.
IP Fragments dropped	Total number of IP fragments dropped due to an error.
IP Fragments Bypassed	Total number of IP fragments bypassed due to bypass policy.
IP Fragments flow created	Total number of IP fragments flows created by the filter module.
IP Fragments flow deleted	Total number of IP fragments flows deleted by the filter module.

Table 11-12   show tpo statistics filter Field Descriptions (continued)

Field	Description
IP Fragments flow create-err	Total number of errors occurred while creating IP fragments flow.
IP Fragments flow expired	Total number of IP Fragments timeouts.
IP Fragments route-error	Total number of errors occurred while routing the IP Fragments.
IP Fragments sent-error	Total number of errors occurred while sending the IP Fragments.
IP Fragments share-error	Total number of errors occurred while sharing the SKB for the IP Fragments.
IP Fragments corrupted	Total number of corrupted IP fragments received.

Related Commands

Command	Description
show tpo statistics	To display the status of the NCE service module directly connected to the current router, use the **show tpo statistics** command in Global configuration mode.

show tpo statistics filter tpo id

To show filter statistics for each peer, use the **show tpo stat filter tpo id** command. This command shows each filter entry and its corresponding optimized TCP connection.

show tpo statistics filter tpo id *tpo-id*

Syntax Description	*tpo-id*	The tpo ID to show statistics on.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples

The following example shows HTTP protocol statistics:

```
se-1-3-252-180> show tpo filter tpo id 10
Filter Entry Dump:
DA            SA          DP    SP      state    peer_id    mode
=================================================================
90.0.0.3    70.0.0.5    80    50712  Established    10    OGW
90.0.0.3    70.0.0.5    80    50713  Established    10    OGW
90.0.0.3    70.0.0.3    80    50714  Established    10    OGW
90.0.0.3    70.0.0.3    80    50715  Established    10    OGW
90.0.0.3    70.0.0.4    80    50716  Established    10    OGW
90.0.0.3    70.0.0.4    80    50717  Established    10    OGW
90.0.0.3    70.0.0.4    80    50718  Established    10    OGW
```

Table 11-13 describes the significant fields shown in the display.

Table 11-13   **show tpo statistics filter tpo id** *n* **Field Descriptions**

Field	Description
DA	Destination IP address.
SA	Source IP address.
DP	Destination port number.
SP	Source port number.
Peer ID	Transport optimization ID.
Mode	Connection terminating or originating gateway.

Related Commands	Command	Description
	show tpo statistics filter	To display detailed status information about the filter module.

show tpo statistics gateway

To show detailed global status information about gateway, use the **show tpo stat gateway** command.

show tpo statistics gateway

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows NCE statistics for the gateway:

```
#RANCH-1-C3845-1> show tpo statistics gateway
Gateway Global Statistics:
Control Plane -
OGW SYN Seen: 0, TCP terminated: 0, TCP bypassed 0
TGW TCP connect attempted: 0, TCP terminated: 0, Ports Inuse 0
Cap Exchange Req Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Cap Exchange Resp Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
INIT Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
INIT RESP Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
TEARDOWN Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
COMPLETE_TEARDOWN Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
DENY Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
HASH UPDATE Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
MASK UPDATE Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
WCCP Update Query Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
KEEP ALIVE Sent: 885616 Received: 885616 Send Failed: 0
SCTP Partial Delivery: 0
No buffer bypass: 0 No matching tpo bypass: 0 Multi-point lookups: 0
Policy Bypass: 0 No Streams Bypass: 0, No Pipes Bypass: 0, Remote Denied Bypass: 0
Data Plane -
Flow-Reset Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Press Enter for More or [q] Quit:
Flow-Query Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Stop Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Stop-Ack Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Allow Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Allow-Ack Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Deflate: 0 Inflate: 0 Uncompressable: 0
Deflate Err: 0, Inflate Err: 0, Inv tcp fd: 0, Tx SCTP Err: 0
Hung connections: 0
```

Table 11-14 describes the significant fields shown in the display.

Table 11-14   show tpo statistics gateway Field Descriptions

Field	Description
OGW SYN Seen	Total number of TCP SYN processed by the gateway.
OGW TCP Terminated	Total number of TCP connections terminated at the gateway by accepts.
OGW TCP bypassed	Total number of TCP connections bypassed by the gateway due to either bypass policy or sessions exceeded the module/NCE limit.
TGW TCP Connect	Total number of TCP connects attempted by the gateway.
TGW TCP Terminated	Total number of TCP connections terminated at the gateway by connects.
TGW Ports In use	Total number of TCP ports currently used by the gateway.
SCTP Partial Delivery	Total number of partial SCTP packet received by the gateway.
Deflate	Total number of packets compressed.
Inflate	Total number of packets un-compressed.
Uncompressible	Total number of uncompressible packets, packets results in bigger length after compression.
Deflate Err	Total number of compression errors.
Inflate Err	Total number of decompression errors.
Inv TCP fd	Total number of packets dropped due to invalid TCP FD.
Tx SCTP error	Total number of SCTP Transmit errors.
SCTP Messages Statistics	
<MSG> Sent	Total number of <MSG > sent.
<MSG> Received	Total number of <MSG > received.
<MSG> Send Failed	Total number of <MSG > sent.
<MSG> Pending	Total number of <MSG > pending for sends.
<MSG> Retry	Total number of <MSG > re-transmits.
Where <MSG> is the following	

- Cap Exchange Req—Capability Exchange Request
- Cap Exchange Resp—Capability Exchange Response
- INIT—SCTP connection INIT Request
- INIT Resp—SCTP connection INIT Response
- TEARDOWN—SCTP connection Teardown request
- COMPLETE_TEARDOWN—SCTP Connection complete Teardown request
- DENY—SCTP connection deny response
- KEEP ALIVE—SCTP PIPE keep-alive message.

Table 11-14   show tpo statistics gateway Field Descriptions (continued)

Field	Description
• Flow Reset—SCTP Flow Control RESET message.	
• Flow-Query—SCTP Flow Control QUERY message.	
• Flow-Stop—SCTP Flow Control STOP message.	
• Flow-Stop-ack—SCTP Flow Control STOP-ACK message.	
• Flow-Allow—SCTP Flow control ALLOW message.	
• Flow-Allow-ack—SCTP Flow control ALLOW-ACK message.	

Related Commands

Command	Description
show tpo statistics gatewaytpo-id	Shows detailed status information about gateway for a specific NCE.

show tpo statistics gateway tpo-id

To show detailed status information about gateway for a specific NCE, use the **show tpo statistics gatewaytpo-id** command.

show tpo statistics gateway tpo-id *tpo-id*

Syntax Description

tpo-id	Unique TPO identification number.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows status information for tpo ID 1.

```
#RANCH-1-C3845-1> show tpo statistics gateway tpo-id 10
- - SCTP Peer 10 Statistics - - -
Control Plane -
OGW SYN Seen: 0, TCP terminated: 0, TCP bypassed 0
CAP Exchange Req Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
CAP Exchange Resp Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
INIT Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
INIT RESP Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
TEARDOWN Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
COMPLETE_TEARDOWN Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
DENY Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
HASH UPDATE Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
MASK UPDATE Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
WCCP Update Query Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
KEEP ALIVE Sent: 442816 Received: 442824 Send Failed: 0
Data Plane -
Flow-Reset Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Query Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Stop Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Stop-Ack Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Flow-Allow Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Press Enter for More or [q] Quit:
Flow-Allow-Ack Sent: 0 Received: 0 Send Failed: 0 Pending: 0 Retry: 0
Deflate: 0, Inflate: 0, Uncompressable: 0
Sessions Allowed: 0 Used: 0 Max Used: 1
10 Seconds Packet Rate:
TCP Read Rate : 0 bps 0 Packets/Sec
TCP Write Rate : 0 bps 0 Packets/Sec
SCTP Read Rate : 0 bps 0 Packets/Sec
SCTP Write Rate : 0 bps 0 Packets/Sec
SCTP Write-Try Rate : 0 bps 0 Packets/Sec
```

Table 11-15 describes the significant fields shown in the display.

Table 11-15   show tpo statistics gateway tpo-id Field Descriptions

Field	Description
OGW SYN Seen	Total number of TCP SYN processed by the gateway.
OGW TCP Terminated	Total number of TCP connections terminated at the gateway by accepts.
OGW TCP bypassed	Total number of TCP connections bypassed by the gateway due to either bypass policy or sessions exceeded the module/NCE limit.
TGW TCP Connect	Total number of TCP connects attempted by the gateway.
TGW TCP Terminated	Total number of TCP connections terminated at the gateway by connects.
TGW Ports In use	Total number of TCP ports currently used by the gateway.
SCTP Partial Delivery	Total number of partial SCTP packet received by the gateway.
Deflate	Total number of packets compressed.
Inflate	Total number of packets un-compressed.
Uncompressible	Total number of uncompressible packets, packets results in bigger length after compression.
Deflate Err	Total number of compression errors.
Inflate Err	Total number of decompression errors.
Inv TCP fd	Total number of packets dropped due to invalid TCP FD.
Tx SCTP error	Total number of SCTP Transmit errors.
SCTP Messages Statistics	
<MSG> Sent	Total number of <MSG > sent.
<MSG> Received	Total number of <MSG > received.
<MSG> Send Failed	Total number of <MSG > sent.
<MSG> Pending	Total number of <MSG > pending for sends.
<MSG> Retry	Total number of <MSG > re-transmits.

Where <MSG> is the following

- Cap Exchange Req—Capability Exchange Request.
- Cap Exchange Resp —Capability Exchange Response.
- INIT—SCTP connection INIT Request.
- INIT Resp—SCTP connection INIT Response.
- TEARDOWN—SCTP connection Teardown request.
- COMPLETE_TEARDOWN—SCTP Connection complete Teardown request.
- DENY—SCTP connection deny response.
- KEEP ALIVE—SCTP PIPE keep-alive message.
- Flow Reset—SCTP Flow Control RESET message.
- Flow-Query—SCTP Flow Control QUERY message.

Table 11-15   show tpo statistics gateway tpo-id Field Descriptions (continued)

Field	Description
• Flow-Stop—SCTP Flow Control STOP message.	
• Flow-Stop-ack—SCTP Flow Control STOP-ACK message.	
• Flow-Allow—SCTP Flow control ALLOW message.	
• Flow-Allow-ack—SCTP Flow control ALLOW-ACK message.	
• TCP Read Rate—TCP Read Rate in bits per second and packets per second.	
• TCP Write Rate—TCP Write Rate in bits per second and packets per second.	
• SCTP Read Rate—SCTP Read Rate in bits per second and packets per second.	
• SCTP Write Rate—SCTP Send Rate in bits per second and packets per second.	
• SCTP Write-Try Rate—SCTP Write Rate in bits per second and packets per second at which gateway is trying to send SCTP data.	

Note   As long as the SCTP pipe is not congested, SCTP write-try rate and SCTP write rate are the same. Once the pipe is congested, the SCTP write rate is the rate at which SCTP packets are transmitted on the WAN and the SCTP write-try rate is the rate at which the gateway is trying to send packets.

Related Commands

Command	Description
show tpo statistics gateway	Shows detailed global status information about the gateway.

show tpo statistics protocol

To show TCP protocol statistics based on TCP port numbers, use the **show tpo stat protocol** command.

show tpo statistics protocol *tcp-port*

Syntax Description	*tcp-port* TCP port number.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines

Table 11-16   **TCP based application protocols.**

DNS	FTP	HTTP	HTTPS
IMAP	IRC	LDAP	LDAP
NNTP	POP	POP3	RPC
RTSP	SFTP	SMTP	SNMP
SSH	TELNET	TFTP	UUCP

Examples   The following example shows TCP protocol statistics:

```
Service-module> show tpo statistics protocol tcp
Protocol Statistics Table (since last Gateway restart) :
Port TotalConn  BytesRxTCP   BytesTxSCTP BytesRxSCTP BytesTxTCP DeflateConn
=================================================================
  80   11334        2.10         2.06        45.16      1404.81      11314
 636       0        0.00         0.00         0.00         0.00          0
 554       0        0.00         0.00         0.00         0.00          0
 540       0        0.00         0.00         0.00         0.00          0
 530       0        0.00         0.00         0.00         0.00          0
 443       0        0.00         0.00         0.00         0.00          0
 389       0        0.00         0.00         0.00         0.00          0
 194       0        0.00         0.00         0.00         0.00          0
 161       0        0.00         0.00         0.00         0.00          0
 143       0        0.00         0.00         0.00         0.00          0
 119       0        0.00         0.00         0.00         0.00          0
 115       0        0.00         0.00         0.00         0.00          0
 110       0        0.00         0.00         0.00         0.00          0
 109       0        0.00         0.00         0.00         0.00          0
  69       0        0.00         0.00         0.00         0.00          0
  53       0        0.00         0.00         0.00         0.00          0
  25       0        0.00         0.00         0.00         0.00          0
```

```
   23            0       0.00        0.00        0.00        0.00            0
   22            0       0.00        0.00        0.00        0.00            0
   21            0       0.00        0.00        0.00        0.00            0
Other            0       0.00        0.00        0.00        0.00            0
se-1-3-252-180>
```

Table 11-17 describes the significant fields shown in the display.

Table 11-17   show tpo statistics protocol Field Descriptions

Field	Description
Port	Specifies the port based on the Application Protocol, for example, port 80 for HTTP.
TotalConn	Total number of connections established.
BytesRxTCP	Bytes received on the TCP leg.
BytesTxSCTP	Bytes sent on the SCTP leg.
BytesRxSCTP	Total bytes received on the SCTP leg.
BytesTxTCP	Total Bytes Sent on the TCP leg.
DeflateConn	Total number of deflate connections.

show tpo statistics sctp

To show statistics for SCTP chunks, use the **show tpo stat sctp** command. This command provides message counts for each chunk, chunks received in order, control chunks, SCTP checksum errors, shutdowns, total in and total out SCTP packets.

show tpo statistics sctp

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows statistics for SCTP chunks:

```
# Service-module> show tpo stat sctp
============================================
 Global SCTP Statistics
============================================
SctpCurrEstab                       1
SctpActiveEstabs                    0
SctpPassiveEstabs                   5
SctpAborteds                        4
SctpShutdowns                       0
SctpOutOfBlues                      0
SctpChecksumErrors                  0
SctpOutCtrlChunks             1043732
SctpOutOrderChunks             439092
SctpOutUnorderChunks                0
SctpInCtrlChunks               178119
SctpInOrderChunks             5079474
SctpInUnorderChunks                 0
SctpFragUsrMsgs                     0
SctpReasmUsrMsgs                    0
SctpOutSCTPPacks              1349787
SctpInSCTPPacks              2200292
```

Table 11-18 describes the significant fields shown in the display.

Table 11-18   show tpo stat sctp Field Descriptions

Field	Description
SctpCurrEstab	The number of associations for which the current state is either ESTABLISHED, SHUTDOWN-RECEIVED or SHUTDOWN-PENDING.
SctpActiveEstabs	The number of times that associations have made a direct transition to the ESTABLISHED state from the COOKIE-ECHOED state: COOKIE-ECHOED -> ESTABLISHED. The upper layer initiated the association attempt.
SctpPassiveEstabs	The number of times that associations have made a direct transition to the ESTABLISHED state from the CLOSED state: CLOSED -> ESTABLISHED. The remote endpoint initiated the association attempt.
SctpAborteds	The number of times that associations have made a direct transition to the CLOSED state from any state using the primitive 'ABORT': AnyState --Abort--> CLOSED. Ungraceful termination of the association.
SctpShutdowns	The number of times that associations have made a direct transition to the CLOSED state from either the SHUTDOWN-SENT state or the SHUTDOWN-ACK-SENT state. Graceful termination of the association.
SctpOutOfBlues	The number of out of the blue packets received by the host. An out of the blue packet is an SCTP packet correctly formed, including the proper checksum, but for which the receiver was unable to identify an appropriate association.
SctpChecksumErrors	The number of SCTP packets received with an invalid checksum.
SctpOutCtrlChunks	The number of SCTP control chunks sent (retransmissions are not included). Control chunks are those chunks different from DATA.
SctpOutOrderChunks	The number of SCTP ordered data chunks sent (retransmissions are not included)
SctpOutUnorderChunks	The number of SCTP unordered chunks (data chunks in which the U bit is set to 1) sent (retransmissions are not included).
SctpInCtrlChunks	The number of SCTP control chunks received (no duplicate chunks included).
SctpInOrderChunks	The number of SCTP ordered data chunks received (no duplicate chunks included).
SctpInUnorderChunks	The number of SCTP unordered chunks (data chunks in which the U bit is set to 1) received (no duplicate chunks included).
SctpFragUsrMsgs	The number of user messages that have to be fragmented because of the MTU.
SctpReasmUsrMsgs	The number of user messages reassembled, after conversion into DATA chunks.
SctpOutSCTPPacks	The number of SCTP packets sent. Retransmitted DATA chunks are included.
SctpInSCTPPacks	The number of SCTP packets received. Duplicates are included.

Related Commands

Command	Description
sctp-peer	Configures the maximum SCTP peer IP.

show tpo wccp group-id redirection-table

To display WCCP redirection table at branch side for a specific WCCP group id, use the **show tpo wccp group-id redirection-table** command. To remove the default setting, use the no form of this command.

show tpo wccp group-id redirection-table

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows the hash-based load balancing:

```
module(config)>show tpo wccp group-id 1 redirection-table
WCCP Group ID: 1, Assigning WC: 10.1.1.25
  Assignment: HASH, Service Flags:   dst-ip
  *****************************************
   Value    TPO ID
   1-63     tpo-id: 1 - tpo-id: 63
   00       bypass
  *****************************************
  Bucket|  0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F
  ----------------------------------------------------------
  00-0F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  10-1F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  20-2F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  30-3F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  40-4F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  50-5F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  60-6F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  70-7F |  04 04 04 04  04 04 04 04  04 04 04 04  04 04 04 04
  80-8F |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  90-9F |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  A0-AF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  B0-BF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  C0-CF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  D0-DF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  E0-EF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
  F0-FF |  02 02 02 02  02 02 02 02  02 02 02 02  02 02 02 02
```

The following example shows the mask-based load balancing:

```
module(config)>show tpo wccp group-id 1 redirection-table
WCCP Group ID: 1, Assigning WC: 10.1.1.40
  Assignment: MASK
  *****************************************
  Mask  SrcAddr    DstAddr    SrcPort DstPort
  ----  -------    -------    ------- -------
  0000: 0x00001741 0x00000000 0x0000  0x0000
  *****************************************
  Value SrcAddr    DstAddr    SrcPort DstPort Tpo-Id
  ----- -------    -------    ------- ------- -------
  0000: 0x00000000 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0001: 0x00000001 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0002: 0x00000040 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0003: 0x00000041 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0004: 0x00000100 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0005: 0x00000101 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0006: 0x00000140 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0007: 0x00000141 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0008: 0x00000200 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0009: 0x00000201 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0010: 0x00000240 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0011: 0x00000241 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0012: 0x00000300 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0013: 0x00000301 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0014: 0x00000340 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0015: 0x00000341 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0016: 0x00000400 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0017: 0x00000401 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0018: 0x00000440 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0019: 0x00000441 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0020: 0x00000500 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0021: 0x00000501 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0022: 0x00000540 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0023: 0x00000541 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0024: 0x00000600 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0025: 0x00000601 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0026: 0x00000640 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0027: 0x00000641 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0028: 0x00000700 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0029: 0x00000701 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0030: 0x00000740 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0031: 0x00000741 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0032: 0x00001000 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0033: 0x00001001 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)

...Removed


  0062: 0x00001740 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
  0063: 0x00001741 0x00000000 0x0000  0x0000  04 (peer: 10.1.1.40)
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

show tpo wccp redirection-table

To display WCCP redirection table at head-end side, use the **show tpo wccp redirection-table** command. To remove the default setting, use the no form of this command.

show tpo wccp redirection-table

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows the WCCP redirection table at the head end side:

```
module>show tpo wccp redirection-table
Assignment: HASH, Service Flags:  src-ip
    *****************************************
    Index     WCCP Client
    00        10.1.1.40
    01        10.1.1.25
    FF        NOT ASSIGNED
    *****************************************
Bucket|  0  1  2  3   4  5  6  7   8  9  A  B   C  D  E  F
-----------------------------------------------------------
00-0F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
10-1F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
20-2F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
30-3F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
40-4F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
50-5F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
60-6F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
70-7F |  01 01 01 01  01 01 01 01  01 01 01 01  01 01 01 01
80-8F |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
90-9F |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
A0-AF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
B0-BF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
C0-CF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
D0-DF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
E0-EF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00
F0-FF |  00 00 00 00  00 00 00 00  00 00 00 00  00 00 00 00

Assignment: MASK
*****************************************
Mask  SrcAddr     DstAddr     SrcPort DstPort
----  -------     -------     ------- -------
0000: 0x00000000 0x00001741 0x0000  0x0000
*****************************************
```

```
      Value SrcAddr     DstAddr     SrcPort DstPort CE-IP
      ----- -------     -------     ------- ------- -------
      0000: 0x00000000 0x00000000 0x0000  0x0000  10.1.1.40
      0001: 0x00000000 0x00000001 0x0000  0x0000  10.1.1.40
      0002: 0x00000000 0x00000040 0x0000  0x0000  10.1.1.40
      0003: 0x00000000 0x00000041 0x0000  0x0000  10.1.1.40
      0004: 0x00000000 0x00000100 0x0000  0x0000  10.1.1.40
      0005: 0x00000000 0x00000101 0x0000  0x0000  10.1.1.40
      0006: 0x00000000 0x00000140 0x0000  0x0000  10.1.1.40
      0007: 0x00000000 0x00000141 0x0000  0x0000  10.1.1.40
      0008: 0x00000000 0x00000200 0x0000  0x0000  10.1.1.40
      0009: 0x00000000 0x00000201 0x0000  0x0000  10.1.1.40
      0010: 0x00000000 0x00000240 0x0000  0x0000  10.1.1.40
      0011: 0x00000000 0x00000241 0x0000  0x0000  10.1.1.40
      0012: 0x00000000 0x00000300 0x0000  0x0000  10.1.1.40
      0013: 0x00000000 0x00000301 0x0000  0x0000  10.1.1.40
      0014: 0x00000000 0x00000340 0x0000  0x0000  10.1.1.40
      0015: 0x00000000 0x00000341 0x0000  0x0000  10.1.1.40
      0016: 0x00000000 0x00000400 0x0000  0x0000  10.1.1.40
      0017: 0x00000000 0x00000401 0x0000  0x0000  10.1.1.40
      0018: 0x00000000 0x00000440 0x0000  0x0000  10.1.1.40
      0019: 0x00000000 0x00000441 0x0000  0x0000  10.1.1.40
      0020: 0x00000000 0x00000500 0x0000  0x0000  10.1.1.40
      0021: 0x00000000 0x00000501 0x0000  0x0000  10.1.1.40
      0022: 0x00000000 0x00000540 0x0000  0x0000  10.1.1.40
      0023: 0x00000000 0x00000541 0x0000  0x0000  10.1.1.40
      0024: 0x00000000 0x00000600 0x0000  0x0000  10.1.1.40
      0025: 0x00000000 0x00000601 0x0000  0x0000  10.1.1.40
      0026: 0x00000000 0x00000640 0x0000  0x0000  10.1.1.40


   ...Removed


      0047: 0x00000000 0x00001341 0x0000  0x0000  10.1.1.40
      0048: 0x00000000 0x00001400 0x0000  0x0000  10.1.1.40
      0049: 0x00000000 0x00001401 0x0000  0x0000  10.1.1.40
      0050: 0x00000000 0x00001440 0x0000  0x0000  10.1.1.40
      0051: 0x00000000 0x00001441 0x0000  0x0000  10.1.1.40
      0052: 0x00000000 0x00001500 0x0000  0x0000  10.1.1.40
      0053: 0x00000000 0x00001501 0x0000  0x0000  10.1.1.40
      0054: 0x00000000 0x00001540 0x0000  0x0000  10.1.1.40
      0055: 0x00000000 0x00001541 0x0000  0x0000  10.1.1.40
      0056: 0x00000000 0x00001600 0x0000  0x0000  10.1.1.40
      0057: 0x00000000 0x00001601 0x0000  0x0000  10.1.1.40
      0058: 0x00000000 0x00001640 0x0000  0x0000  10.1.1.40
      0059: 0x00000000 0x00001641 0x0000  0x0000  10.1.1.40
      0060: 0x00000000 0x00001700 0x0000  0x0000  10.1.1.40
      0061: 0x00000000 0x00001701 0x0000  0x0000  10.1.1.40
      0062: 0x00000000 0x00001740 0x0000  0x0000  10.1.1.40
      0063: 0x00000000 0x00001741 0x0000  0x0000  10.1.1.40
```

Related Commands	Command	Description
	clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

show tpo wccp statistics

To to check WCCP traffic statistics, use the **show tpo wccp statistics** command. To remove the command setting, use the **no** form of this command.

show tpo wccp statistics

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   The packets-received & packets-accepted counters shows no. of packets redirected to this NCE module from IOS wan interface, and accepted by the module. Packets sent back to router, counter shows total no. of packets bypassed and not optimized.

Examples   The following example shows WCCP traffic statistics. The *Packets received* and *Packets accepted* counters show the number of packets redirected to this NCE module from the Cisco IOS WAN interface and accepted by the module. *Packets sent back to router* shows total number of packets bypassed and not optimized.

```
NCE-HQ> show tpo wccp statistics
      WCCP Statistics:
       Transparent GRE packets received: 5346715
       Transparent non-WCCP packets received: 0
       Transparent non-TCP packets received: 0
       Total packets accepted: 5346715
       Invalid packets received: 0
       Packets received with invalid service: 0
       Packets received on a disabled service: 0
       Packets dropped due to zero TTL: 0
       Packets sent back to router: 0
       GRE fragments redirected: 0
       Packets dropped due to invalid fwd method: 0
       Packets w/WCCP GRE received too small: 0
       Packets dropped due to received on loopback:0
       Packets fragmented for bypass: 0
       Packet pullups needed: 0
       Packets dropped due to no route found: 0
       NCE-HQ>
```

show tpo wccp status

To display WCCP control information on NCE module, use the **show tpo wccp status** command. To remove the default setting, use the **no** form of this command.

> **show tpo wccp status**

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows WCCP control information on an NCE module:

```
NCE-HQ> show tpo wccp status
 WCCP Service ID: 61, Version: 2.0
 ******************************************
 Router IP: 90.0.0.1, Status: ACTIVE, Recv-ID: 6320, ID: 90.0.0.1
 NCE Status: ACTIVE, Service Flags: 0x1
 Redirection: GRE, Packet Return: GRE, Assignment: HASH
 NCE Modules in this service group: 1.3.252.111
 ******************************************
```

Table 11-19 describes the significant fields shown in the display.

Table 11-19   show tpo wccp status Field Descriptions

Field	Description
WCCP Service ID	61, NCE supports WCCP service 61(TCP promiscuous Mode).
Router IP	IP address of the WCCP router configured on the NCE module.
NCE Status	Shows NCE status. If the NCE is successfully registered with WCCP router, it is Active, otherwise it is Inactive.
Redirection	GRE or L2 Redirection. Default is GRE.
Assignment	Mask or Hash. Default is Hash.
NCE Modules in the same WCCP group	The NCE module IP address which is registered with the same WCCP group.

Related Commands	Command	Description
	clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

show version

To shows version and serial number information for different components on the NCE service module, use the **show version** command.

show version

Syntax Description   This command has no arguments or keywords.

Command Default   None

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows the version information:

```
#Service-module> show version
System Type:              EBH3100
CPU Model:                Cavium Networks Octeon CN31XX V0.2
BogoMIPS:                 1000.28
Chassis Type:             C3845
Chassis Serial:           FTX0930A5Y9
Module Type:              NME-TPO
Module Serial:            FHH111903DZ
Encryption/Compression:   ON
SDRAM (MByte):            1024
```

Related Commands

Command	Description
transport-opt	Configures the NCE service module for NCE on a WAN interface through TCP packet interception and optimization.

shutdown

To shutdown the TPO-ID, use the **shutdown** command.

shutdown

Syntax Description   This command has no arguments or keywords.

Command Default   A tpo ID is not already shutdown.

Command Modes   NCE specific

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows how shut down TPO ID 1:

```
module(config)>tpo id 61
module(config)>shutdown
module(config)> show tpo id 61
   ===============================================================
   TPO-ID: 61, SCTP Peer: 7.7.7.8, Peer Relationship:  Initiator
    Capability Exchange: Not Available, Native Version: 2.0
Default Policy-action: bypass, Service Policy: <not configured>
    Bandwidth Profile: default-sctp,  TCP Connections: 0/10240 (active/max)
    10 sec input rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
    10 sec output rate: SCTP: 0 bits/sec, 0 pkts/sec TCP: 0 bits/sec
      sctp_tx: 0 pkts, 0 bytes, sctp_rx: 0 pkts, 0 bytes
      tcp_tx: 0 bytes, tcp_rx: 0 bytes, dropped: 0 bytes

     _____
     TOS: 0, DSCP: 0, TCP Connections: 0
       Status: administratively down, UP -> DOWN at Tue Jan 20 22:52:34 2009
   ===============================================================
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

tpo id

To create or modify a tpo ID, use the **tpo id** command in configuration mode.

tpo id

Syntax Description   This command has no keywords or arguments.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   You can define one or more tpo IDs by using this command in global configuration mode. To delete a NCE configuration, use the **no** form of the command. The **tpo** command enters NCE configuration mode, in which you can configure or modify the NCE configurations for that specific tpo ID. To disable the tpo ID, use the **no** form of this command.

Examples   The following example:

Related Commands

Command	Description
show tpo id	Shows detailed configuration and status information for the specific NCE.

tpo debug filter-events

To view filter events, use the **tpo debug filter-events** command. To remove the command setting, use the **no** form of this command.

tpo debug filter-events [*all* | *detailed-trace* | *errors* | *events* | *informational* | *nat*]

no tpo debug filter-events

Syntax Description

all	Display all messages.
detailed-trace	Display detailed-trace messages.
errors	Display error messages.
events	Display event messages.
informational	Display informational messages.
nat	Display NAT messages.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows debug filter events:

```
branch-office(config)> tpo debug ?
  filter-events View filter event details
  packets      View details of packets received by Filter module

branch-office(config)> tpo debug filter-events ?
  all         View all details
  detailed-trace View detailed trace
  errors      View error details
  events      View event details
  informational View informational details
  nat         View NAT details
```

tpo debug packets

To view packets, use the **tpo debug packets** command. To remove the command setting, use the **no** form of this command.

> **tpo debug packets** [*all | ip | sctp | tcp*]

> **no tpo debug packets**

Syntax Description

all	Display packets of all protocol types.
ip	Display IP packets.
sctp	Display SCTP packets.
tcp	Display TCP packets.

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows the tpo debug command:

```
branch-office(config)> tpo debug ?
  filter-events View filter event details
  packets       View details of packets received by Filter module

branch-office(config)> tpo debug packets ?
  all        All packets
  ip         All IP packets
  sctp       SCTP packets
  tcp        TCP packets
```

tpo lookup

To configure TPO lookup based on binding or the transport-opt TPO ID, use the **tpo lookup** command. To remove the default setting, use the **no** form of this command.

tpo lookup *mode*

no tpo lookup

Syntax Description

bind	Based on binding information configured on the module.
tpo-id	Based on transport-opt TPO-ID configured on Cisco IOS.

Command Default   TPO lookup is based on the transport-opt TPO ID configured on Cisco IOS.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows how tpo lookup is configured on the NCE module:

```
module(config)> tpo lookup tpo-id
```

Related Commands

Command	Description
clear tpo statistics	Clears global statistics for all interfaces for filter, gateway, and protocol.

tpo ip nat inside source

To map the source ip address to the destination address, use the **tpo ip nat inside source** command in global configuration mode. To disable NAT on NCE, use the **no** form of this command.

tpo ip nat inside source *source-IP-address destination-IP-address subnet-mask*

no tpo ip nat inside source

Syntax Description

source IP address	Inside global IP address.
destination IP address	Destination IP address.
subnet mask	Subnet mask.

Command Default   NAT is not configured.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   After configuring the client side, login into the server side module. The remote end SCTP peer IP now needs to be mapped to the NAT Global IP address on the client end.

Because NAT is only on the client side in this case, the public networks needs to be accessed from the service module and the router and the server on the remote side.

Examples   The following example shows the command:

```
router#tpo ip nat inside source 10.10.10.11 9.9.9.0 255.255.255.0
```

Related Commands

Command	Description
show run	Shows detailed configuration and status information.

tpo wccp 61

To enable and disable WCCP on a web cache, use the **tpo wccp 61** command in global configuration mode. To remove the command setting, use the **no** form of this command.

tpo wccp 61

no tpo wccp 61

Syntax Description   This command has no arguments or keywords.

Command Default   WCCP is disabled.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   To enable WCCP on the NCE module, you must configure TPO lookup as bind using the **tpo lookup bind** command on the NCE module.

Examples   The following example shows how to enable WCCP on a web cache:

```
branch-office(config)> NCE-HQ(config)# [no] tpo wccp 61 ?
  <cr>
61 – TCP Promiscuous mode, to intercept TCP traffic
```

Related Commands

Command	Description
tpo lookup	Configures TPO lookup based on binding.

tpo wccp group-id bind

To bind the destination network with a WCCP group ID, use the **tpo wccp group-id bind** command.

tpo wccp group-id *id* **bind** *ip-address subnet-mask*

Syntax Description	*id*	WCCP group ID in the range 1 to 63.
	ip address	Destination IP address.
	subnet mask	Subnet mask.

Command Default   Bind is not configured for a TPO WCCP group.

Command Modes   Global configuration

Command History	Release	Modification
	2.0.1	This command was introduced.

Usage Guidelines   The group ID is based on the Transport-opt TPO ID configured in Cisco IOS.

Examples   The following example shows a TPO WCCP group binded to an IP address:

```
branch-office(config)> tpo wccp group-id 10 bind 1.1.1.1 255.255.255.0
branch-office(config)>
```

Related Commands	Command	Description
	tpo id	Create or modify a NCE.

tpo wccp group-id map-tpo-id

To bind a WCCP group to a specific network/subnet or a specific transport opt id (tpo id), use the **tpo wccp group-id map-tpo-id** command.

tpo wccp group-id *id* **map-tpo-id**

Syntax Description

id	Group ID number in the range 1 to 63.

Command Default   No WCCP group is configured.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Examples   The following example shows:

```
branch-office(config)> tpo wccp group-id 10 map-tpo-id
```

Related Commands

Command	Description
tpo id	Create or modify a NCE.

tpo wccp group-id

To configure a WCCP group, use the **tpo wccp group-id** command. To remove the command setting, use the **no** form of this command.

> **tpo wccp group-id** *group ID*

> **no tpo wccp group-id**

Syntax Description

group ID	Group ID number in the range 1 to 63.

Command Default   There is no WCCP group ID configured.

Command Modes   Exec

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   Tpo lookup bind needs to be configured to use the **tpo wccp group-id** command.

Configure WCCP group on branch service modules with the **group ID bind** command, where this WCCP group binds with the given destination network address. This group ID is then attached to all tpo IDs associated with the peers configured on the Data Center NCE modules. This command is required on branch service modules when there are multiple NCE modules configured ondata center service modules in a WCCP service group.

Traffic is optimized based on the destination address. For different destination network, traffic is bypassed.

For example, if there are four NCE modules on the head end, then four TPO IDs must be configured on the branch, one for each Data Center NCE module. This wccp group-id is attached to all the four TPO IDs. One WCCP group ID associates a single WCCP service group on the Data Center NCE module.

Examples   The following example shows the **tpo wccp group-id** command:

```
NCE-BRANCH(config)> tpo wccp group-id  <id>  ?
  bind            Based on Binding
  map-tpo-id      Based on Transport-opt TPO ID configured on IOS
NCE-BRANCH(config)> tpo wccp group-id <id> bind ?
  A.B.C.D     Destination Network IP address
NCE-BRANCH(config)> tpo wccp group-id <id> bind <ip address> <subnet mask>
```

tpo wccp load-balance

To load balance traffic across multiple WCCP clients, use the **tpo wccp load-balance** command.

>   **tpo wccp load-balance** *hash mask*
>
>   **no tpo wccp load-balance**

Syntax Description

hash	• dst-ip—Destination ip address
	• dst-port—Destination port number
	• src-ip—Source ip address
	• src-port—Source port number
mask	• src-ip-mask—Specify sub-mask used in packet source-IP address. Mask is Hexadecimal number (0x0 - 0xFFFFFFFF).
	• dst-ip-mask—Specify sub-mask used in packet destination-IP address. Mask is Hexadecimal number (0x0 - 0xFFFFFFFF).
	• src-port-mask—Specify sub-mask used in packet source port number. Mask is Hexadecimal number (0x0 - 0xFFF).

Command Default   None

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   WCCP v2.0 protocol allows either hash or mask as the assignment method. A single WCCP client within a service group (the one with the lowest IP address) is elected as the designated or *master* WCCP client. Its responsibility is to provide routers within the same service group with the hash table and mask/value sets for load balancing in the service group.

The designated NCE module distributes the hash table to the router based on the load balance configuration. The designated NCE module also passes the hash table to all the available branches to transport TCP traffic to right SCTP tunnel.

Whenever we change the hash table, the existing connections on the old hash bucket is reset. The router starts redirecting the TCP packets based on the new hash as it works on packet-by-packet rather than data flows.

The masking method can only be used for load balancing with the Catalyst 6500 /3750 series switches and Cisco 7600 series routers.

Examples   The following example shows how load balancing is configured on the data center service module:

```
CA-2821-1(config)> tpo wccp load-balance ?
  hash        Hash Parameters
  mask        Mask Parameters
CA-2821-1(config)> tpo wccp load-balance hash ?
  dst-ip      Destination ip address
  src-ip      Source ip address
CA-2821-1(config)> tpo wccp load-balance hash dst-ip ?
  <cr>
  src-ip      Source ip address
CA-2821-1(config)> tpo wccp load-balance hash dst-ip src-ip ?
  <cr>
CA-2821-1(config)> tpo wccp load-balance hash dst-ip src-ip

CA-2821-1(config)> tpo wccp load-balance mask src-ip-mask ?
  Hexadecimal  Mask in Hexadecimal number (0x0 - 0xFE000000)
CA-2821-1(config)> tpo wccp load-balance mask src-ip-mask 0xFE000000 ?
  <cr>
  dst-ip-mask  Specify sub-mask used in packet destination-IP address
CA-2821-1(config)> $ask src-ip-mask 0xFE000000 dst-ip-mask 0xFE000000
```

tpo wccp router-list

To specify a router IP interface address, use the **tpo wccp router-list** command. To remove the IP addresses from the existing list, use the **no** form of this command.

tpo wccp router-list *address*

no tpo wccp router-list

Syntax Description

address	Router IP address.

Command Default   A router list is not configured.

Command Modes   Global configuration

Command History

Release	Modification
2.0.1	This command was introduced.

Usage Guidelines   Up to 32 WCCP router IP interface addresses can be specified for the routers with WCCP service 61 enabled.

Examples   The following example shows the **tpo wcc router-list** command:

```
NCE-HQ(config)# tpo wccp router-list ?
  A.B.C.D      Router's IP Address
NCE-HQ(config)# tpo wccp router-list (wccp-router1-ip) (wccp-router2-ip)
<wccp-router32-ip>
```

coincidental.

Index