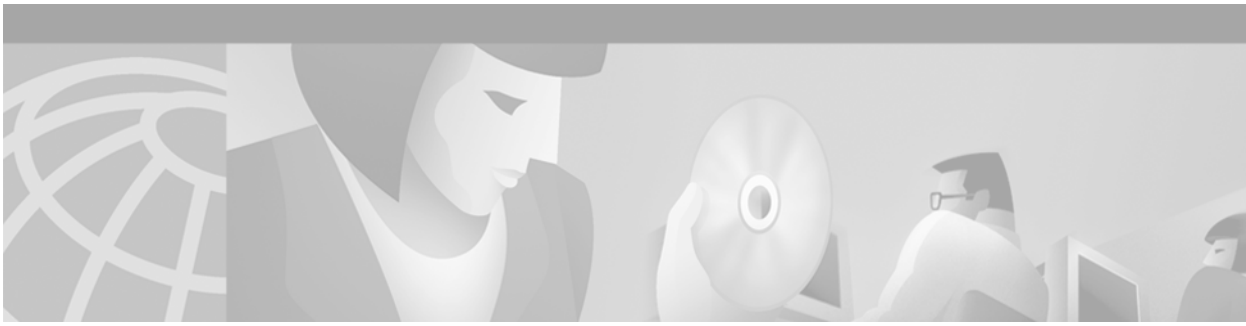

Network Services Engine

This document describes how to configure the network services engine (NSE) on Cisco 7200 VXR series routers. It includes the following sections:

Feature Overview

The network services engine (NSE) is the latest processor engine for Cisco 7200 VXR series routers. The NSE delivers wire rate OC-3 throughput while running concurrent high-touch WAN edge services. It is the first Cisco processing engine to offer integrated hardware acceleration increasing Cisco 7200 VXR series system performance by 50 to 300% for combined “high touch” edge services. The NSE takes advantage of a new technology called Parallel eXpress Forwarding (PXF).

Benefits

Accelerated Services

The following features are accelerated on the NSE: Network Address Translation (NAT), weighted fair queuing (WFQ), and NetFlow for both enterprise and service provider customers.

PXF Field Upgradable

Parallel eXpress Forwarding (PXF) is based on microcode and can be upgraded with new software features in future IOS releases.

The PXF processor enables IP parallel processing functions that work with the primary processor to provide accelerated IP Layer 3 feature processing. The PXF processor off-loads IP packet processing and switching functions from the Route Processor (RP) to provide accelerated and highly consistent switching performance when coupled with one or more of several IP services features such as access control lists (ACLs), address translation, quality of service (QoS), flow accounting, and traffic shaping.

PXF offers the advantage of hardware-based switching power, plus the flexibility of a programmable architecture. The PXF architecture provides future-proofing—if additional features are added in the future, an application-specific integrated circuit (ASIC) will not be required. New features for accelerated services can be added by reprogramming the PXF processor.

System Requirements

An NSE-1 can be used on existing Cisco 7200 VXR series routers with Cisco IOS Release 12.1(1)E or later version of Cisco IOS Release 12.1 E.

High Performance

Network layer services such as traffic management, security, and QoS benefit significantly from NSE-1 high-performance. NSE-1 is the first Cisco processing engine to offer integrated hardware acceleration increasing Cisco 7200 VXR series system performance by 50 to 300 percent for combined “high-touch” WAN edge services.

Restrictions

Normal IOS packet debugging facilities are not enabled while PXF is configured. To enable IOS packet debugging facilities, disable PXF using the **no ip pxf** configuration command.

Related Documents

- *Network Processing Engine and Network Services Engine Installation and Configuration*
- For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

Supported Platforms

- Cisco 7204 VXR
- Cisco 7206 VXR

Supported Standards, MIBs, and RFCs

Standards

None

MIBs

- CPU-FLOO-NSE1

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on CCO at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

RFCs

None

Prerequisites

Before enabling the PXF processor, you must have IP routing and IP Cisco Express Forwarding (CEF) switching turned on.

Configuration Tasks

The PXF processor is turned on by default. If it is ever disabled, you must enable it to take advantage of IP packet switching and feature acceleration.

Note Before enabling the PXF processor, you must have IP routing and IP CEF switching turned on.

See the following sections for configuration tasks. Each task in the list indicates if it is optional or required:

- Configuring the Network Services Engine (Required)
- Verifying the Network Services Engine (Optional)

Configuring the Network Services Engine

	Command	Purpose
Step 1	`Router# configure terminal`	Enters global configuration mode.
Step 2	`Router (config)# [no] ip pxf`	Enables PXF processing.

Verifying the Network Services Engine

Enter the **show pxf accounting** command to view all interfaces.

```
Router# show pxf accounting ?
  ATM           ATM interface
  Ethernet      IEEE 802.3
  FastEthernet  FastEthernet IEEE 802.3
  Hssi          High Speed Serial Interface
  Null          Null interface
  POS           Packet over Sonet
  Serial        Serial
  summary       PXF summary statistics
```

Troubleshooting Tips

Use the following workarounds if you encounter an error message:

Error Message	Workaround

`WARNING:PXF Exception:mac_xid=0x10000`
`*** IHB watchdog timer expired`
`6d16h:%PXF-2-EXCEPTION:pxf exception on pxf tmc.`
	Run the **show pxf crash** command to obtain more information.

`PXF processor hang and error message:`
`WARNING:PXF Exception:mac_xid=0x8`
`*** External Memory Column 3 exception, type = 20`
	This error message indicates that the PXF processor has been left in HALT state. During boot up, the PXF processor is in error state and cannot be brought up. To workaround this problem, reload the router.

`PXF processor crash and error message:`
`00:49:37:Fatal pxf interrupt, int_reg=0x80,`
`int_mask=0xFFFF, config=0x1FF4000`
`00:49:37:-Traceback= 6055B9CC 60530D10`
	This message indicates the PXF processor encountered a serious error and crashed. To workaround this problem, reload the router.

Monitoring and Maintaining the NSE

Command	Purpose
`Router#` **`show pxf accounting`**	Displays PXF switching statistics for all interfaces.
`Router#` **`show pxf accounting`** *`ethernet`*	Displays PXF switching statistics for ethernet interfaces.
`Router#` **`show pxf accounting`** *`null`*	Displays PXF switching statistics for NULL interfaces.
`Router#` **`show pxf accounting`** *`pos`*	Displays PXF switching statistics for packet OC-3 interfaces.
`Router#` **`show pxf accounting`** *`serial`*	Displays PXF switching statistics for serial interfaces.
`Router#` **`show pxf accounting`** *`summary`*	Displays a summary of PXF switching statistics.
`Router#` **`show pxf crash`**	Displays PXF crash information.

Command	Purpose
Router# **show pxf feature cef**	Displays PXF routing feature tables for CEF.
Router# **show pxf feature nat**	Displays PXF routing tables for NAT.

Configuration Examples

This section provides two configuration examples using **show** commands:

- Use the **show version** command to display the configuration of the system hardware, including the NPE or NSE and the software version. The following example shows an NSE installed in a Cisco 7206 VXR router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-JS-M), Version 12.1(1)E
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Wed 22-Mar-00 08:37 by Biff
Image text-base:0x60008900, data-base:0x6141C000

  (display text omitted)

cisco 7206VXR (NSE-1) processor (revision A) with 122880K/8192K bytes of memory.
R7000 CPU at 262Mhz, Implementation 39, Rev 1.0, 256KB L2 Cache6 slot VXR midplane,
Version 2.0
  (display text omitted)

PXF processor tmc is running.
6 FastEthernet/IEEE 802.3 interface(s)
10 Serial network interface(s)
2 HSSI network interface(s)
2 Channelized T3 port(s)
125K bytes of non-volatile configuration memory.
```

- Use the **show c7200** command to obtain information about the router.

```
Router# show c7200
Network IO Interrupt Throttling:
throttle count=0, timer count=0
active=0, configured=0
netint usec=4000, netint mask usec=200

C7200 Midplane EEPROM:
Hardware revision 2.0           Board revision A0
Serial number     16061833      Part number    73-3223-05
Test history      0x0           RMA number     00-00-00
MAC=00b0.4aae.4000, MAC Size=1024
EEPROM format version 1, Model=0x6
EEPROM contents (hex):
0x20:01 06 02 00 00 F5 15 89 49 0C 97 05 00 B0 4A AE
0x30:40 00 04 00 00 00 00 00 00 01 13 50 00 00 FF 00
```

```
C7206VXR CPU EEPROM:
Hardware revision 1.2           Board revision A0
Serial number     15053437      Part number    73-3453-04
Test history      0x0           RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20:01 C2 01 02 00 E5 B2 7D 49 0D 7D 04 00 00 00 00
0x30:50 00 00 00 00 01 14 00 00 00 FF FF FF FF FF FF

C7200 PE EEPROM:
Hardware Revision        :1.0
Top Assy. Part Number    :800-05272-04
Part Number              :73-4068-02
Board Revision           :A0
PCB Serial Number        :12342775
RMA History              :00
Fab Version              :02
Fab Part Number          :28-3146-02
Product Number           :NSE1
EEPROM format version 4
EEPROM contents (hex):
0x00:04 FF 40 00 DE 41 01 00 C0 46 03 20 00 14 98 04
0x10:82 49 0F E4 02 42 41 30 C1 8B 31 32 33 34 32 37
0x20:37 35 20 20 20 04 00 02 02 85 1C 0C 4A 02 CB 84
0x30:4E 53 45 31 FF FF FF FF FF FF FF FF FF FF FF FF
0x40:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x50:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x60:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x70:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Command Reference

This section documents new commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **show pxf accounting**
- **show pxf crash**
- **show pxf feature cef**
- **show pxf feature nat**

show pxf accounting

To show PXF switching statistics for individual interfaces, use the **show pxf accounting** *interface* [*slot/port*] EXEC command.

show pxf accounting *interface* [*slot/port*]

Syntax Description

interface	(Optional) Specifies the type of interface to display.
slot	(Optional) Backplane slot number on the Cisco 7200 VXR series routers. On the Cisco 7200 VXR series routers, the value can be 0 to 6.
port	(Optional) Port number of the interface. On the Cisco 7200 VXR series routers, the value can be 0 to 5.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced.

Usage Guidelines

You can display information about the following interface types using the **show pxf accounting** *interface* command:

Keyword	Interface Type
atm	ATM interface
ethernet	Ethernet interface
fastethernet	FastEthernet interface
hssi	High Speed Serial interface
null	Null interface
pos	Packet-over-SONET interface
serial	Synchronous serial interface
summary	PXF summary statistics

Examples

The following is sample output from the **show pxf accounting ?** command:

```
Router# show pxf accounting ?
  ATM           ATM interface
  Ethernet      IEEE 802.3
  FastEthernet  FastEthernet IEEE 802.3
  Hssi          High Speed Seriel Interface
  Null          Null interface
  POS           Packet over Sonet
  Serial        Serial
  summary       PXF summary statistics
```

The following example is sample output from the **show pxf accounting** *ethernet* command using a ethernet interface in slot 4 on a Cisco 7200 VXR series router:

```
Router# show pxf accounting ethernet 4/0
Interface    Pkts In   Chars In   Pkts Out  Chars Out     Punted     Dropped
Ethernet4/0    0          0        122      11490          4          0
```

The following example is sample output from the **show pxf accounting** *null* command using a null interface in slot 0 on a Cisco 7200 VXR series router:

```
Router# show pxf accounting null 0/0
Interface    Pkts In   Chars In   Pkts Out  Chars Out     Punted    Dropped
nu0/0          0          0          0          0       4932          0
```

The following example is sample output from the **show pxf accounting** *pos* command using a Packet-over-SONET interface in slot 4 on a Cisco 7200 VXR series router:

```
Router# show pxf accounting pos
Interface    Pkts In   Chars In   Pkts Out  Chars Out     Punted    Dropped
POS4/0          19       1064         0          0         44         0
```

The following example is sample output from the **show pxf accounting** *serial* command using a serial interface in slot 5 on a Cisco 7200 VXR series router:

```
Router# show pxf accounting serial 5/0
Interface    Pkts In   Chars In   Pkts Out  Chars Out     Punted    Dropped
Serial5/0          0          0          0          0          0       0
```

The following example is sample output from the **show pxf accounting** *summary* command:

```
Router# show pxf accounting summary
            Pkts        Dropped   RP Processed        Ignored
           Total              0          48360              0

PXF Statistic:
Packets RP -> PXF:
    switch ip:                0
    switch raw:           30048360
    qos fastsend:             0
    qos enqueue:           1938
Total:                    30050298

Packets PXF -> RP:
    qos pkts:              1938
    fast pkts:            30000000
    drops:total               0
    punts:total           48360
      "    not IP            :      40572
      "    CEF no adjacency  :       7788
Total:                    30050298

Packets ignored:              0     |    ring space:
    shadow ring full:         0     |        shadow ring:          16384
    in ring full:             0     |        inring:                 968
    PXF inactive:             0

tx credits:               16230330     |    delayed credits:             0
holdq enqueues:               0        |    requeue drops:               0
interrupts:                40538       |    interrupt misses:         1947
interrupt packets:         53326
pending read bytes:            0

     Interface    Pkts In   Chars In   Pkts Out  Chars Out     Punted    Dropped
         Fa0/0          0          0   30000000 1740000000        970          0
         Et1/0          0          0          0          0      21309          0
         Et1/1          0          0          0          0          0          0
         Et1/2          0          0          0          0          0          0
         Et1/3          0          0          0          0          0          0
         Se2/0          0          0          0          0        963          0
         Se2/1          0          0          0          0          0          0
         Se2/2          0          0          0          0          0          0
         Se2/3          0          0          0          0          0          0
         Fa3/0          0          0          0          0        963          0
         PO4/0   30000000 1440000000          0          0        963          0
         AT5/0          0          0          0          0      23192          0
           Vi1          0          0          0          0          0          0
           Vt1          0          0          0          0          0          0
           Vi2          0          0          0          0          0          0
      Vt2       0       0       0       0       0
```

Related Commands

Command	Description
show pxf crash	Displays PXF crash information.
show pxf interface	Displays a summary of the interfaces in the router and the PXF features and capabilities are enabled on these interfaces.
show pxf feature	Displays the PXF routing feature tables for enabled PXF features.

show pxf crash

To show PXF crash information, use the **show pxf crash** EXEC command.

show pxf crash

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced.

Examples

The following is sample output from the **show pxf crash** command:

```
Router# show pxf crash
  EX_Type = 0x80000000
  EX_ID(b0~3,16~17) = 0x00400
  CPU_EX_ID(b0~15) = 0x0004
  IHB_EX_Type(b0~5) = 0x00
  XRAM0(b0~13) = 0x00000
  XRAM1(b0~13) = 0x00000
  XRAM2(b0~13) = 0x00000
  XRAM3(b0~13) = 0x00000
  Pipeline:7FDEFD pdone[3210]:1F  17  17  1D

ICM0(b4~13) = 0x00000  ICM1(b4~13) = 0x00000
ICM2(b4~13) = 0x00010  ICM3(b4~13) = 0x00000
LOCK0(b0~4) = 0x00000  LOCK1(b0~4) = 0x00000
LOCK2(b0~4) = 0x00000  LOCK3(b0~4) = 0x00000
CPU0/2: SW EX Type=0x00000000 LBUS EX Type=0x00000081 HW EX
Type=0x00000400

CPU:row=0x0 column=0x2 cpu=0x2
 PC:0000098E  LR:0000087F  CR:002C4C00
 r0:00000000  r1:8001CEA0  r2:80784390  r3:00000000
 r4:00005400  r5:80D3BA04  r6:80A7CA00  r7:00000004
 r8:00000000  r9:00000008 r10:80092324 r11:800A6200
r12:00000033 r13:00000008 r14:00000000 r15:00000000
  misr1a:00000000 misr1bhi:00000000 misr1blo:00000000  misr2hi:00000000
 misr2lo:00000000  reserve:00000000  reserve:00000000  reserve:00000000
  sisr1a:01000040   sisr1b:00000000     irhi:4402200F     irlo:00000000
cAll:C20DE822 DCD1:00020400 DCD2:00000002 CNTL:00000000
TBuf intr 0:1111111F
TBuf intr 1:020FFFF0
TBuf intr 2:00003C80
TBuf intr 3:80000000
TBuf intr 4:00000400
Xram return:00000000
```

```
Icram return hi:80024E00
Icram return lo:800A4E00
TBuf addr 0:005E6800 TBuf sblock1 0:8078A374 TBuf sblock0 0:804FD600
TBuf addr 1:005E6800 TBuf sblock1 1:8078A374 TBuf sblock0 1:804FD600
TBuf addr 2:005E6800 TBuf sblock1 2:8078A374 TBuf sblock0 2:804FD600
TBuf addr 3:005E6800 TBuf sblock1 3:8078A374 TBuf sblock0 3:804FD600
TBuf addr 4:005E6800 TBuf sblock1 4:8078A374 TBuf sblock0 4:804FD600
TBuf addr 5:005E6800 TBuf sblock1 5:8078A374 TBuf sblock0 5:804FD600
TBuf addr 6:005E6800 TBuf sblock1 6:8078A374 TBuf sblock0 6:804FD600
TBuf addr 7:005E6800 TBuf sblock1 7:8078A374 TBuf sblock0 7:804FD600
```

show pxf feature cef

To display PXF routing feature tables for Cisco Express Forwarding (CEF), use the **show pxf feature cef** EXEC command.

show pxf feature cef *entry*

Syntax Description

entry	Display PXF entry.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced.

Examples

The following is sample output from the **show pxf feature cef** command:

```
Router# show pxf feature cef entry
Shadow 16-4-4-8 PXF Mtrie:
  41 leaves, 1968 leaf bytes, 15 nodes, 267000 node bytes
  5 invalidations
  46 prefix updates
  refcounts: 66746 leaf, 66720 node

Prefix/Length        Refcount   Parent
0.0.0.0/0            62282
0.0.0.0/32           3          0.0.0.0/0
171.69.12.128/27     34         0.0.0.0/0
171.69.12.128/32     3          171.69.12.128/27
171.69.12.129/32     3          171.69.12.128/27
171.69.12.130/32     3          171.69.12.128/27
171.69.12.131/32     3          171.69.12.128/27
171.69.12.132/32     3          171.69.12.128/27
171.69.12.138/32     3          171.69.12.128/27
171.69.12.139/32     3          171.69.12.128/27
171.69.12.140/32     3          171.69.12.128/27
171.69.12.141/32     3          171.69.12.128/27
171.69.12.142/32     3          171.69.12.128/27
171.69.12.143/32     3          171.69.12.128/27
171.69.12.145/32     3          171.69.12.128/27
171.69.12.146/32     3          171.69.12.128/27
171.69.12.147/32     3          171.69.12.128/27

(display text omitted)
```

Related Commands

Command	Description
show pxf feature nat	Displays PXF routing feature tables for NAT.

show pxf feature nat

To display PXF routing tables for Network Address Translation (NAT), use the **show pxf feature nat** EXEC command.

show pxf feature nat [*entry* | *stat* | *tcp*]

Syntax Description

entry	Displays NAT information.
stat	Displays NAT processing information.
tcp	Displays NAT TCP logging information.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced.

Examples

The following is sample output from the **show pxf feature** *entry* command:

```
Router# show pxf feature nat entry
--- 171.69.12.175      192.168.0.129      ---                ---
--- 171.69.12.163      192.168.0.7        ---                ---
--- 171.69.12.161      192.168.0.13       ---                ---
--- 171.69.12.162      192.168.0.3        ---                ---
--- 171.69.12.165      192.168.0.8        ---                ---
--- 171.69.12.168      192.168.0.14       ---                ---
--- 171.69.12.170      192.168.0.12       ---                ---
--- 171.69.12.166      192.168.0.15       ---                ---
```

Related Commands

Command	Description
show pxf feature cef	Displays PXF routing feature tables for CEF.