Configuring IBM Channel Attach

This chapter describes how to configure the Cisco 7000 series mainframe Channel Interface Processor (CIP), which supports the IBM channel attach feature.

For hardware technical descriptions and information about installing the router interfaces, refer to the hardware installation and maintenance publication for your product. For command descriptions and usage information, refer to the chapter entitled "IBM Channel Attach Commands" of the *Router Products Command Reference* publication.

Cisco's Implementation of IBM Channel Attach

IBM (and compatible) mainframe hosts are connected to each other and to communication controllers through high-performance communication subsystems called mainframe channels. Cisco supports IBM channel attachment technologies, including both the fiber-optic Enterprise Systems Connection (ESCON) channel introduced on the ES/9000 mainframe and the parallel bus-and-tag channel supported on System 370 and later mainframes.

Cisco has implemented Common Link Access for Workstations (CLAW) support in the CIP, which is a link-level protocol used by channel-attached RISC System / 6000 series systems and by IBM 3172 devices running Transmission Control Protocol/Internet Protocol (TCP/IP) offload. The CLAW protocol improves efficiency of channel use and allows the CIP to provide the functionality of a 3172 in TCP/IP environments and support direct channel attachment. The output from TCP/IP mainframe processing is a series of IP datagrams that the router can switch without modifications.

The Cisco 7000 series configured with the CIP (and other interface processors) is an ideal connectivity hub for large corporate networks, providing routing services between mainframes and LANs:

- A Cisco 7000 series with a CIP can replace an IBM 3172 interconnect controller, enabling mainframe and peripheral access from LAN-based workstations.

- Because the number of network devices is reduced, a Cisco 7000 series with a CIP simplifies the network, especially in situations where a router can replace a 3172.

- To ensure 100 percent IBM compatibility, the Cisco ESCON Channel Adapter (ECA) adapter card for the CIP uses the IBM ESCON chipset.

IBM Channel Attach Hardware Requirements

Support for IBM channel attach requires the following hardware:

- A Cisco 7000 series with one available card slot

- A Channel Interface Processor (CIP) with one or two adapter cards (ECA, PCA, or a combination)

- All necessary cables for interconnecting the adapter cards to the mainframe or ESCON Director Switch

IBM Channel Attach Host Software Requirements

Your mainframe host software must meet the following minimum requirements:

- IBM TCP/IP for VM Version 2 Release 2, with PTF enhancements for RISC System / 6000 series ESCON support

- IBM TCP/IP for MVS Version 2 Release 2.1, with PTF enhancements for RISC System / 6000 series ESCON support

Interface Configuration Task List

You can perform the tasks in the following sections to configure and maintain IBM channel attach interfaces. In addition, several examples show how host configuration settings correlate to values used in the router configuration commands. The first section provides some background on the IBM channel attach feature and the Cisco 7000 series interfaces that support it.

- Understand the IBM Channel Attach Interface

- Select the Interface

- Configure IBM Channel Attach

- Select Host System Parameters

- Monitor and Maintain the Interface

See the end of this chapter for configuration examples.

Understand the IBM Channel Attach Interface

Support for IBM channel attach is provided on the Cisco 7000 series routers by the Channel Interface Processor (CIP) and an appropriate interface adapter card. With a CIP and the ESCON Channel Adapter (ECA) or bus and tag Parallel Channel Adapter (PCA), a Cisco 7000 series router can be directly connected to a mainframe, replacing the function of an IBM 3172 interconnect controller. This connectivity enables mainframe application and peripheral access from LAN-based workstations.

Transmission Control Protocol/Internet Protocol (TCP/IP) mainframe protocol environments for IBM operating systems Multiple Virtual Storage (MVS) and Virtual Machine (VM) are supported in the initial release. This support includes TCP/IP-based applications such as terminal emulation (Telnet), the File Transfer Protocol (FTP), Simple Mail Transfer Protocol (SMTP) and Network File System (NFS), a distributed file access system.

A single CIP can support up to two channel adapter cards in any combination. Because of this flexibility, upgrading from parallel bus and tag to ESCON is simplified. The CIP can be configured for ESCON support by replacing a parallel channel adapter with an ESCON adapter. Note that this upgrade procedure must be done by authorized service personnel.

A CIP configured with 8 megabytes of memory can support up to 128 common link access to workstation (CLAW) connections, or approximately 240 devices. Each CLAW connection requires two devices. Subsequent releases will support up to 256 CLAW connections per CIP, or a maximum of 128 CLAW connections per interface adapter card.

Use the **show extended channel** EXEC command to display current CIP status. This command provides a report for each physical interface configured to support IBM channel attach.

Select the Interface

Before you configure your channel attach interface, you must select the interface. Perform the following task in global configuration mode:

Task	Command
Select the channel attach interface and enter ingerface configuration mode.	**interface channel** *slot*/*port*

You need not add a space between the interface type (**channel**) and the slot and port number. For example, you can specify **interface channel 3/0** or **interface channel3/0**.

The following section describes how to configure your channel attach interface.

See the section "IBM Channel Attach Interface Configuration Examples" at the end of this chapter for example configuration commands.

Configure IBM Channel Attach

The following sections describe how to configure the IBM channel attach interface.

- Define the Routing Process
- Assign an IP Address
- Configure the IBM Channel Attach Interface
- Select a Data Rate for the Parallel Channel Adapter (PCA)
- Configure Other Interface Support

See the section "Select Host System Parameters" for guidelines on matching interface configuration values with host system values.

Define the Routing Process

You must configure the routing process that will be used by the router. We recommend using the enhanced IGRP routing process to perform IP routing on the IBM channel attach interface. Perform the following steps in global and router configuration mode:

Task	Command
Select the routing process, preferably EIGRP, and the autonomous system the router belongs to.	**router eigrp** *autonomous-system*
Define the directly connected networks that are part of the autonomous system.	**network** *address*

Assign an IP Address

You must assign an IP address to the ECA or PCA interface so that it can communicate with other devices (or tasks) on the network. The IP address you assign to the interface must be in the same subnetwork as the hosts with which you wish to communicate. Perform the following task in interface configuration mode:

Task	Command
Assign an IP address and network mask to the selected interface.	**ip address** *address mask*

Configure the IBM Channel Attach Interface

You must define the devices, or tasks supported on the interface. Some information you need to perform this task is derived from the following host system configuration files: MVSIOCP, IOCP, and the TCPIP configuration. Refer to the section "Select Host System Parameters" for guidelines and pointers.

Perform the following task in interface configuration mode:

Task	Command
Define the CLAW parameters for this device.	**claw** *path device-address ip-address host-name device-name host-app device-app*

See the section "IBM Channel Attach Interface Configuration Examples" at the end of this chapter for samples of **claw** commands for different configurations.

Select a Data Rate for the Parallel Channel Adapter (PCA)

When you configure a channel attach interface that supports a PCA adapter card, you must define a data rate of either 3 megabytes per second or 4.5 megabytes per second.

Task	Command
Define the PCA data transfer rate.	**channel-protocol** [**s** | **s4**]

Configure Other Interface Support

You can further define how the interface and the router interoperate. You can perform the following tasks to enhance the usefulness of IBM channel attach support:

Task	Command
Disable fast switching (IP route cache switching). Fast switching is on by default, but access lists can inhibit fast switching.	[**no**] **ip route-cache**
Use access lists to filter connections.	**access-list** *list* {**permit**	**deny** } *source source-mask*
Enable autonomous switching through either the silicon switching engine (SSE) or the CxBus controller.	**ip route-cache** [**cbus**	**sse**]
Include autonomous switching support for multiple IP datagram applications running on the same CIP, as required.	**ip route-cache same-interface**

Select Host System Parameters

This section describes how to correlate values found in the VM and MVS system IOCP files with the fields in the **claw** command. In addition, you will need configuration information from the host TCP/IP application configuration file. Refer to the following IBM operating system manuals for specific IOCP configuration statement details:

- *Transmission Control Protocol/Internet Protocol TCP/IP Version 2 Release 2.1 for MVS: Planning and Customization*, SC31-6085 (or later version)

- *Transmission Control Protocol/Internet Protocol TCP/IP Version 2 Release 2 for VM: Planning and Customization*, SC31-6082 (or later version)

Values from the Host IOCP File

When you define CLAW parameters, you must supply path information and device address information to support routing on an IBM channel. The path information can be simple, in the case of a channel directly attached to a router, or more challenging when the path includes an ESCON director switch or multiple image facility support.

First we will examine the **claw** command *path* argument. It is a concatenation of three hexadecimal numbers that represent the following values:

CLAW Path Argument Breakdown	Values	Description
Path	01–FF	For a directly attached ESCON channel or any parallel channel, this value is 01 *unless* the system administrator has configured another value.
		For a channel attached through an ESCON director switch, this value will be the path that, from the router point of view, exits the switch and attaches to the host.

CLAW Path Argument Breakdown	Values	Description
Channel logical address	0–F	For a directly attached ESCON channel or any parallel channel, this value is 0.
		If the host is running in Logical Partition (LPAR) mode, this is the channel logical address associated with the channel and defined in the IOCP.
		The default for this part of the path argument is 0.
		Otherwise, the channel logical address associated with the channel is defined in the IOCP.
Control unit logical address	0–F	For a directly attached ESCON channel or any parallel channel, this value defaults to 0. If this value is specified in the IOCP, match that value here.
		Otherwise, the control unit logical address is specified in the IOCP CNTLUNIT statement for the host channel in the CUADD parameter.

In Figure 26-1, two host systems connect to the ESCON director switch, on paths 23 and 29. The channels both exit the switch on path 1B and attach to Router A.
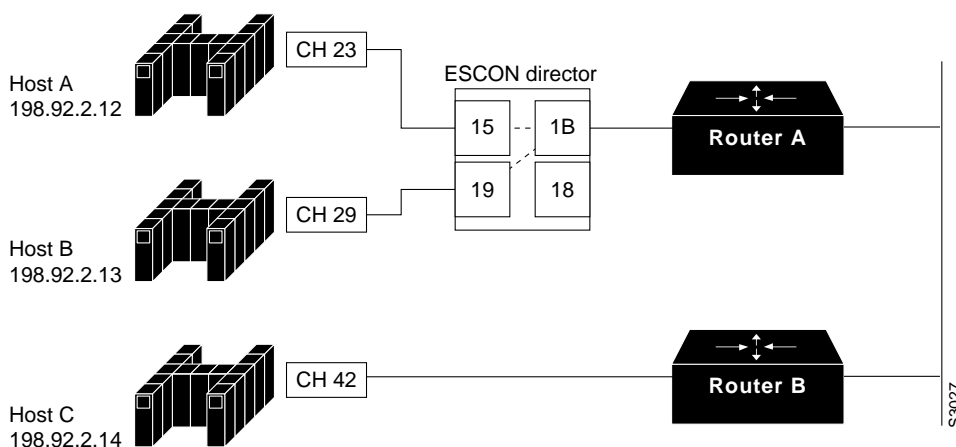

Figure 26-1 System with an ESCON Director Switch and a Directly Attached Channel

Note that the path between Host A and Host B is dynamically switched within the ESCON director. A third host is attached directly to Router B through path 42. The IOCP control unit statements would look something like the following examples:

- Host A

  ```
  CNTLUNIT CUNUMBER=0001, PATH=(23), LINK=1B, UNITADD=((00,64)), UNIT=SCTC, CUADD=F
  ```

- Host B

  ```
  CNTLUNIT CUNUMBER=0002, PATH=(29), LINK=1B, UNITADD=((00,64)), UNIT=SCTC, CUADD=A
  ```

- Host C

  ```
  CNTLUNIT CUNUMBER=000A, PATH=(42), UNIT=SCTC, UNITADD=((00,64))
  ```

Note If you use the Hardware Configuration Definition (HCD) program to generate an IOCP and your release of HCD does not support the value RS6K, you may need to set the control unit and device value to SCTC for your ESCON channels. A device mismatch error message will be displayed, but the device will come on line and operate correctly.

The system administrator would provide you with the values, for example 15 and 19, for the return channel attachment from the switch to each host. Given these values, the **claw** command *path* argument for the two channel attachments to Router A becomes

```
claw 150F
claw 190A
```

The **claw** command *path* argument for the directly attached channel to Router B is easy to determine:

```
claw 0100
```

Next, determine the **claw** command *device-address* argument value, which is shown as 00 in the UNITADD parameter for all three devices. This value can be any even value between 00 and 3E, as long as it matches an allowed UNITADD value in IOCP. The **claw** commands now become

- Router A

```
claw 150F 00
claw 190A 00
```

- Router B

```
claw 0100 02
```

Values from the Host TCPIP File

The remainder of the **claw** command arguments are derived from the DEVICE, LINK, and HOME statements in the host TCPIP configuration files. The statements will be similar to the following:

- Host A

```
DEVICE EVAL CLAW 500 VMSYSTEM C7000 NONE  20  20 4096 4096
LINK EVAL1 IP 0 EVAL
HOME 198.92.2.12   EVAL1
```

- Host B

```
DEVICE EVAL CLAW 600 STSYSTEM C7000 NONE  20  20 4096 4096
LINK EVAL1 IP 0 EVAL
HOME 198.92.2.13   EVAL1
```

- Host C

```
DEVICE EVAL CLAW 700 RDUSYSTM C7000 NONE  20  20 4096 4096
LINK EVAL1 IP 0 EVAL
HOME 198.92.2.14   EVAL1
```

The DEVICE statement lists the *host-name* and *device-name* values to use, which follows the CLAW 500 entry in the DEVICE statement.

The LINK statement links the device name, EVAL, to EVAL1. The IP address for EVAL1 appears in the HOME statement.

Based on this example, you can supply the remainder of the arguments for the sample **claw** commands:

- Router A

```
claw 150F 00 198.92.2.12 VMSYSTEM C7000 TCPIP TCPIP
claw 190A 00 198.92.2.13 STSYSTEM C7000 TCPIP TCPIP
```

- Router B

```
claw 0100 02 198.92.2.14 RDUSYSTM C7000 TCPIP TCPIP
```

Example of a Derived Value

When you have a directly attached channel, the system administrator might provide you with a system IODEVICE ADDRESS that you can use. In this case, you must work backwards through the IOCP file to locate the proper *device-address* argument value for the **claw** command.

In this first example, the IODEVICE ADDRESS value is 800. Using this number, you locate the IODEVICE ADDRESS statement in the IOCP file, which points you to the CNTLUNIT statement that contains the *device-address* argument value for the **claw** command:

```
IODEVICE ADDRESS=(0800,256),CUNUMBR=(0012),UNIT=SCTC
**** Address 800 points to CUNUMBR 0012 in the following statement

CNTLUNIT CUNUMBR=0012,PATH=(28),UNIT=SCTC,UNITADD=((00,256))
**** The device-address is the UNITADD value of 00
```

From this example, the **claw** command would be similar to the following:

```
claw 0100 00 197.91.2.12 CISCOVM EVAL TCPIP TCPIP
```

In the next example, the system administrator has given you an IODEVICE ADDRESS of 350, which does not correspond exactly to a value in the IOCP file. In this instance you must calculate an offset *device-address* argument value for the **claw** command:

```
IODEVICE ADDRESS=(0340,64),CUNUMBR=(0008),UNIT=SCTC
IODEVICE ADDRESS=(0380,64),CUNUMBR=(0009),UNIT=SCTC
**** Address 350 (340 + 10) is in the range covered by CUNUMBER 0008

CNTLUNIT CUNUMBR=0008,PATH=(24),UNIT=SCTC,UNITADD=((40,64)),SHARED=N, X
**** The device-address is the UNITADD value of 40, offset by 10
**** The device-address to use is 50
```

From this example, the **claw** command would be similar to the following:

```
claw 0100 50 197.91.2.12 CISCOVM EVAL TCPIP TCPIP
```

Note In the IOCP examples for the IODEVICE and CNTLUNIT statements, UNIT=SCTC is the usual value for ESCON channels. Parallel channels will have UNIT=3088 in the CNTLUNIT statement and UNIT=CTC in the IODEVICE statement.

Caution When you are running MVS, you must disable the missing interrupt handler (MIH) to avoid introducing errors into the CLAW algorithm. Refer to the IBM publication *Transmission Control Protocol/Internet Protocol TCP/IP Version 2 Release 2.1 for MVS: Planning and Customization* (publication SC31-6085 or later) for information on disabling the MIH.

Monitor and Maintain the Interface

You can perform the tasks in the following sections to monitor and maintain the interfaces:

- Monitor Interface Status
- Clear and Reset the Interface
- Shut Down and Restart an Interface
- Run CIP Interface Loopback Diagnostics

Monitor Interface Status

The software allows you to display information about the interface, including the version of the software and the hardware, the controller status, and statistics about the interfaces. The following table lists some of the interface monitoring tasks. (The full list of **show** commands can be displayed by entering the **show ?** command at the EXEC prompt.)

Perform the following commands in EXEC mode:

Task	Command
Display information about the channel interface processor (CIP) interfaces on the Cisco 7000 series. These commands display information that is specific to the interface hardware.	**show extended channel** *slot*/*port* **statistics** [*path* [*device-address*]]
	show extended channel *slot*/*port* **subchannel**
Display current internal status information for the interface controller cards in the Cisco 7000.	**show controllers** {**cxbus** | **fddi** | **serial** | **t1** | **token**}
Display the number of packets of each protocol type that have been sent through the interface for the Cisco 7000.	**show interfaces channel** [*slot*/*port*]
Display the hardware configuration, software version, the names and sources of configuration files, and the boot images.	**show version**[1]

1. This command is documented in the "System Image, Microcode Image, and Configuration File Load Commands" chapter of the *Router Products Command Reference* publication.

Clear and Reset the Interface

To clear the interface counters shown with the **show interfaces** command, enter the following command at the EXEC prompt:

Task	Command
Clear interface counters for the Cisco 7000.	**clear counters** [*slot*/*port*]

Note This command will not clear counters retrieved using SNMP, but only those seen with the EXEC **show interfaces** command.

Complete the following tasks in EXEC mode to clear and reset interfaces. Under normal circumstances, you do not need to clear the hardware logic on interfaces.

Task	Command
Reset the hardware logic on an interface.	**clear interface** *type number*

Shut Down and Restart an Interface

You can disable an interface. Doing so disables all functions on the specified interface and marks the interface as unavailable on all monitoring command displays. This information is communicated to other network servers through all dynamic routing protocols. The interface will not be mentioned in any routing updates. On the CIP with an ECA interface adapter, a command is sent to the host to inform it of the impending shutdown. On the CIP with a PCA interface adapter, the **shutdown** command disables the adapter card's transceivers and the PCA stops responding to all commands. A a select-out bypass relay must be manually set at the cable connecting to the PCA.

One reason to shut down an interface is if you want to change the interface type of a Cisco 7000 port online. To ensure that the system recognizes the new interface type, shut down the interface, then reenable it after changing the interface. Refer to your hardware documentation for more details.

To shut down an interface and then restart it, perform the following tasks in interface configuration mode:

Task	Command
Shut down an interface.	**shutdown**
Reenable an interface.	**no shutdown**

To check whether an interface is disabled, use the EXEC command **show interfaces**. An interface that has been shut down is shown as administratively down in the **show interfaces** command display.

Run CIP Interface Loopback Diagnostics

The CIP does not provide software loopback support. You can use special "wrap" plugs to perform hardware loopback with the ECA and PCA interface cards. Hardware loopback information is included in the hardware installation notes for the CIP.

IBM Channel Attach Interface Configuration Examples

The following sections include examples to help you understand some aspects of interface configuration:

- Routing Process Configuration Example
- IP Address and Network Mask Configuration Example
- CLAW Configuration Example
- Interface Shutdown and Startup Example

Routing Process Configuration Example

The following example configures an Enhanced IGRP routing process in autonomous system 127 and defines two networks to be advertised as originating within that autonomous system:

```
router eigrp 127
network 197.91.2.0
network 197.91.0.0
```

IP Address and Network Mask Configuration Example

The following example assigns an IP address and network mask to the IBM channel attach interface on the router:

```
ip address 197.91.2.5 255.255.255.0
```

CLAW Configuration Example

The following example configures the IBM channel attach interface to support a directly connected device:

```
claw 0100 00 197.91.0.21 VMSYSTEM C7000 TCPIP TCPIP
```

Interface Shutdown and Startup Example

The following example turns off the CIP interface in slot 2 at port 0:

```
interface channel 2/0
shutdown
```

The following example enables the CIP interface in slot 3 at port 0 that had been previously shut down:

```
interface channel 3/0
no shutdown
```