Configuring CLAW and TCP/IP Offload Support

This chapter provides information about configuring several related features on a Channel Interface Processor (CIP) or Channel Port Adapter (CPA) in a Cisco router to support TCP/IP environments. The features included in this chapter are Common Link Access to Workstation (CLAW), TCP/IP offload, and IP host backup.

This information is described in the following sections:

For a complete description of the commands in this chapter, refer to the "CLAW and TCP/IP Offload Commands" chapter of the *Cisco IOS Bridging and IBM Networking Command Reference* (Volume 2 of 2). To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

For information on the CMPC+ feature, which also supports TCP/IP environments, refer to the "Configuring CMPC+" chapter in this publication.

To identify the hardware platform or software image information associated with a feature, use the Feature Navigator on Cisco.com to search for information about the feature or refer to the software release notes for a specific release. For more information, see the "Identifying Platform Support for Cisco IOS Software Features" section on page lv in the "Using Cisco IOS Software" chapter.

Overview of CLAW, TCP/IP Offload, and IP Host Backup Support

This section provides an overview of the TCP/IP environments supported by the CLAW, TCP/IP offload, and IP host backup. It includes the following topics:

TCP/IP Environments Using CLAW

TCP/IP mainframe protocol environments for IBM operating systems Multiple Virtual Storage (MVS) and Virtual Machine (VM) are supported. 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. In addition, Internet Control Message Protocol (ICMP) and User Datagram Protocol (UDP) are supported.

The Cisco IOS implements the CLAW channel protocol to transport data between the mainframe and a Cisco Mainframe Channel Connection (CMCC) adapter in TCP/IP environments. Each CLAW connection requires two devices out of a maximum of 256. Although this allows for a maximum of 128 CLAW connections per interface, a maximum of 32 CLAW connections per interface is recommended.

The CLAW packing feature enables the transport of multiple IP packets in a single channel operation and significantly increases throughput performance between a mainframe and a CMCC adapter. Currently, IBM's TCP/IP stack does not support the CLAW packing feature.

The CLAW packing feature requires changes to the mainframe CLAW driver support. In partnership with Cisco Systems, Interlink Computer Science (now Sterling Software) has made the corresponding CLAW driver change to Cisco IOS for S/390 Release 2 and Interlink TCPaccess 5.2. Customers must make the necessary changes to their host configurations in order to enable the CLAW packing feature.

TCP/IP Offload Environments

TCP/IP mainframe protocol environments for IBM operating systems MVS, VM, and Transaction Processing Facility (TPF) are supported.

The TCP/IP offload feature for CMCC adapters delivers the same function as the TCP/IP offload function on the IBM 3172 Interconnect Controller (Model 3), but with increased performance.

Offload Alias Support

The Offload Alias feature allows multihomed IP addresses for offload devices. This feature enables dispatch-based load-balancing access to mainframe hosts through TCP/IP offload devices that are configured on a CMCC adapter. The Offload Alias feature supports load-balancing access to multiple hosts by allowing you to associate multiple real IP addresses with a virtual IP address at the offload device on a CMCC adapter. Each of the real IP addresses is associated with a common single virtual IP address, or alias, for client access.

Figure 1 shows an example of TCP/IP offload devices that are configured on two different CIP adapters, which are connected to multiple mainframe hosts using three different real IP addresses. The figure depicts the benefit that can be achieved when configuring offload alias support on a CMCC adapter in a networking environment that supports MultiNode Load Balancing (MNLB)—such as the MNLB Feature Set for LocalDirector.

The scenario shown in Figure 1 assumes that any of the configured hosts in the offload environment support the same services that a potential client seeks. A client specifies a virtual IP address, 10.2.33.88, as the destination address for those services. Using offload alias support, the virtual IP address 10.2.33.88 represents any of the three hosts (at real IP addresses 10.10.21.5, 10.10.21.3, or 10.10.22.4) as potential offload servers.

Upon receipt of the virtual IP address from a client, a networking architecture that supports MNLB can assess the load at any of the associated real IP addresses of the hosts supported by the offload devices. Based upon the load information, the load-balancing software forwards the packet to a particular real IP address. The destination IP address within the packet always appears as the virtual IP, or alias, address.

Figure 1   Two Offload Devices Using the Same Virtual IP Address to Access Multiple Real IP Addresses
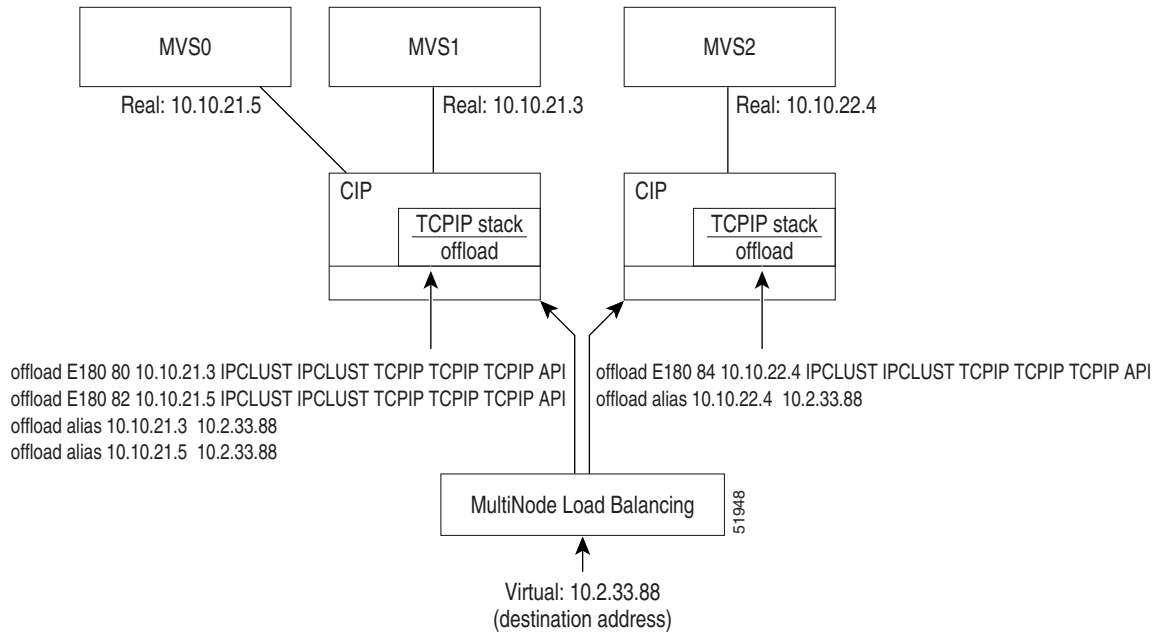
IP Host Backup Environments

You can connect multiple mainframes to a single CMCC adapter using ESCON channel attachment. Often these mainframes run using the ESCON Multiple Image Facility (EMIF), which permits the physical machine to be divided into multiple logical partitions (LPARs). By defining an unused partition on another mainframe, a user can move the operating system from a failed mainframe or mainframe partition to the unused partition. By having multiple paths to each device, the move is accomplished without changing the mainframe software. This function also permits moving an IP stack between multiple operating system images.

On the CMCC adapter, each IP connection is treated as a physical device. The CMCC adapter does not support multiple active paths to a single IP connection (or device). Prior to IP Host Backup, the router configuration had to be changed whenever the mainframe operating system was moved from one mainframe or LPAR to another. The IP Host Backup feature permits the mainframe operating system to be moved from one mainframe to another without requiring a change to the router configuration at the time of the move.

Note The IP Host Backup feature does not provide single system image or automatic failover to a waiting backup application. Host operator action on the mainframe is required in these instances.

Preparing to Configure CLAW, TCP/IP Offload and IP Host Backup Support

The following topics in this section provide information that is useful when you are planning to configure CLAW, TCP/IP offload, or IP host backup support:

Hardware and Software Requirements

This section provides information about the router and mainframe requirements to support CLAW, TCP/IP offload, or IP host backup support. The router requirements are the same to support all features.

Router Requirements

The CLAW, TCP/IP offload, and IP host backup features are supported on the following router platforms:

- Cisco 7500 series—Supports CIP adapters
- Cisco 7200 series—Supports the ECPA and PCPA adapters
- Cisco 7000 series with RSP7000—Supports CIP adapters

You must configure CLAW, TCP/IP offload, and IP host backup features on the physical interface of a CMCC adapter. For a CIP, the physical interface is either 0 or 1. For the CPA adapters, ECPA and PCPA, the physical interface is port 0.

Mainframe Requirements

The CMCC adapters provide support for IP clients to communicate with TCP/IP stacks on IBM hosts that are running the following operating systems:

- IBM Multiple Virtual Storage (MVS)
- OS/390
- Virtual Machine (VM)
- Transaction Processing Facility (TPF)—Supported by the TCP/IP offload feature only

Note OS/390 Version 2.5 and later does not support the TCP/IP offload feature on a CMCC adapter.

TCP/IP protocol services are supported by the following TCP/IP software on the host:

- IBM TCP/IP for MVS Version 2, Release 2.1 and later
- IBM TCP/IP for VM Version 2, Release 2 and later
- Cisco IOS for S/390 Release 1 and later—Interlink Computer Sciences TCP access for MVS

Note Certain Authorized Program Analysis Reports (APARs) and Program Temporary Fixes (PTFs) are required with the IBM TCP/IP software on MVS and VM including: PTF UN47759 (and later) and PTF UN51632 (APAR PN45287).

Mainframe Host Configuration Considerations

Configuring CLAW, TCP/IP offload, or IP host backup support requires that you perform tasks for configuration of the mainframe and the router sides of the network environment.

Often in the mixed network environment of mainframes and LANs, a systems programmer installs and maintains the mainframe side of the network, while a network engineer manages the routers on the LAN side of the network. In such an environment, the successful configuration of CLAW, TCP/IP offload, or IP host backup support requires the close coordination between these job functions at a customer site.

This chapter contains information for both the network engineer and the host systems programmer to properly configure the network devices for CLAW, TCP/IP offload, and IP host backup support. The tasks for configuring this support are organized by whether they are host-related configuration tasks or router-related configuration tasks. In addition, a topic for correlating the mainframe and router configuration is provided so that you can identify the dependencies between the host and router configuration elements and be sure that they are set up correctly.

Defining the Channel Subsystem for the Router

To establish the path and allocate the range of subchannel addresses that the CMCC adapter can use for the CLAW, TCP/IP offload, or IP host backup features, you need to specify the channel subsystem definitions in the Input/Output Control Program (IOCP) or Hardware Configuration Definition (HCD).

For more information about the statements that might be defined in an IOCP file for parallel channels and ESCON channels on the CIP or CPA, see the "Defining the Channel Subsystem for the Router" section in the "Configuring Cisco Mainframe Channel Connection Adapters" chapter of this guide.

Disabling the Missing Interrupt Handler

Because the appropriate configuration of the missing interrupt handler (MIH) varies according to the protocols and software releases used, Cisco offers the following guidance:

- For OS/390 releases Version 2 Release 4 and earlier, set the MIH to zero.

- For OS/390 releases later than Version 2 Release 4 and z/OS releases, refer to the following section of the z/OS Communications Server IP Configuration Reference: http://publibfp.boulder.ibm.com/cgi-bin/bookmgr/BOOKS/f1a1b420/1.2.13?SHELF=f1a1bk31&DT=20020604120755#HDRMOLLY

For information about how to disable the MIH for the unit addresses being used for your CMCC adapter configuration, see the section "Disabling the Missing Interrupt Handler" section in the "Configuring Cisco Mainframe Channel Connection Adapters" chapter of this publication.

Related Publications

The following mainframe-related publications might be useful when configuring TCP/IP on the mainframe to support CLAW, TCP/IP offload, and IP host backup support on a CMCC adapter in the router:

- *OS/390 eNetwork Communications Server: IP Planning and Migration Guide*, SC31-8512-02

- *OS/390 eNetwork Communications Server: IP Configuration Guide*, SC31-8513-02

- *OS/390 eNetwork Communications Server: IP User's Guide*, GC31-8514-02

- *OS/390 eNetwork Communications Server: IP Diagnosis*, SC31-8521-02

- *OS/390 eNetwork Communications Server: IP and SNA Codes*, SC31-8571-02

PROFILE.TCPIP Host Configuration Task List

Note The information in this section on configuring the PROFILE.TCPIP data set on the host is provided to help you correlate the host and router configurations. For the latest information about configuring TCP/IP support on the mainframe, refer to your host publications.

Complete the following tasks on the host to properly configure the PROFILE.TCPIP data set to support the CLAW feature:

Consider the following sample configuration statements when you perform the tasks to configure the PROFILE.TCPIP data set on the host. The names shown in bold and italic identify the relationship to some of the important configuration names within the PROFILE.TCPIP configuration.

Sample PROFILE.TCPIP Configuration for CLAW

```
; Device statement—Defines each CIP subchannel. Values CLAW and NONE
; are required. The read-size argument must be 4096.
;
; DEVICE device-name CLAW subchannel-address host-name device-name-on-router NONE
; read-buffers write-buffers read-size write-size
;
DEVICE CIP1 CLAW 762 CISCOVM CIP NONE 20 20 4096 4096
;
; Link statement—Defines a link name and type. Values "IP" and "0"
; are required for CLAW
;
; LINK link-name IP 0 device-name
;
LINK CIPL1 IP 0 CIP1
;
; Home statement—Specifies an IP address for a link
;
; HOME ip-address link-name

HOME 172.16.20.2 CIPL1
;
!
; Routing information (if you are not using the ROUTED SERVER)
GATEWAY
; NETWORK FIRST HOP  DRIVER    PCKT_SZ    SUBN_MSK        SUBN_VALUE
;
172.16     =         CIPL1     4096       0.0.255.0       0.0.20.0
DEFAULTNET 172.16.20.1 CIPL1   1500       0
!
;START statements—Starts the IP datagram (CLAW) device
;
; START device-name
;
START CIP1
!
```

Figure 1 shows the corresponding claw configuration on the router.

Sample CLAW Configuration on the Router

```
claw C010 62 172.16.20.2 CISCOVM CIP TCPIP TCPIP
```

See the "CLAW and TCP/IP Offload Support Configuration Examples" section on page 24 for more examples.

Defining the Device Statement

The DEVICE statement in the PROFILE.TCPIP data set defines the link type (CLAW) and a user-specified name for the CLAW device according to the following format:

```
DEVICE device-name CLAW subchannel-address host-name device-name-on-router NONE
read-buffers write-buffers read-size write-size
```

When you configure the DEVICE statement consider the following points:

- The user-specified *device-name* argument does not have any dependencies with the router configuration.

- The name following the DEVICE keyword must match the *device-name* argument in the corresponding LINK statement in the PROFILE.TCPIP data set.

- The name that you specify for the *device-name-on-router* argument must match the device name that you specify in the **claw** configuration command in the router. This is "CIP" in Figure 1.

- The CIP sends blocks up to 4096 in size. If the value for the read size is any smaller, you might have overruns, so the *read-size* argument must be 4096. The *write-size* argument should be less than or equal to 4096.

Defining the Link Statement for CLAW

The LINK statement for CLAW in the PROFILE.TCPIP data set specifies the link type and a name for the link according to the following format:

```
LINK link-name IP 0 device-name
```

When you configure the LINK statement for CLAW consider the following points:

- The user-specified *link-name* argument does not have any dependencies with the router configuration.

- "IP" and "0" are required values for CLAW.

- The name that you specify for the *device-name* argument in the LINK statement must match the *device-name* argument in the DEVICE statement. In Figure 1 this name is CIP1.

Defining the Link Statements for Offload

The LINK statements for offload support in the PROFILE.TCPIP data set specify the link type and a name for the link and the IP address of the TCP/IP stack in the router according to the following format:

```
LINK link1-name OFFLOADLINK1 1 device-name
```

```
LINK link2-name OFFLOADAPIBROAD ip-address device-name link1-name
```

Note The HOME statement is replaced by the second LINK statement in TCP/IP offload configuration.

When you configure the first LINK statement for offload consider the following points:

- The user-specified *link1-name* argument does not have any dependencies with the router configuration.
- "OFFLOADLINK1" and "1" are required values for offload support.
- The name that you specify for the *device-name* argument in the LINK statement must match the *device-name* argument in the DEVICE statement.

When you configure the second LINK statement for offload consider the following things:

- The user-specified *link2-name* argument does not have any dependencies with the router configuration.
- "OFFLOADAPIBROAD" is a required keyword.
- The *ip-address* argument in the HOME statement must match the *ip-address* argument that you specify in the **claw** configuration command in the router.
- The name that you specify for the *device-name* argument in the LINK statement must match the *device-name* argument in the DEVICE statement.
- The *link1-name* argument must match the link name in the first LINK statement.

Defining the Home Statement for CLAW

The HOME statement in the PROFILE.TCPIP data set specifies an IP address for a link according to the following format:

```
HOME ip-address link-name
```

When you configure the HOME statement consider the following points:

- The HOME statement is not used when configuring TCP/IP offload support.
- The *ip-address* argument in the LINK statement must match the *ip-address* argument that you specify in the **claw** configuration command in the router. This is "172.16.20.2" in Figure 1.
- The *link-name* argument in the HOME statement must match the *link-name* argument in the LINK statement. In Figure 1 this name is CIPL1.

Defining the Gateway Statement

The GATEWAY statement in the PROFILE.TCPIP data set defines a static route from the host to the router according to the following format:

```
GATEWAY network first-hop driver packet-size subnet-mask subnet-value
```

When you configure the GATEWAY statement consider the following points:

- Specify the value "=" in the *first-hop* argument to indicate the local network.
- The *driver* argument in the GATEWAY statement for CLAW must match the *link-name* in the LINK statement. In Figure 1 this name is CIPL1.
- The *driver* argument in the GATEWAY statement for offload must match the *link2-name* in the second LINK statement.
- The GATEWAY statement is not used if the host is using dynamic routing. For information about configuring dynamic routing, see the "Configuring Dynamic Routing" section on page 10.

Defining the Defaultnet Statement

The DEFAULTNET statement in the PROFILE.TCPIP data set defines the default gateway for the network according to the following format:

```
DEFAULTNET first-hop driver packet-size subnet-mask subnet-value
```

When you configure the DEFAULTNET statement consider the following points:

- Specify the IP address for the CMCC adapter in the *first-hop* argument.
- The *driver* argument in the GATEWAY statement must match the *link-name* in the LINK statement. In Figure 1 this name is CIPL1.

Defining the Start Statement

The START statement instructs the host to start the CLAW device when TCP/IP is started according to the following format:

```
START device-name
```

When you configure the START statement consider the following points:

- The *device-name* argument in the START statement must match the *device-name* in the DEVICE statement. In Figure 1 this name is CIP1.
- You must have a START statement for each device that you want TCP/IP to start.

Configuring Dynamic Routing

The BSDROUTINGPARMS statement in the PROFILE.TCPIP data set allows you to configure the host to support dynamic routing algorithms using Routing Information Protocol (RIP) with ROUTED or OROUTED.

Note Do not configure BSDROUTINGPARMS for OMPROUTE, which uses the Open Shortest Path First (OSPF) Protocol.

Configure the BSDROUTINGPARMS statement according to the following format:

```
BSDROUTINGPARMS [TRUE|FALSE]
link  maxmtu  metric  subnet-mask  dest-addr
ENDBSDROUTINGPARMS
```

The following example shows a dynamic routing configuration with the router IP address specified as a point-to-point link:

```
BSDROUTINGPARMS TRUE
CIPL1 4096 0 255.255.255.0 172.16.21.1
ENDBSDROUTINGPARMS
```

When you configure BSDROUTINGPARMS consider the following points:

- Do not configure the GATEWAY statement in PROFILE.TCPIP when you configure BSDROUTINGPARMS.

- The BSDROUTINGPARMS statement supports the following options:

    - TRUE—Maximum transmission unit (MTU) for the interface is specified by the *maxmtu* argument.

    - FALSE—Offnet traffic has an MTU size of 576 bytes.

- The *link-name* matches the *link-name* argument in the LINK statement.

- The *maxmtu* specifies the maximum MTU in bytes for the network.

- The *metric* is 0 to indicate that the network is directly connected to the host.

- The *subnet-mask* is the bit mask associated with the subnet for the link.

- The *dest-addr* specifies point-to-point links. Specify a value of "0" if the link is on a broadcast-capable network.

Configuring CLAW Support

The CLAW feature in Cisco IOS software implements the CLAW channel protocol to transport data between the mainframe host and a CMCC adapter in TCP/IP environments. This section describes the configuration tasks required to enable CLAW support on the mainframe and router and includes the following topics:

CLAW Configuration Guidelines

To configure the CLAW feature, you must configure the TCP/IP stack on the host and the CMCC adapter. Consider the following guidelines as you prepare to configure CLAW support:

- To define the host subchannel (or path) and device, use the **claw** command on the router. The **claw** command is configured on the CMCC adapter's physical interface (port 0 or 1 on a CIP; port 0 on a CPA).

- The host IOCP or HCD parameters must define a subchannel pair for use by the CLAW device on a CMCC adapter. The even address is used for host reads and the odd address is used for host writes.

- The PROFILE.TCPIP data set DEVICE statement on the host must specify the CLAW subchannel address defined in the host IOCP or HCD configuration.

- The host IOCP or HCD parameters must coordinate with the **claw** command parameters on the router to specify the subchannel path, device, and subchannel address.

- The PROFILE.TCPIP data set parameters on the host must coordinate with the **claw** command parameters on the router.

- Up to a maximum of 32 CLAW connections per interface are recommended.

- CLAW can coexist with TCP/IP offload, IP host backup, CSNA, CMPC, CMPC+ and TN3270 server features on the router.

CLAW Router Configuration Task List

The following sections describe how to configure a CMCC adapter for CLAW support. These tasks require configuration of the physical port on a CMCC adapter:

- Configuring the CLAW Subchannels, page 12
- Assigning an IP Address to the Network Interface, page 14
- Configuring Other Interface Support, page 14

Refer to the "CLAW and TCP/IP Offload Support Configuration Examples" section on page 24 to see an example of CLAW configurations.

Configuring the CLAW Subchannels

Configuring the CLAW subchannels establishes the physical path between the CMCC interface and the mainframe channel. You must define the devices, or tasks, supported on the interface. Some of the information that you need to perform this task is derived from the following host system configuration files: Channel subsystem definitions such as the IOCP or HCD, and the TCP/IP configuration.

The CLAW Packing feature requires changes to the mainframe CLAW driver support. In partnership with Cisco Systems, Interlink Computer Science has made the corresponding CLAW driver change to Cisco IOS software for S/390 Release 2 and Interlink TCPaccess 5.2. Configuration parameters in the host TCP/IP applications must change to enable the CLAW Packing feature.

To define a host subchannel supported by the CLAW feature, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface channel** *slot/port*	Selects the interface on which to configure CLAW support and enters interface configuration mode. The *port* value differs by the type of CMCC adapter:
		- CIP—*Port* value corresponds to the physical interface, which is port 0 or 1.
		- CPA—*Port* value corresponds to port 0.

Command	Purpose
Step 2 `Router(config-if)# claw` *path device-address ip-address host-name device-name host-app device-app* [**broadcast**] [**backup**]	Defines the CLAW subchannel device with the following arguments:

Continued description for Step 2:

The available options for this command are:

- *path*—Four-digit value that represents the channel path for the device. The path value is always 0100 for parallel channels.

- *device*—Unit address for the device on the subchannel.

- *ip-address*—IP address of the host. This address is specified in the HOME statement of the host TCP/IP configuration file.

- *host-name*—Name of the host. This name is specified in the DEVICE statement of the host TCP/IP configuration file.

- *device-name*—Name for the router's CMCC device. This name is specified in the DEVICE statement of the host TCP/IP configuration file.

- *host-app*—Host application name as specified in the host application file. If connected to the host using TCP/IP without CLAW packing, this value is **tcpip**. If attached to other applications, this value must match the value specified in that host application. To enable CLAW packing, this value is **packed**.

- *device-app*—CLAW workstation application name as specified in the host application file. If connected to the host using TCP/IP without CLAW packing, this value is **tcpip**. If attached to other applications, this value must match the value specified in that host application. To enable CLAW packing, this value is **packed**.

The available options for this command are:

- **broadcast**—(Optional) Enables broadcast forwarding to the host on the subchannel (for RIP updates).

- **backup**—(Optional) Enables the CLAW connection to be used as part of a backup group of CLAW connections for the specified IP address.

Use the **no claw** command to remove the CLAW subchannel device.

Mainframe Configuration Tips

- Configuring the subchannel information in the router requires that you correlate the *path* and *device* information from the IOCP or HCD file on the host.
  - The *path* argument is a four-digit hexadecimal value that concatenates the path value (2 digits), EMIF partition number (1 digit), and control unit logical address (1 digit).
  - The *device* argument is a valid number in the UNITADD range of the IOCP CNTLUNIT statement.

  For detailed information about how to determine the *path* and *device* values for the **claw** command, see the "Correlating Channel Configuration Parameters" section in the "Configuring Cisco Mainframe Channel Connection Adapters" chapter in this publication.

- Configuring the subchannel information in the router also requires that you correlate the *ip-address*, *host-name*, *device-name*, *host-app*, and *device-app* arguments with the TCP/IP configuration on the host. For a summary of how the mainframe and router options correlate, see the "Correlating the Router and Mainframe Configuration Elements" section on page 22.

Assigning an IP Address to the Network Interface

You must assign an IP address to the channel 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.

To assign an IP address to the network interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Assigns an IP address to the network interface.

Configuring Other Interface Support

To enhance the performance of the CLAW support, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	`Router(config)# interface channel slot/port`	Selects the CLAW interface on which to configure the options and enters interface configuration mode. The *port* value differs by the type of CMCC adapter: • CIP—*Port* value corresponds to the physical interface, which is port 0 or 1. • CPA—*Port* value corresponds to port 0.

Step 2	`Router(config-if)# ip mtu 4096`
	
	or
	
	`Router(config-if)# ip mtu 4092`
		Sets the MTU size of IP packets sent on the interface to 4096 bytes. The default MTU is 4472 bytes across the channel on a CMCC. The CLAW feature cannot accept packets larger than 4096 bytes on a CMCC.
		
		or
		
		Sets the MTU size of IP packets sent on the interface to 4092 bytes when running CLAW packing. The default MTU is 4472 bytes across the channel on a CMCC. The CLAW feature cannot accept packets larger than 4092. It cannot be 4096 due to the presence of a four byte length field that preceeds the packet when running CLAW packing.

Step 3	`Router(config-if)# ip route-cache same-interface`	(Optional) Includes fast switching support for multiple IP datagram applications running on the same CMCC adapter.
Step 4	`Router(config-if)# no ip redirects`	(Required when configuring host-to-host communications through the same interface) Disables the sending of ICMP redirect messages if the Cisco IOS software is forced to resend a packet through the same interface on which was received.

For additional information about configuring other CMCC adapter options such as the data rate for parallel channel interfaces, see the "Configuring Cisco Mainframe Channel Connection Adapters" chapter in this publication.

Configuring TCP/IP Offload Support

The TCP/IP Offload feature in Cisco IOS software implements TCP/IP processing on the router using the CLAW protocol. This section describes the configuration tasks required to enable TCP/IP offload support on the router and includes the following topics:

TCP/IP Offload Configuration Guidelines

To configure the TCP/IP Offload feature, you must configure the TCP/IP stack on the host and the CMCC adapter. Consider the following guidelines as you prepare to configure TCP/IP offload support:

- To define the host subchannel (or path) and device, use the **offload** command on the router. The **offload** command is configured on the CMCC adapter's physical interface (port 0 or 1 on a CIP; port 0 on a CPA).

- The host IOCP or HCD parameters must define a subchannel pair for use by the offload device on a CMCC adapter. The even address is used for host reads and the odd address is used for host writes.

- The PROFILE.TCPIP data set DEVICE statement on the host must specify the offload subchannel address defined in the host IOCP or HCD configuration.

- The host IOCP or HCD parameters must coordinate with the **offload** command parameters on the router to specify the subchannel path, device, and subchannel address.

- The PROFILE.TCPIP data set parameters on the host must coordinate with the **offload** command parameters on the router.

- TCP/IP offload uses CLAW and can coexist with IP host backup, CMPC, CMPC+ and TN3270 server features on the router. It is important to be sure that the SAPs used for these entities are unique.

TCP/IP Offload Router Configuration Task List

The following sections describe how to configure a CMCC adapter for TCP/IP offload support. These tasks require configuration of the physical port on a CMCC adapter:

- Configuring the Offload Subchannels, page 17
- Assigning an IP Address to the Network Interface, page 19
- Configuring Offload Alias Support, page 19
- Configuring Other Interface Support, page 20

Refer to the "CLAW and TCP/IP Offload Support Configuration Examples" section on page 24 to see an example of an offload configuration.

Configuring the Offload Subchannels

Configuring the offload subchannels establishes the physical path between the CMCC interface and the mainframe channel. You must define the devices, or tasks, supported on the interface. Some of the information that you need to perform this task is derived from the following host system configuration files: Channel subsystem definitions such as the IOCP or HCD, and the TCP/IP configuration.

To define a host subchannel supported by the offload feature, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface channel** *slot*/*port*	Selects the interface on which to configure offload support and enters interface configuration mode. The *port* value differs by the type of CMCC adapter: • CIP—*port* value corresponds to the physical interface, which is port 0 or 1. • CPA—*port* value corresponds to port 0.
Step 2	Router(config-if)# **offload** *path device-address ip-address host-name device-name host-ip-link device-ip-link host-api-link device-api-link* [**broadcast**][**backup**]	Defines the offload subchannel device with the following arguments: • *path*—Four-digit value that represents the channel path for the device. The path value is always 0100 for parallel channels. • *device*—Unit address for the device on the subchannel. • *ip-address*—IP address of the host. This address is specified in the second LINK statement of the host TCP/IP configuration file. • *host-name*—Name of the host. This name is specified in the DEVICE statement of the host TCP/IP configuration file. • *device-name*—Name for the router's CMCC device. This name is specified in the DEVICE statement of the host TCP/IP configuration file. • *host-ip-link*—CLAW host link name as specified by the host application. For IBM VM and MVS TCP/IP stacks, this value is always **tcpip**. • *device-ip-link*—CLAW workstation link name as specified by the host application. For IBM VM and MVS TCP/IP stacks, this value is always **tcpip**. • *host-api-link*—CLAW host link name for the application programming interface (API) link as specified by the host application. For IBM VM and MVS TCP/IP stacks, this value is always **tcpip**. • *device-api-link*—Offload link name for the API link as specified by the host application. For IBM VM and MVS TCP/IP stacks, this value is always **api**. The available options for this command are: • **broadcast**—(Optional) Enables broadcast forwarding to the host on the subchannel (for RIP updates). • **backup**—(Optional) Enables the offload connection to be used as part of a backup group of offload connections for the specified IP address.

Use the **no offload** command to remove the offload subchannel device.

Mainframe Configuration Tips

- Configuring the subchannel information in the router requires that you correlate the *path* and *device* information from the IOCP or HCD file on the host.

    - The *path* argument is a four-digit hexadecimal value that concatenates the path value (two digits), EMIF partition number (one digit), and control unit logical address (one digit).

    - The *device* argument is a valid number in the UNITADD range of the IOCP CNTLUNIT statement.

    For detailed information about how to determine the *path* and *device* values for the **offload** command, see the "Correlating Channel Configuration Parameters" section in the "Configuring Cisco Mainframe Channel Connection Adapters" chapter in this publication.

- Configuring the subchannel information in the router also requires that you correlate the *ip-address*, *host-name*, and *device-name* arguments with the TCP/IP configuration on the host. For a summary of how the mainframe and router options correlate, see the "Correlating the Router and Mainframe Configuration Elements" section on page 22.

Assigning an IP Address to the Network Interface

You must assign an IP address to the channel 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.

To assign an IP address to the network interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Assigns an IP address to the network interface.

Configuring Offload Alias Support

The Offload Alias feature allows you to assign up to eight virtual IP addresses to a single real IP address for an offload device. You must configure TCP/IP offload support before configuring support for offload aliases. Offload aliases are configured on the physical interface of a CMCC adapter.

To configure offload alias support on a CMCC adapter, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **offload alias** *real-ip alias-ip*	Assigns a virtual IP address (alias) to the real IP address of an offload device.

Use the **no offload alias** command to remove the alias IP address.

Verifying Offload Alias Configuration

To configure and verify offload alias support on a CMCC adapter, perform the following steps:

Step 1 Configure offload and offload alias support on the CMCC adapter as shown in the following example:

```
interface channel 3/1
 ip address 10.10.21.1 255.255.255.0
 offload E180 83 10.10.21.3 IPCLUST IPCLUST TCPIP TCPIP TCPIP API
 offload alias 10.10.21.3 10.2.33.88
```

Step 2 Create a static route from the alias IP address to the real IP address as shown in the following example:

```
ip route 10.2.33.88 255.255.255.255 10.10.21.3
```

Step 3 Run a server, such as Telnet, on the host supported by the offload device.

Step 4 From a client device, run Telnet to the host using the alias IP address, which is 10.2.33.88 in this configuration example.

Configuring Other Interface Support

To enhance the performance of offload support, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface channel** *slot/port*	Selects the CLAW interface on which to configure the options and enters interface configuration mode. The *port* value differs by the type of CMCC adapter: • CIP—*port* value corresponds to the physical interface, which is port 0 or 1. • CPA—*port* value corresponds to port 0.
Step 2	Router(config-if)# **ip mtu 4096**	(Recommended for CPA interfaces) Sets the MTU size of IP packets sent on the interface to 4096 bytes. The default MTU is 4472 bytes across the channel on a CPA. Specifying 4096 eliminates fragmentation and increases performance.
Step 3	Router(config-if)# **ip route-cache same-interface**	(Optional) Includes fast switching support for multiple IP datagram applications running on the same CMCC adapter.
Step 4	Router(config-if)# **no ip redirects**	(Required when configuring host-to-host communications through the same interface) Disables the Internet Control Message Protocol (ICMP) flow that notifies the router of a better path when frames are being sent from one host to another host through the router.

For additional information about configuring other CMCC adapter options such as the data rate for parallel channel interfaces, see the "Configuring Cisco Mainframe Channel Connection Adapters" chapter in this publication.

IP Host Backup Support Configuration Task List

The following sections describe how to configure a CMCC adapter for IP Host Backup support. With IP Host Backup, you can configure a backup group for each CLAW or offload device, one path at a time, or you can specify a group of IP host paths and then configure which CLAW or offload IP addresses are used with those paths. Using the second method, specifying paths, provides a shortcut to the one at a time method.

- Configuring a CLAW IP Host Backup Group, page 21
- Configuring an Offload IP Host Backup Group, page 21
- Configuring an IP Host Backup Group Using Paths, page 22

Configuring a CLAW IP Host Backup Group

To configure the CLAW IP Host Backup, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **claw** *path device-address ip-address host-name device-name host-app device-app* [**broadcast**] **backup**	Defines the CLAW subchannel device for backup support.

For more information about configuring the **claw** command, see the "Configuring CLAW Support" section on page 11.

Configuring an Offload IP Host Backup Group

To configure the Offload IP Host backup, use the following command in interface configuration mode to configure an Offload device (read and write subchannel) for communication with a mainframe TCP/IP stack in Offload mode:

Command	Purpose
Router(config-if)# **offload** *path device-address ip-address host-name device-name host-ip-link device-ip-link host-api-link device-api-link* [**broadcast**] **backup**	Defines the offload subchannel device for backup support.

For more information about configuring the **offload** command, see the "Configuring TCP/IP Offload Support" section on page 15.

Configuring an IP Host Backup Group Using Paths

You can define a backup group by specifying a path, or group of paths, that are used as the IP Host Backup. Under the backup group, you can have multiple backup connections defined that all use the same IP address.

To configure the IP Host Backup using paths, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface channel** *slot/port*	Selects the interface on which to configure the IP host backup paths and enters interface configuration mode. The *port* value differs by the type of CMCC adapter: • CIP—*port* value corresponds to the physical interface, which is port 0 or 1. • CPA—*port* value corresponds to port 0.
Step 2	Router(config-if)# **path** *path* [[*path ...*]]	Defines the backup path or paths for this group and enters IP Host Backup configuration mode.
Step 3	Router(config-if-path)# **claw** *device-address ip-address host-name device-name host-app device-app* [**broadcast**]	Defines the CLAW parameters for this device.
Step 4	Router(config-if-path)# **offload** *device-address ip-address host-name host-ip-link device-ip-link host-api-link device-api-link* [**broadcast**]	Defines the offload parameters for this device.
Step 5	Router(config-if-path)# **exit**	Exits IP Host Backup configuration mode and returns to interface configuration mode.

Correlating the Router and Mainframe Configuration Elements

Table 1 shows a summary of the configuration elements on the router and host that must be correlated for proper operation of CLAW and TCP/IP offload support. The column labeled "Configuration Element" identifies the type of entity to be configured. The columns labeled "Router Configuration" and "Mainframe Configuration" identify the related parameters on the router and the mainframe whose values must be compatible or match.

Table 1   *Relationship of Router and Mainframe Configuration Elements*

Configuration Element	Router Configuration	Mainframe Configuration
Subchannels	*path* and *device* arguments of the **claw** and **offload** commands	RESOURCE PARTITION, CHPID, and CNTLUNIT statements of the IOCP definition defining the following parameters for the CLAW or offload channel path: • LPAR number (if defined) in the RESOURCE PARTITION and CHPID statements—Specify in the third digit of the *path* argument in the router **claw** and **offload** commands. • CUADD value (if defined) in the CNTLUNIT statement—Specify in the fourth digit of the *path* argument in the router **claw** and **offload** commands. • Available device address in the UNITADD parameter of the CNTLUNIT statement—Specify in the *device* argument of the router **claw** and **offload** commands.
Host IP address	*ip-address* argument of the **claw** and **offload** commands	• For CLAW—*ip-address* argument in the HOME statement of the PROFILE.TCPIP data set. • For offload—*ip-address* in the second LINK statement of the PROFILE.TCPIP data set.
Host name	*host-name* argument of the **claw** and **offload** commands	*host-name* argument in the DEVICE statement of the PROFILE.TCPIP data set.
Device name	*device-name* argument of the **claw** and **offload** commands	*device-name* argument in the DEVICE and statement of the PROFILE.TCPIP data set.

Monitoring and Maintaining CLAW and TCP/IP Offload

To monitor CMCC adapter interface status, you can display information about the interface, including the version of the software and the hardware, the controller status, and statistics about the interfaces. In addition, you can display information about feature-related statistics on the CMCC adapter. This section lists some additional commands that are useful when monitoring CMCC adapter interfaces that are configured for TCP/IP environments.

For a complete list of the **show** commands that are related to monitoring CMCC adapter interfaces, see the "Configuring Cisco Mainframe Channel Connection Adapters" chapter in this publication. To display the full list of **show** commands, enter **show ?** at the EXEC prompt.

To display information related to CLAW and TCP/IP offload configurations, use the following commands in EXEC mode:

Command	Purpose
Router# **show extended channel** *slot*/*port* **backup** [*ip-address*]	Displays information about CLAW and offload commands for each backup group.
Router# **show extended channel** *slot*/*port* **icmp-stack** [*path* [*ip-address*]]	Displays information about the ICMP stack running on the CMCC adapter interfaces.
Router# **show extended channel** *slot*/*port* **ip-stack** [*ip-address*]	Displays information about the IP stack running on the CMCC adapter interfaces.
Router# **show extended channel** *slot*/*port* **packing names** [*path* [*device*]]	Displays CLAW packing names and their connection state.
Router# **show extended channel** *slot*/*port* **packing stats** [*path*[*device*]]	Displays CLAW packing statistics.
Router# **show extended channel** *slot*/*port* **tcp-connections** [[**loc-ip-addr**[*loc-port*[*rem-ip-addr*[*rem-port*]] [**detail**|**summary**]	Displays information about the TCP sockets on a channel interface that is configured for offload.
Router# **show extended channel** *slot*/*port* **tcp-stack** [*ip-address*]	Displays information about the TCP stack running on the CMCC adapter interfaces that are configured for offload.

CLAW and TCP/IP Offload Support Configuration Examples

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

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 00 197.91.2.2 VMSYSTEM C7000 TCPIP TCPIP
```

CLAW Packing Configuration Example

The following example configures the IBM channel attach interface to support CLAW packing on HOSTA and HOSTC and the nonpacked version of CLAW on HOSTB:

```
interface Channel0/0
ip mtu 4092
  ip address 172.18.4.49 255.255.255.248
  no keepalive
  claw C010 F2 172.18.4.50 HOSTA RTRA PACKED PACKED
  claw C020 F4 172.18.4.52 HOSTB RTRA TCPIP TCPIP
  claw C030 F6 172.18.4.53 HOSTC RTRA PACKED PACKED
```

The following example shows a CLAW definition in the host configuration file for Cisco IOS/390:

```
000100 *-------------------------------------------
000200 * Member: IOS390R2.V510.PARM(TCPCFGxx)
000300 * Description: TCP task group configuration
000400 *-------------------------------------------
000500
000600 * Define the virtual medium
000700
000800 MEDIA VIRTUAL MTU(4096) NAME(LOOPBACK)
000900
001000 * Define the physical medium
001100
001200 MEDIA CLAW    MTU(4096) NAME(ROGCLAW) ASSIST
001300
001400 * Define the host
001500
001600 NETWORK IPADDRESS(172.18.4.50)
001700      SUBNET(255.255.255.248)
001800
001900 *
002000
002100 CLAW DEVADDR(8f2)
002200      BUFSIZE(32768)
002300      IBUF(5)
002400      OBUF(5)
002500      RESTART(60)
002600      HOSTNAME(HOSTA)
002700      WSNAME(RTRA)
002800      START
002900      PACKED
003000
003100 * Define gateway
003200
003300 ROUTE DEST(0.0.0.0) ROUTE(172.18.4.49)
003400
003500 * Define the transport pr
003600
003700 TCP  MAXRCVBUF(131072)
003800      MAXSNDBUF(131072)
003900      DEFRCVBUF(131072)
004000      DEFSNDBUF(131072)
004100      DELAYACK(2)
004200      FASTRX(3)
004300      MAXRXMIT(18)
004400      MINDEV(90)
004500      PORTUSE(1:4095)
004600      PORTASGN(4096:8191)
004700
```

```
004800 UDP  MAXRCVBUF(64000)005200      PORTUS
004900      MAXSNDBUF(64000)
005000      DEFRCVBUF(64000)
005100      DEFSNDBUF(64000)005300      PORTAS
005200      PORTUSE(1:4095)
005300      PORTASGN(4096:8191)
005400
005500 RAW  MAXRCV
005600      MAXSND
005700
```

TCP/IP Offload Configuration Example

The following example consists of the mainframe host profile statements, buffer poolsize recommendations, and router configuration statements for the network shown in Figure 2.

Figure 2   Offload Network Configuration Block Diagram

.
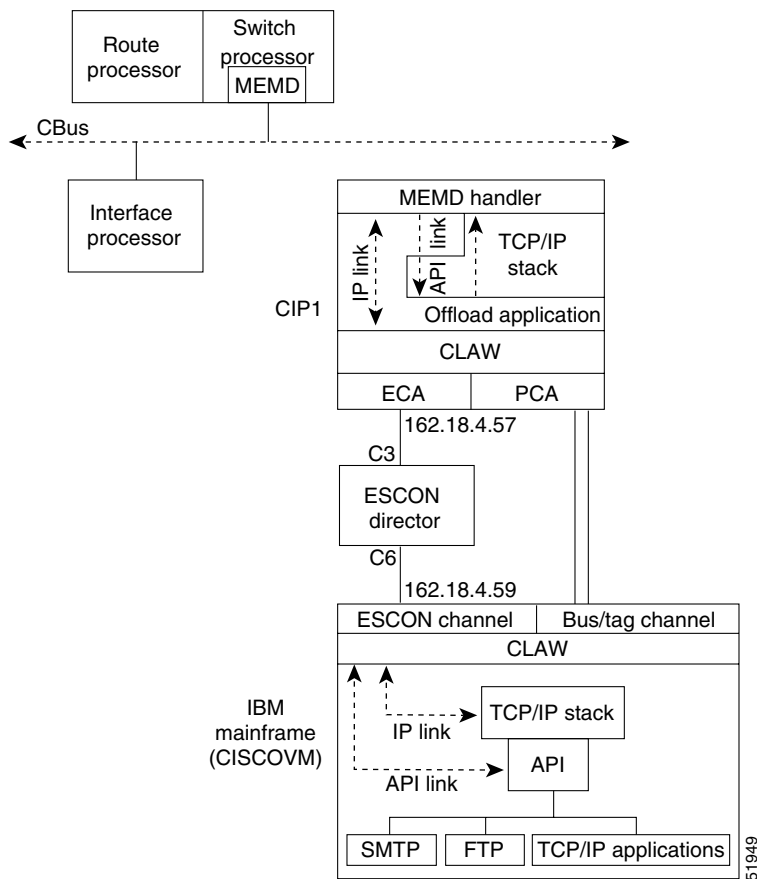
Host Profile Statements

```
; Device statement
DEVICE OFF CLAW 762 CISCOVM CIP1 NONE 20 20 4096 4096
!
; Link Statements (both needed)
LINK OFFL OFFLOADLINK1 1 OFF
LINK MEMD OFFLOADAPIBROAD 162.18.4.59 OFF OFFL
```

```
!
; Home Statement
; (No additional home statements are added for offload)
!
!
; Routing information (if you are not using the ROUTED SERVER)
GATEWAY
; NETWORK FIRST HOP  DRIVER    PCKT_SZ    SUBN_MSK        SUBN_VALUE
162.18       =       MEMD      4096       0.0.255.248      0.0.4.56
DEFAULTNET   =       MEMD      1500       0
!
;START statements
START OFF
!
```

Router Configuration Statements

The following statements configure the offload feature in the router. When you configure a host-to-host communication through the same channel interface, include the **no ip redirects** and **ip route-cache same-interface** commands:

```
interface Channel0/0
 ip address 162.18.4.57 255.255.255.248
 no ip redirects
 ip route-cache same-interface
no keepalive
 offload C300 62 162.18.4.59 CISCOVM CIP1 TCPIP TCPIP TCPIP API
```

Offload Alias Configuration Example

The following example shows an offload alias configuration on two routers with CIP adapters that provide offload support to three MVS hosts.

Figure 3 shows the architecture for this example and the relationship of the IP addresses on the host and offload devices. The alias IP address for each of the MVS hosts is 10.2.33.88 in this example. Each host has a unique real IP address that is associated with the alias IP address in the offload configuration on the CMCC adapter.

Figure 3   Offload Alias Support on Multiple CMCC Adapters to Multiple Hosts
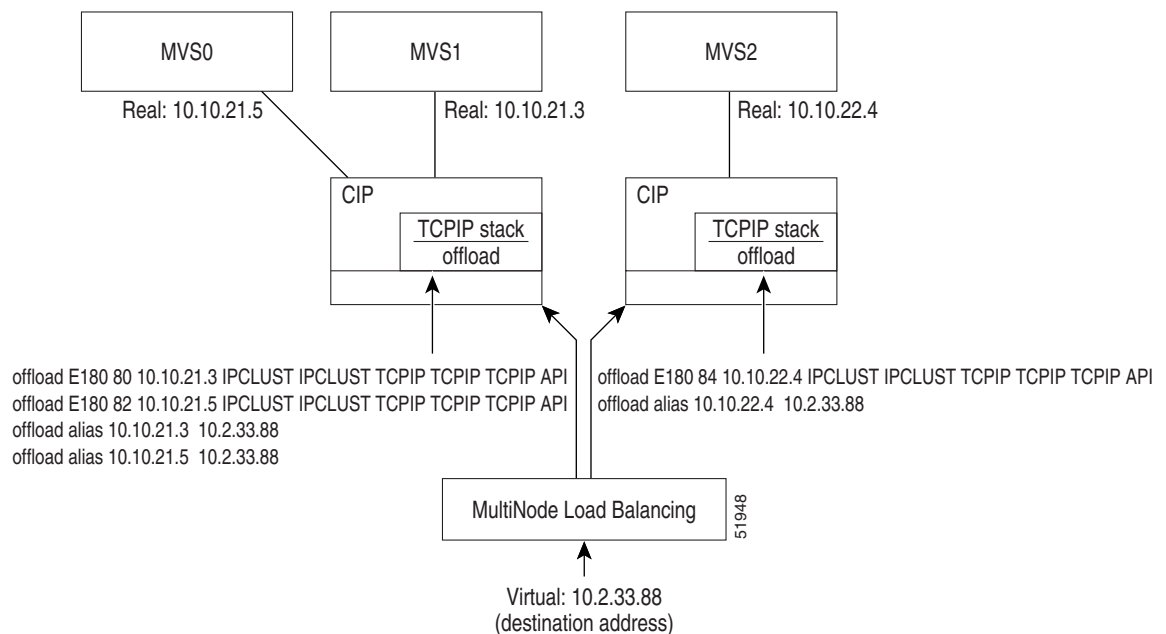
Router 1 Configuration

```
! Select the physical channel interface
!
interface channel 3/1
!
! Assign an IP address to the channel interface
!
 ip address 10.10.21.1 255.255.255.0
!
! Configure other router network characteristics
!
 no ip directed-broadcast
 ip route-cache flow
 no ip mroute-cache
 no ip redirects
 no keepalive
!
! Configure TCP/IP offload and alias support to MVS0 and MVS1
!
offload E180 80 10.10.21.3 IPCLUST IPCLUST TCPIP TCPIP TCPIP API
offload E180 82 10.10.31.5 IPCLUST IPCLUST TCPIP TCPIP TCPIP API
offload alias 10.10.21.3 10.2.33.88
offload alias 10.10.31.5 10.2.33.88
```

Router 2 Configuration

```
! Select the physical channel interface
!
interface channel 3/1
!
! Assign an IP address to the channel interface
!
 ip address 10.10.22.2 255.255.255.0
!
! Configure other router network characteristics
!
 no ip directed-broadcast
 ip route-cache flow
 no ip mroute-cache
 no ip redirects
 no keepalive
!
! Configure TCP/IP offload and alias support to MVS2
!
offload E180 84 10.10.22.4 IPCLUST IPCLUST TCPIP TCPIP TCPIP API
offload alias 10.10.22.4 10.2.33.88
```

IP Host Backup Configuration Example

Figure 4 shows the backup connection occurring between System B Mainframe 3 when Mainframe 2 fails.

The intent of this backup configuration is that the system named A will be loaded on one of the mainframes in LPAR1 on that mainframe. The DASD for that system will be shared among all the mainframes but only one of them will ever IPL the system at one time. The same holds for LPAR2 and LPAR3.

The ESCON director has the following connections:

- Cisco 7500 series router with a CIP connected to port C5

- Mainframe1 connected to C0

- Mainframe2 connected to C1

- Mainframe3 connected to C2
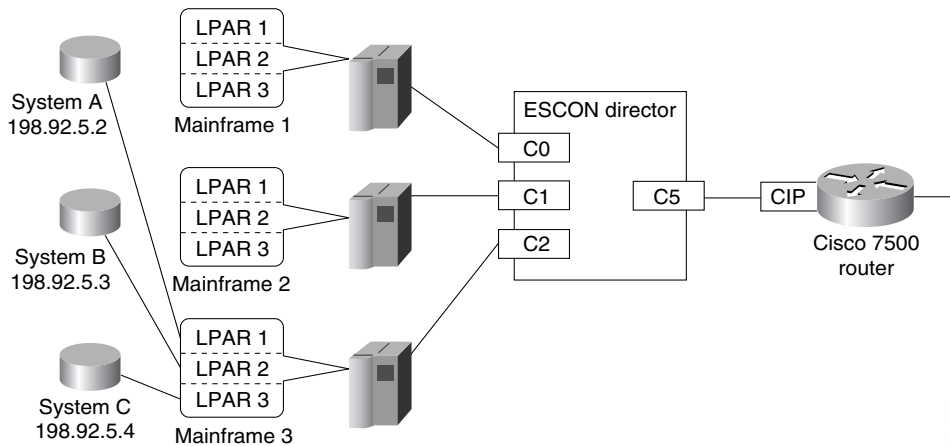
Figure 4   *IP Host Backup Configuration*
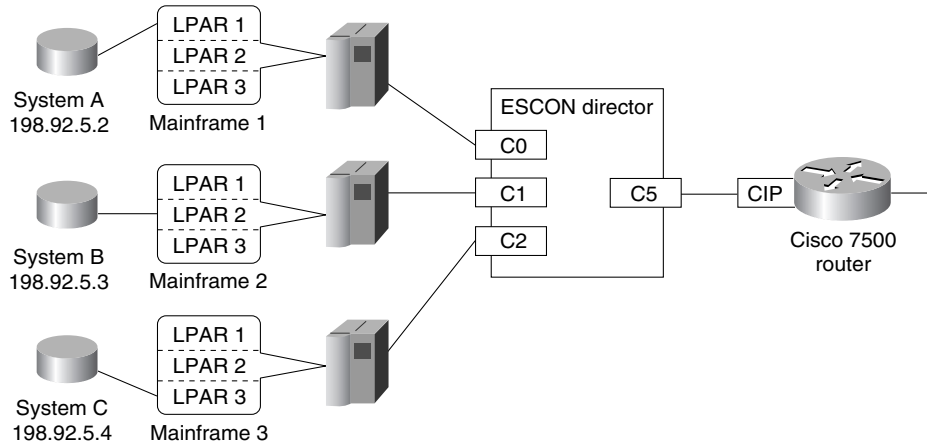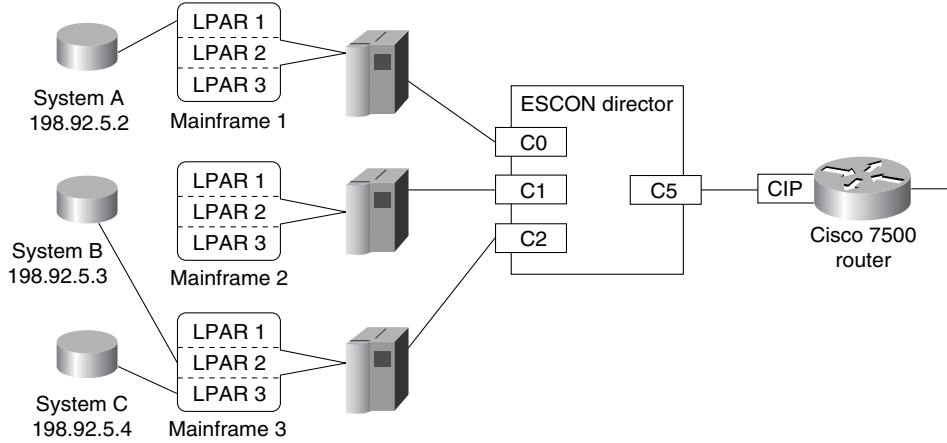
The following examples show how to configure IP Host Backup for three mainframe hosts, Mainframe 1, Mainframe 2, and Mainframe 3, as shown in Figure 4. Each mainframe is configured for at least three logical partitions (LPARs).

Excerpts from the host TCP/IP profiles show how the host might be configured. Excerpts from the router configuration show how the IP Host Backup configuration statements are configured.

Host TCP/IP Profiles

The DEVICE and HOME statements in the nine TCP/IP profiles are similar to the following:

```
LPAR1 (mainframes 1, 2, 3):
DEVICE CIP1 CLAW 630 LPAR1 CIP1 NONE 20 20 4096 4096
LINK CIP1L IP 0 CIP1
HOME
 198.92.5.2 CIP1L

LPAR2 (mainframes 1, 2, 3):
DEVICE CIP1 CLAW 730 LPAR1 CIP1 NONE 20 20 4096 4096
LINK CIP1L IP 0 CIP1
HOME
 198.92.5.3 CIP1L

LPAR3 (mainframes 1, 2, 3):
DEVICE CIP1 CLAW 830 LPAR1 CIP1 NONE 20 20 4096 4096
LINK CIP1L IP 0 CIP1
HOME
 198.92.5.4 CIP1L
```

Router Configuration

On the router, the CIP is located in slot 3 and port 1 is connected to the ESCON director. The **path** commands define the group of paths that are used as the IP Host Backup.

```
interface channel 3/1
 ip address 198.92.5.1 255.255.255.128
 path c010 c110 c210
   claw 30 198.92.5.2 lpar1 cip1 tcpip tcpip
 path c020 c120 c220
   claw 30 198.92.5.3 lpar2 cip1 tcpip tcpip
 path c030 c130 c230
   claw 30 198.92.5.4 lpar3 cip1 tcpip tcpip
```