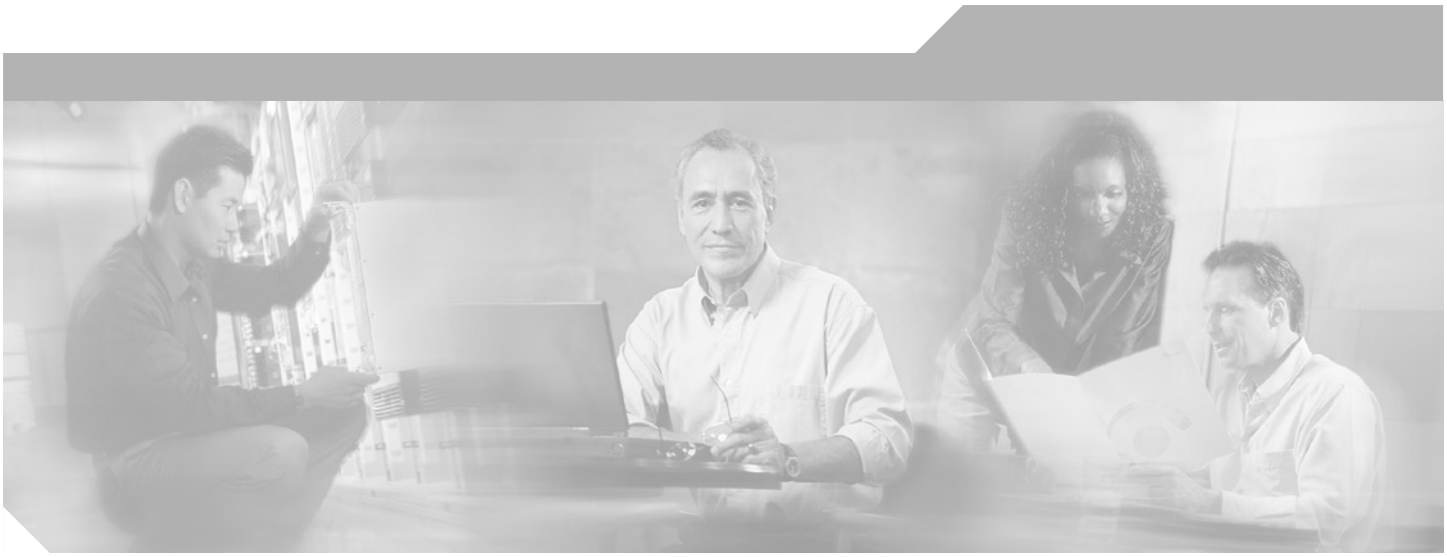

Cisco MWR 1900 Mobile Wireless Edge Router Software Configuration Guide

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Cisco MWR 1900 Mobile Wireless Edge Router Software Configuration Guide

CONTENTS

About This Guide

This preface discusses the objectives, audience, organization, and conventions of this software configuration guide, and where to get the latest version of this guide.

Objectives

This guide explains how to configure features that enable the MWR 1900 to be used in an IP-RAN solution.

Audience

This publication is designed for the person who will be responsible for configuring the router. This guide is intended for the following audiences:

- Customers with technical networking background and experience
- System administrators who are familiar with the fundamentals of router-based internetworking, but who might not be familiar with Cisco IOS software
- System administrators who are responsible for installing and configuring internetworking equipment, and who are familiar with Cisco IOS software

Organization

The major sections of this software configuration guide include:

Chapter	Title	Description
Chapter 1	Overview of the MWR 1900	Describes the purpose of the MWR 1900 and its unique software features.
Chapter 2	First-Time Configuration	Discusses using the setup command facility to configure basic attributes of your router.
Chapter 3	Cisco IOS Software Basics	Describes what you need to know about the Cisco IOS software.

Chapter	Title	Description
Chapter 4	Configuring with the Command-Line Interface	Describes how to use the Cisco IOS software command-line interface (CLI) to configure basic router functionality.
Chapter 5	Command Reference	Provides information about new and changed commands.

Document Conventions

This publication uses the following conventions to convey instructions and information.

Convention	Description
boldface font	Commands and keywords.
italic font	Variables for which you supply values.
[ ]	Keywords or arguments that appear within square brackets are optional.
{x | y | z}	A choice of required keywords appears in braces separated by vertical bars. You must select one.
`screen font`	Examples of information displayed on the screen.
boldface screen font	Examples of information you must enter.
< >	Nonprinting characters, for example passwords, appear in angle brackets in contexts where italic font is not available.
[ ]	Default responses to system prompts appear in square brackets.

Note Means *reader take note*. Notes contain helpful suggestions or references to additional information and material.

Timesaver This symbol means *the described action saves time*. You can save time by performing the action described in the paragraph.

Caution This symbol means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Tips This symbol means *the following information will help you solve a problem*. The tips information might not be troubleshooting or even an action, but could be useful information, similar to a Timesaver.

Additional Information

This configuration guide does not contain the following:

- Network design guide
- Application case studies
- Troubleshooting guide
- A comprehensive reference to access services

For additional information about any of these topics, refer to the following resources:

- Documentation CD-ROM
- Cisco Connection Online (CCO)
- Customer Service
- Technical Assistance Center (TAC)
- European TAC

Related Documentation

The following is a list of related Cisco MWR 1900 Mobile Wireless Edge Router publications.

- *Release Notes for the Cisco MWR 1900 Mobile Wireless Edge Router for Cisco IOS Release 12.2 MC*
- *Cisco MWR 1900 Hardware Installation Guide*
- *MWR 1900 Mobile Wireless Edge Router Rack Mounting Instructions*
- *Regulatory Compliance and Safety Information for the Cisco MWR 1900 Mobile Wireless Edge Router*

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

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- http://www.cisco.com
- http://www-china.cisco.com
- http://www-europe.cisco.com

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Obtaining Technical Assistance

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Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

Contacting TAC by Telephone

If you have a priority level 1(P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.

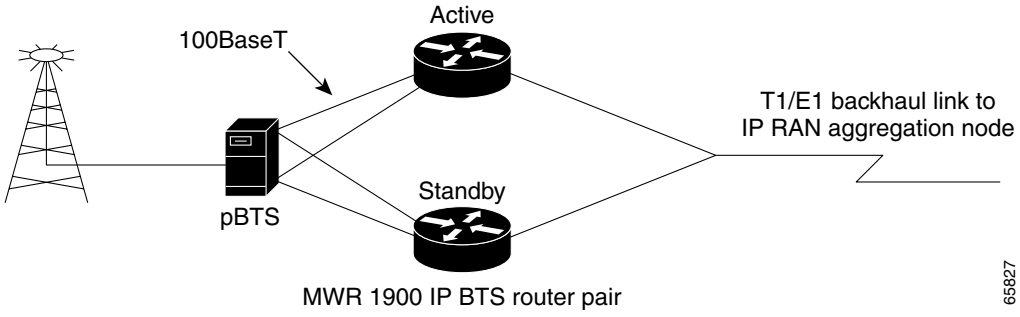
Overview of the MWR 1900

The MWR 1900 Mobile Wireless Edge Router is a networking platform optimized for use in mobile wireless networks. It extends IP connectivity to the cell site and Base Transceiver Station (BTS), and through a Fast Ethernet interface to the BTS, provides bandwidth-efficient IP transport of voice and data bearer traffic, as well as maintenance, control, and signalling traffic, over the leased line backhaul network between the BTS and leased line termination and aggregation node via compression (cRTP/cUDP) and packet multiplexing (PPPmux and MLPPP). It supports a limited set of interfaces and protocols, but offers high performance at a low cost while meeting the critical requirements for deployment in cell sites, including small size, extended operating temperature range, high availability, and DC input power flexibility.

Benefits

The MWR 1900 router is designed to be used at a cell site as part of an IP-RAN solution. Figure 1-1 shows the placement of and connections for the MWR 1900 for this application.

Figure 1-1 MWR 1900 in an IP-RAN Solution



In the IP-RAN solution, the BTS site consists of a pair of MWR 1900 routers. The pair of MWR 1900s provides for an active and standby router for redundancy. A failure of the active MWR 1900 causes the standby router to take over as the active router for the BTS site.

Each pair of MWR 1900 routers at the BTS site is identical in hardware configuration. They connect to each other through the BTS via the Fast Ethernet interfaces. The individual backhaul links to an MWR 1900 router are cabled from a single T1/E1 termination block in the BTS, connecting to both the active and standby routers utilizing a “Y” cable. The redundancy design to control the active/standby

transitions of the router pair leverages HSRP to control the relays on the VWIC-2MFT-T1-DIR (or VWIC-2MFT-E1-DIR) in each router to ensure that the relays on the active router are closed and the relays on the standby router are open to avoid double termination of the T1 (or E1).

Software Features

The software running on the MWR 1900 platform consists of two components: Cisco IOS software running on the MIPs-based route processor portion of the MWR 1900 hardware, and microcode running on the Cisco network processor, also known as "Parallel eXpress Forwarding (PXF)." Because the MWR 1900 is designed specifically for deployment in an IP-RAN at the BTS, it is customized for performance, high availability, quality of service, and link efficiency.

Cisco IOS Software

Cisco IOS software functions added to the MWR 1900 router for the IP-RAN application include:

- Redundancy logic—For monitoring Hot Standby Routing Protocol (HSRP) information to determine the active and standby router and control T1 termination.
- Failover logic—To force a switchover for hardware failures or an over-temperature condition.
- Relay control—To open and close the T1/E1 interfaces on the active and standby routers.
- Diagnostic functions—To monitor the "health" of the standby MWR 1900 router.

Standard Cisco IOS software features supported in the MWR 1900 for the IP-RAN application include:

- IP Fragmentation
- IP Multicast
- IGMP
- MLP, PPP Control Path (IPCP, NCP, LCP, CLNS)
- HSRP
- OSPF
- DHCP
- CDP
- NTP
- SNMP

Network Processor Software

To achieve the required efficiency, the MWR 1900 router has microcode running on the network processor to offload the fast-path processing of packets. This allows the MWR 1900 router to support the traffic of up to 4 T1s or E1s (up to 60,000 packets per second) at a targeted 80% processor utilization while performing UDP/RTP header compression/decompression (cUDP/cRTP) and PPPmux.

The following features are supported in the network processor:

- MAC Classify
- ICMP
- FIB (CEF)
- Load-balancing
- MAC Rewrite
- QoS Matching, including IP Access Lists (Input/Output Security ACLs are not supported), QoS Group, IP Precedence, IP DSCP, and Input Interface
- QoS Actions, including Set IP Precedence, Set IP DSCP, Set QoS Group, Traffic Shaping, Class Based WFQ (CB-WFQ), and Low Latency Queuing (LLQ)
- Maintenance of statistics, such as Forwarding, Drop, and Interface
- IPv4
- MLPPP
- MLP, PPP Data Path (MLP LFI is not supported)
- PPPmux
- cRTP/cUDP

PPP Multiplexing/Demultiplexing

Encapsulated PPP frames contain several bytes of header information, which adds overhead to a network that is used to transport PPP frames.

RFC 3153 describes a way to overcome this overhead. On the sending end, a multiplexor concatenates multiple PPP frames (subframes) into a single, multiplexed frame (superframe). One header is included in the superframe and the individual PPP subframes are separated by delimiters. On the receiving end, a demultiplexor uses the delimiters to separate the individual PPP subframes.

The MWR 1900 network processor software conforms to this specification and acts as both a multiplexor and a demultiplexor.

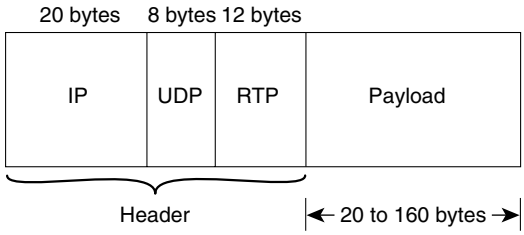
RTP/UDP Header Compression

RTP is a protocol used for carrying packetized audio and video traffic over an IP network. RTP, described in RFC 1889, is not intended for data traffic, which uses TCP or UDP. Instead, RTP provides end-to-end network transport functions intended for applications with real-time requirements (such as audio, video, or simulation data) over multicast or unicast network services.

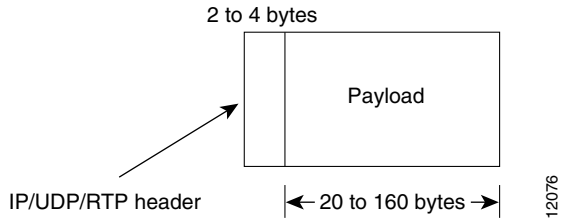
In an RTP frame, there is a minimum 12 bytes of the RTP header, combined with 20 bytes of IP header, and 8 bytes of UDP header. This creates a 40-byte IP/UDP/RTP header. By comparison, the RTP packet has a payload of approximately 20 to 160 bytes for audio applications that use compressed payloads. Given this ratio, it is very inefficient to transmit the IP/UDP/RTP header without compressing it.

Figure 1-2 RTP Header Compression

Before RTP header compression:



After RTP header compression:



RFCs 2508 and 2509 describe a method for compressing not only the RTP header, but also the associated UDP and IP headers. Using this method, the 40 bytes of header information is compressed into approximately 2 to 4 bytes, as shown in Figure 1-2. Because the frames are compressed on a link-by-link basis, the delay and loss rate are lower, resulting in improved performance.

The MWR 1900 network processor offloads both the compression and decompression of RTP frames from the Cisco IOS software.

Note The MWR 1900 router can be configured to perform only IP/UDP compression, in which case the header is reduced from 28 bytes to 2 to 4 bytes.

Redundancy Support

To ensure availability, the backhaul links to an MWR 1900 router are redundantly cabled to the VWIC-2MFT-T1-DIR/ VWIC-2MFT-E1-DIR cards. This card, designed specifically for the MWR 1900 router, is a modified 2-port T1/E1 Multiflex VWIC with Drop and Insert.The modifications include the addition of relays to activate the T1/E1 ports. The relays allow “Y” cabling for router redundancy where the T1/E1 link is not redundant and default to open. The relays are controlled by HSRP/redundancy protocol between the two routers connected to the same T1/E1.

Note If you choose to use the MWR 1900 router in a non-redundant configuration, you must close the relays on the card using the **standalone** subcommand. Also, redundancy parameters are processed when the router is booted up. These parameters cannot be changed “on the fly.”

HSRP

Cisco's Hot Standby Router Protocol (HSRP) is used to control which router is active and which is standby. HSRP uses a priority scheme to determine which HSRP-configured router is to be the default active router. Priority is determined first by the configured priority value, and then by the IP address. In each case a higher value is of greater priority.

MIB Support

The MWR 1900 supports the following MIBs:

- CISCO-ACCESS-ENVMON-MIB
- CISCO-CDP-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-CONFIG-COPY-MIB
- CISCO-CONFIG-MAN-MIB
- CISCO-ENVMON-MIB
- CISCO-FLASH-MIB
- CISCO-HSRP-EXT-MIB
- CISCO-HSRP-MIB
- CISCO-ICSUDSU-MIB
- CISCO-IMAGE-MIB
- CISCO-IP-STAT-MIB
- CISCO-IPMROUTE-MIB
- CISCO-MEMORY-POOL-MIB
- CISCO-PROCESS-MIB
- CISCO-QUEUE-MIB
- CISCO-SYSLOG-MIB
- CISCO-TCP-MIB
- ENTITY-MIB
- IF-MIB
- IGMP-MIB
- IPMROUTE-MIB
- OLD-CISCO-CHASSIS-MIB
- OLD-CISCO-FLASH-MIB
- OLD-CISCO-INTERFACES-MIB
- OLD-CISCO-IP-MIB
- OLD-CISCO-SYSTEM-MIB
- OLD-CISCO-TS-MIB
- RFC1213-MIB
- RFC1253-MIB
- RFC1406-MIB
- TCP-MIB
- UDP-MIB

The MWR 1900 uses the same software base as the Cisco 10000. As such, it shares the same QoS MIB limitations of the Cisco 10000. For information about the Cisco10000 MIB support, see the *Cisco 10000 Series ESR MIB Specifications Guide on CCO* at http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/10kmibs/specgdll/index.htm.

Limitations and Restrictions

The MWR 1900 requires a special release of Cisco IOS software. Not all Cisco IOS software features can be used with this router as the core routing is handled by the network processor. A list of supported features is included in the "Software Features" section on page 1-2. The following features are not supported on the MWR 1900:

- Security Access Control Lists
- MPLS
- 802.1Q VLANs
- Frame Relay (FR)
- MLP LFI
- ATM
- Use of additional WICs (The only supported WIC is the VWIC-2MFT-T1DIR/ VWIC-2MFT-E1DIR.)

First-Time Configuration

This chapter describes how to use the setup command facility to configure your router. The setup command facility prompts you to enter information needed to start a router functioning quickly. The facility steps you through a basic configuration, including local-area network (LAN) and wide-area network (WAN) interfaces. The following sections are included:

If you prefer to configure the router manually or you wish to configure a module or interface that is not included in the setup command facility, proceed to "Chapter 3, "Cisco IOS Software Basics" to familiarize yourself with the command-line interface (CLI) and then proceed to "Chapter 4, "Configuring with the Command-Line Interface" for step-by-step instructions.

Before You Begin

This section contains information with which you should be familiar before you begin to configure your router for the first time, including understanding boot images, understanding interface numbering, and knowing what you should do before starting your router.

Understanding Boot Images

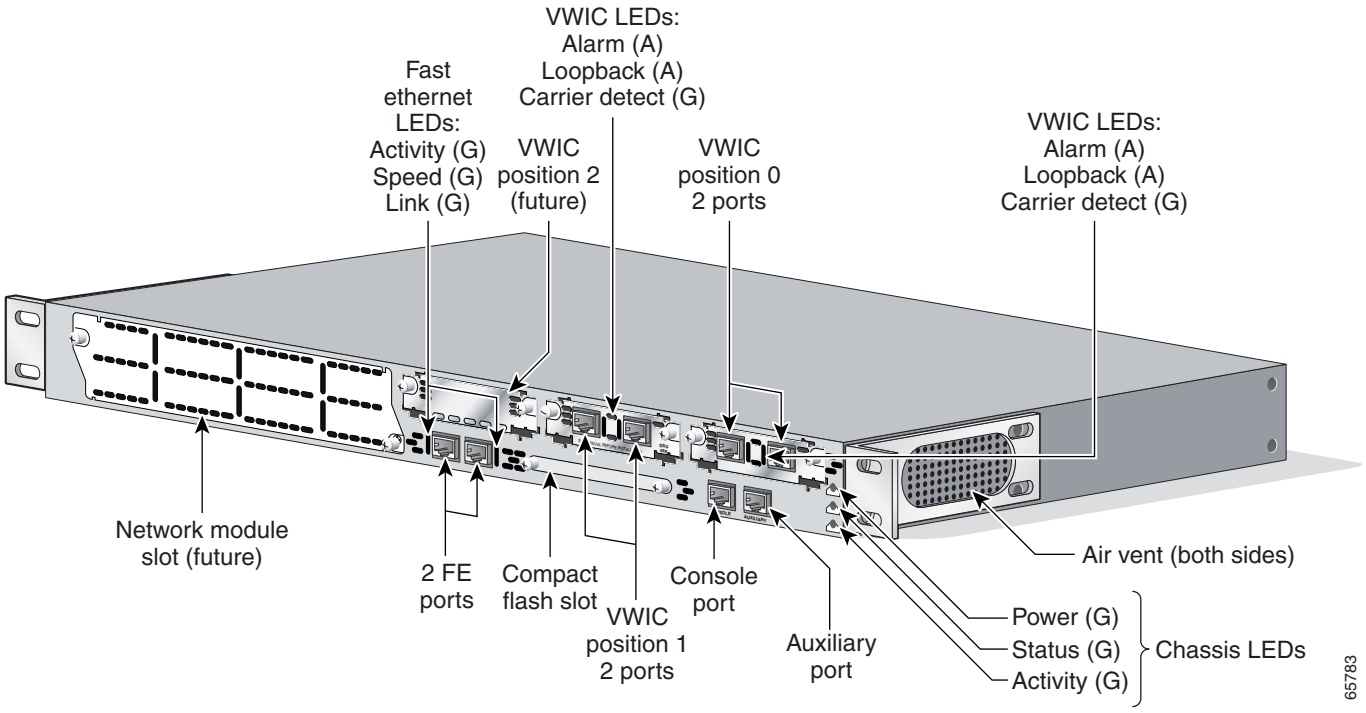
The first file on the compact flash device in slot0: **must** be the Cisco IOS software image that you want to use. If it is not, the MWR 1900 will not be able to boot.

If you need to upgrade or replace the compact flash, be sure to follow the procedures in the *Cisco MWR 1900 Mobile Wireless Router Hardware Installation Guide*.

Understanding Interface Numbering

Each individual interface (port) on a Cisco MWR 1900 router is identified by number. Figure 2-1 shows the front of the MWR 1900 with the Fast Ethernet ports and the Voice/WAN Interface Card (VWIC) ports.

Figure 2-1 Front of the MWR 1900



The Cisco MWR 1900 router chassis contains the following LAN and WAN interface types:

- Two built-in Fast Ethernet LAN interfaces
- Two slots in which you can install Voice/WAN interface cards (VWICs)

The slot numbers are as follows:

- 0 for all built-in interfaces
- 0 for all VWIC interfaces

The numbering format is:

Interface type Slot number/Interface number

Interface (port) numbers begin at 0 for each interface type, and continue from right to left.

The two built-in Ethernet 10/100 interfaces are Fast Ethernet 0/0 and Fast Ethernet 0/1.

The slot number for all VWIC interfaces is always 0. (The W0 and W1 slot designations are for physical slot identification only.) Interfaces in the VWICs are numbered from right to left, starting with 0/0 for each interface type, *regardless of the physical slot in which the VWICs are installed.*

For example, if you have a VWIC in each VWIC slot, then the interfaces are Serial 0/0 and Serial 0/1 in physical slot W0 and Serial 0/2 and Serial 0/3 in physical slot W1. However, if you install a VWIC in physical slot W1 (leaving slot W0 empty), the interfaces in slot W1 are Serial 0/0 and Serial 0/1. If you then add a VWIC to slot W0, the interface numbering will shift. The configuration that you created for interfaces Serial 0/0 and Serial 0/1 will now be applied to the VWIC in slot W0 and you will need to create a new configuration for the interfaces that you previously configured on W1 (which will now be Serial 0/2 and Serial 0/3).

Before Starting Your Router

Before you power ON your router and begin to use the setup command facility, make sure you follow these steps:

Step 1 Set up the hardware and connect the console and network cables as described in the *Cisco MWR 1900 Router Hardware Installation Guide*.

Step 2 Configure your PC terminal emulation program for 9600 baud, 8 data bits, no parity, and 1 stop bit.

Using the Setup Command Facility

The setup command facility displays from your PC terminal emulation program window.

To create a basic configuration for your router, do the following:

- Complete the steps in the "Configuring Global Parameters" section on page 2-3.
- Complete the steps in the "Completing the Configuration" section on page 2-5.

Note If you make a mistake while using the setup command facility, you can exit and run the facility again. Press **Ctrl-c**, and type **setup** at the enable mode prompt (`1900#`).

Configuring Global Parameters

Step 1 Power ON the router, see the *Cisco MWR 1900 Router Hardware Installation Guide*.

Messages will begin to appear in your terminal emulation program window.

Caution *Do not press any keys on the keyboard until the messages stop*. Any keys pressed during this time are interpreted as the first command typed when the messages stop, which might cause the router to power off and start over. It takes a few minutes for the messages to stop.

```
rommon 1 >b slot0:mwr1900-i-mz.12042001
program load complete, entry point:0x80008000, size:0x658258
Self decompressing the image :
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
################################################################################
######################## [OK]

               Restricted Rights Legend

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Software clause at DFARS sec. 252.227-7013.

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           San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) 10000 Software (MWR1900-I-M), Version 12.2(xy), EARLY DEPLOYMENT RELEASE SOFTWARE
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Tue 04-Dec-01 23:20 by jsmith
Image text-base:0x600089C0, data-base:0x60B42000

cisco mwr1900 (R7000) processor (revision 0.5) with 98304K/32768K bytes of
memory.
Processor board ID 12345678901
R7000 CPU at 240Mhz, Implementation 39, Rev 3.3, 256KB L2 Cache
Bridging software.
X.25 software, Version 3.0.0.
Primary Rate ISDN software, Version 1.1.
Toaster processor tmc has been reset.
2 FastEthernet/IEEE 802.3 interface(s)
2 Channelized T1/PRI port(s)
DRAM configuration is 64 bits wide with parity disabled.
55K bytes of non-volatile configuration memory.
39168K bytes of ATA Slot0 CompactFlash (Read/Write)

--- System Configuration Dialog ---

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
```

Step 2 When the following message appears, enter **yes** to begin the initial configuration dialog:

```
Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]:y
Configuring global parameters:
```

Step 3 Enter a host name for the router (this example uses 1900-1):

```
Configuring global parameters:

  Enter host name [Router]: 1900-1
```

Step 4 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when viewing the configuration:

```
The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret: xxxx
```

Step 5 Enter an enable password that is different from the enable secret password. This password is *not* encrypted (less secure) and can be seen when viewing the configuration:

```
The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password: guessme
```

Step 6 Enter the virtual terminal password, which prevents unauthenticated access to the router through ports other than the console port:

```
The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password: guessagain
```

Step 7 Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [yes]:
    Community string [public]:
```

Step 8 The summary of interfaces is displayed.

```
Current interface summary

Controller Timeslots D-Channel Configurable modes Status
T1 0/0     24        23        pri/channelized    Administratively up
T1 0/1     24        23        pri/channelized    Administratively up
T1 0/2     24        23        pri/channelized    Administratively up
T1 0/3     24        23        pri/channelized    Administratively up

Interface               IP-Address      OK? Method Status        Protocol
FastEthernet0/0         172.18.46.74    YES NVRAM  up            up
FastEthernet0/1         150.0.1.0       YES NVRAM  up            up
Serial0/0:0             unassigned      YES NVRAM  up            up
Serial0/1:0             unassigned      YES NVRAM  up            up
```

Step 9 Specify the interface to be used to connect to the network management system.

```
Enter interface name used to connect to the
management network from the above interface summary:FastEthernet0/0
```

Step 10 You are then prompted to configure the specified interface.

```
Configuring interface FastEthernet0/0:
Use the 100 Base-TX (RJ-45) connector? [yes]:
Operate in full-duplex mode? [no]:
Configure IP on this interface? [yes]:no
```

Completing the Configuration

When you have provided all the information prompted for by the setup command facility, messages similar to the following appear:

```
The following configuration command script was created:

!
hostname 1900-1
enable secret 5 $1$kA4t$2LpzAVTQADpqTMeqAIG3F0
enable password guessme
line vty 0 4
password guessagain
no snmp-server
!
no ip routing

!
interface FastEthernet0/0
no shutdown
```

```
media-type 100BaseX
half-duplex
no ip address
!
interface FastEthernet0/1
shutdown
no ip address
!
end
```

To complete your router configuration, do the following:

Step 1 A setup command facility prompt asks if you want to save this configuration.

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.

Enter your selection [2]:
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.


Press RETURN to get started!
```

If you answer **no**, the configuration information you entered is *not* saved, and you return to the router enable prompt. Type **setup** to return to the System Configuration Dialog.

If you answer **yes**, the configuration is saved and you are returned to the EXEC prompt.

Step 2 When the messages stop displaying on your screen, press **Return** to get the command line prompt.

The `1900-1>` prompt indicates that you are now at the command-line interface (CLI) and you have just completed a basic router configuration. However, this is *not* a complete configuration. You must configure additional parameters using the Cisco IOS software CLI.

Where to Go Next

At this point you can proceed to the following:

- Chapter 3, “Cisco IOS Software Basics” to learn how to use the CLI to configure additional features.
- Chapter 4, “Configuring with the Command-Line Interface” to complete the configuration of the interfaces, routing protocols, and other features.
- The Cisco IOS software configuration guide and command reference publications for more advanced configuration topics.The Cisco 10000 ESR Quality of Service Documents for more information on configuring QoS. These publications are available on the Documentation CD-ROM that came with your router, on the World Wide Web from Cisco’s home page, or you can order printed copies.

Cisco IOS Software Basics

This chapter describes what you need to know about the Cisco IOS software before you configure the router using the command-line interface (CLI). This chapter includes the following:

Understanding these concepts will save time as you begin to use the CLI. If you have never used the Cisco IOS software or need a refresher, take a few minutes to read this chapter before you proceed to the next chapter.

If you are already familiar with the Cisco IOS software, proceed to Chapter 4, “Configuring with the Command-Line Interface.”

Getting Help

Use the question mark (?) and arrow keys to help you enter commands:

- For a list of available commands, enter a question mark:

  ```
  Router> ?
  ```

- To complete a command, enter a few known characters followed by a question mark (with no space):

  ```
  Router> s?
  ```

- For a list of command variables, enter the command followed by a space and a question mark:

  ```
  Router> show ?
  ```

- To redisplay a command you previously entered, press the up arrow key. You can continue to press the up arrow key for more commands.

Understanding Command Modes

The Cisco IOS user interface is divided into different modes. Each command mode permits you to configure different components on your router. The commands available at any given time depend on which mode you are currently in. Entering a question mark (**?**) at the prompt displays a list of commands available for each command mode. Table 3-1 lists the most common command modes.

Table 3-1 Common Command Modes

Command Mode	Access Method	Router Prompt Displayed	Exit Method
User EXEC	Log in.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, enter the **enable** command.	`Router#`	To exit to user EXEC mode, use the **disable**, **exit**, or **logout** command.
Global configuration	From the privileged EXEC mode, enter the **configure terminal** command.	`Router (config)#`	To exit to privileged EXEC mode, use the **exit** or **end** command, or press **Ctrl-z**.
Interface configuration	From the global configuration mode, enter the **interface** *type number* command, such as **interface serial 0/0**.	`Router (config-if)#`	To exit to global configuration mode, use the **exit** command. To exit directly to privileged EXEC mode, press **Ctrl-z**.

Timesaver Each command mode restricts you to a subset of commands. If you are having trouble entering a command, check the prompt, and enter the question mark (**?**) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.

In the following example, notice how the prompt changes after each command to indicate a new command mode:

```
Router> enable
Password: <enable password>
Router# configure terminal
Router (config)# interface serial 0/0
Router (config-if)# line 0
Router (config-line)# controller t1 0
Router (config-controller)# exit
Router (config)# exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

The last message is normal and does not indicate an error. Press **Return** to get the `Router#` prompt.

Note You can press **Ctrl-z** in any mode to immediately return to enable mode (`Router#`), instead of entering **exit**, which returns you to the previous mode.

Undoing a Command or Feature

If you want to undo a command you entered or disable a feature, enter the keyword **no** before most commands; for example, **no ip routing**.

Saving Configuration Changes

You need to enter the **copy running-config startup-config** command to save your configuration changes to nonvolatile random-access memory (NVRAM), so the changes are not lost if there is a system reload or power outage. For example:

```
Router# copy running-config startup-config
Building configuration...
```

It might take a minute or two to save the configuration to NVRAM. After the configuration has been saved, the following appears:

```
[OK]
Router#
```

Where to Go Next

Now that you have learned some Cisco IOS software basics, you can begin to configure the router using the CLI.

Remember that:

- You can use the question mark (?) and arrow keys to help you enter commands.
- Each command mode restricts you to a set of commands. If you have difficulty entering a command, check the prompt and then enter the question mark (**?**) for a list of available commands. You might be in the wrong command mode or using the wrong syntax.
- To disable a feature, enter the keyword **no** before the command; for example, **no ip routing**.
- You need to save your configuration changes to NVRAM so the changes are not lost if there is a system reload or power outage.

Proceed to Chapter 4, “Configuring with the Command-Line Interface” to begin configuring the router.

Configuring with the Command-Line Interface

This chapter describes how to use the Cisco IOS software command-line interface (CLI) to configure the following features of the MWR 1900:

Follow the procedures in this chapter to configure the router manually or if you want to change the configuration after you have run the setup command facility (described in Chapter 1, “First-Time Configuration”).

This chapter describes how to configure features related to the use of the MWR 1900 in an IP-RAN. For additional configuration topics, refer to the Cisco IOS configuration guide and command reference publications. These publications are available on the Documentation CD-ROM that came with your router, on the World Wide Web from Cisco’s home page, or you can order printed copies separately.

Note If you skipped the previous chapter, Chapter 3, “Cisco IOS Software Basics,” and you have never configured a Cisco router, go back to that chapter and read it now. The chapter contains important information you need to successfully configure your router.

Before You Begin

Before you configure the MWR 1900, there are a few caveats of which you should be aware:

- You cannot disable Cisco Express Forwarding (CEF) on the MWR 1900. Commands such as **no ip cef** will display an error message "%Cannot disable CEF on this platform." Some commands, such as **no ip route-cache cef**, will not return an error message. However, CEF will **not** be disabled regardless of whether an error message is displayed.
- If you are using the MWR 1900 in a redundant configuration and are attaching the MWR 1900 to a device that uses spanning tree, configure portfast on the device to avoid problems with HSRP at start up.
- If you are using the MWR 1900 in a redundant configuration, disable Extended Availability Drop and Insert (EADI) capabilities on the router (using the **disable-eadi** global configuration command) to avoid a double-termination scenario upon reboot. If the MWR 1900 is not being used in a redundant configuration, and EADI is specifically required, re-enable EADI using the **no disable-eadi** global configuration command.
- In case of a tie in priority, HSRP uses the IP address to determine the active router. Therefore, you should ensure that the order of the IP addresses of the E1/T1 interfaces of the active router corresponds to the order of the IP addresses of the E1/T1 interfaces of the standby router.

Verifying the Version of Cisco IOS Software

The MWR 1900 requires Cisco IOS Release 12.2(8)MC2 or a later Cisco IOS Release 12.2 MC be installed. To verify the version of Cisco IOS software, use the **show version** command.

The **show version** command displays the configuration of the system hardware, the software version, the names and sources of configuration files, and the boot images.

Configuring the Host Name and Password

One of the first configuration tasks you might want to do is configure the host name and set an encrypted password. Configuring a host name allows you to distinguish multiple Cisco routers from each other. Setting an encrypted password allows you to prevent unauthorized configuration changes.

Step 1 Enter enable mode and enter the password.

You have entered enable mode when the prompt changes to `Router#`.

```
Router> enable
Password: <password>
```

Step 2 Enter global configuration mode.

```
Router# configure terminal
```

The prompt changes to `Router(config)#`.

Step 3 Change the name of the router to a meaningful name.

```
Router(config)# hostname router_name
```

The prompt changes from "Router" to the user-configured hostname once this command is issued.

Step 4 Enter an enable secret password. This password provides access to privileged EXEC mode. When a user types **enable** at the EXEC prompt (`Router>`), they must enter the enable secret password to access configuration mode.

```
router_name(config)# enable secret password
```

Step 5 Enter line configuration mode to configure the console port. The prompt changes to `Router(config-line)#`.

```
router_name(config)# line con 0
```

Step 6 Enter a timeout value of 0 to prevent the router's EXEC facility from timing out if you do not type any information on the console screen for an extended period.

```
router_name(config-line)# exec-timeout 0 0
```

Step 7 Exit to global configuration mode.

```
router_name(config-line)# exit
```

Configuring Loopback Interfaces

The loopback interface is a software-only, virtual interface that emulates an interface that is always up. The interface-number is the number of the loopback interface that you want to create or configure. There is no limit on the number of loopback interfaces you can create.

The multilink interface is a virtual interface, if you are **not** going to assign an explicit IP address to the interface, you should create a loopback interface for the multilink interface to enable IP processing on the interface.

In the case where the MWR 1900 is used in a redundant configuration, you must also configure loopback interfaces for the health and revertive interfaces. The health interface monitors the status of the redundant configuration so that the standby router can take over if there is a problem with the active router. The revertive interface is required to ensure that the switchover takes place. We recommend that you use 101 for the health interface and 102 for the revertive interface.

To configure a loopback interface, do the following beginning in global configuration mode:

Step 1 Create a loopback interface for each multilink interface:

```
Router(config)# interface loopback number
Router(config-if)# ip address ip_address subnet_mask
```

Note For the health and revertive interfaces, you do not need to assign an IP address.

Step 2 Exit interface configuration mode:

```
Router(config-if)# exit
```

Configuring Fast Ethernet Interfaces

To configure the FE interface of the MWR 1900, complete the following tasks:

- Configuring the FE Interface IP Address
- Setting the Speed and Duplex Mode
- Configuring Routing Protocol Attributes
- Configuring PIM
- Configuring HSRP Support
- Enabling the FE Interface

Configuring the FE Interface IP Address

To configure the FE interface, do the following starting in global configuration mode:

Step 1 Specify the port adapter type and the location of the interface to be configured.

```
Router(config)# interface fastethernet slot/port
```

The *slot* is always 0 and the *port* is the number of the port (0 or 1).

Step 2 Assign an IP address and subnet mask to the interface.

```
Router(config-if)# ip address ip_address subnet_mask
```

Setting the Speed and Duplex Mode

The Fast Ethernet ports of the MWR 1900 can run in full or half duplex mode and at 100 Mbps or 10 Mbps. The MWR 1900 also has an auto-negotiation feature that allows the router to negotiate the speed and duplex mode with the corresponding interface on the other end of the connection.

Auto negotiation is the default setting for the speed and transmission mode.

When configuring an interface speed and duplex mode, note these guidelines:

- If both ends of the line support auto negotiation, we highly recommend the default auto negotiation settings.
- When the auto negotiation is turned on for either speed or duplex, it auto negotiates both speed and duplex.
- If one interface supports auto negotiation and the other end does not, configure duplex and speed on both interfaces; do not use the auto setting on the supported side or the duplex setting will be half.

To configure speed and duplex operation, do the following while still in interface configuration mode:

Step 1 Specify the duplex operation.

```
Router(config-if)# duplex [auto | half | full]
```

Step 2 Specify the speed.

```
Router(config-if)# speed [auto | 100 | 10]
```

Configuring Routing Protocol Attributes

When used in the CDMA IP-RAN solution, the MWR 1900 must be configured to support the OSPF routing protocol. To configure OSPF routing protocol attributes, do the following while still in interface configuration mode:

Step 1 Enable OSPF Message Digest 5 (MD5) authentication.

```
Router(config-if)# ip ospf message-digest-key key-id md5 key
```

Step 2 Specify the interval between hello packets that the Cisco IOS software sends on the interface.

```
Router(config-if)# ip ospf hello-interval seconds
```

Step 3 Set the interval at which hello packets must not be seen before neighbors declare the router down.

```
Router(config-if)# ip ospf dead-interval seconds
```

Configuring PIM

Because the MWR 1900 is used in a multicast PPP environment, you should configure the PIM mode of the FE interface.

To configure the PIM mode, do the following while still in interface configuration mode:

Step 1 Enter the following command:

```
Router(config-if)# ip pim {sparse-mode | sparse-dense-mode | dense-mode [proxy-register
{list access-list | route-map map-name}]}
```

Configuring HSRP Support

In redundant configurations, the MWR 1900 uses HSRP to control the active and standby routers. To use HSRP, you must configure the standby priority attributes and the IP address of the virtual router. Priority is determined first by the configured priority value, and then by the IP address. In each case a higher value is of greater priority.

Note If you do not plan to use the MWR 1900 in a redundant configuration, do not configure HSRP support and see Configuring Redundancy, page 4-16 for information about using the router in a stand-alone environment.

To configure HSRP support, do the following while still in interface configuration mode:

Step 1 Specify the name of the standby group.

```
Router(config-if)# standby group name group-name
```

Note The standby group names must be “one” and “two.” For FE 0/0, the command must be **standby 1 name one**. For FE 0/1, the command must be **standby 2 name two**.

Tips If you omit the *group-name* or if you enter a group name that doesn’t begin with one or two, the configuration will fail and there will be a mismatch in the information displayed by the **show redundancy** and **show standby** commands.

Step 2 Enable HSRP and assign an IP address to the virtual router. This address is the same for both the active and standby routers.

```
Router(config-if)# standby group ip address
```

Step 3 Configure the time between hello packets and the time before other routers declare the active Hot Standby or standby router to be down.

```
Router(config-if)# standby group timers [msec] hellotime [msec] holdtime
```

Note You ***must*** use 1 for the hello time and 3 for the hold time.

Step 4 Indicate that the router can become the active router when its priority is higher than all other HSRP-configured routers. Without preemption, a standby router will only transition to the active state if HSRP “hello messages” cease. In the CDMA IP-RAN solution, there may be situations in which you want a switchover to occur in the absence of a router or FE failure, therefore, preemption is required.

```
Router(config-if)# standby group preempt
```

Step 5 Specify other interfaces on the router for the HSRP process to monitor in order to alter the HSRP priority for a given group. When using the MWR 1900 router in the CDMA IP-RAN solution, you must configure each FE interface to track the multilink interface, the loopback interfaces, and the **other** FE interface.

```
Router(config-if)# standby group track multilinknumber decrement_value

Router(config-if)# standby group track loopbacknumber decrement_value

Router(config-if)# standby group track fastethernetnumber decrement_value
```

Note In redundant configurations, you should issue **standby track** commands for both the health interface (loopback101) and the revertive interface (loopback102) as well as for the backhaul interface (multilink1). The decrement values ***must*** be as follows: 10 for the multilink, FE, and health interfaces; 5 for the revertive interface.

Step 6 Specify a priority of 100.

```
Router(config-if)# standby group priority 100
```

Note If you are using the MWR 1900 in a redundant configuration, you must also set the keepalives under the FE interface to 1.

```
Router(config-if)# keepalive 1
```

Enabling the FE Interface

Once you have configured the FE interface, enable it by doing the following while still in interface configuration mode:

Step 1 Enable the interface.

```
Router(config-if)# no shutdown
```

Configuring Multilink Interfaces

To configure the multilink interfaces, complete the following tasks:

- Configuring Multilink PPP
- Configuring IP Address Assignment
- Configuring PPP Multiplexing
- Configuring RTP/UDP Compression
- Configuring Routing Protocol Attributes
- Configuring PIM

Configuring Multilink PPP

As higher-speed services are deployed, Multilink-PPP (MLP) provides a standardized method for spreading traffic across multiple WAN links, while providing multivendor interoperability and load-balancing on both inbound and outbound traffic.

A Multilink interface is a special virtual interface which represents a multilink PPP bundle. The multilink interface serves to coordinate the configuration of the bundled link, and presents a single object for the aggregate links. However, the individual PPP links that are aggregated together, must also be configured. Therefore, to enable Multilink PPP on multiple serial interfaces, you need to first set up the multilink interface, and then configure each of the serial interfaces and add them to the same multilink interface.

The MWR 1900 router can support up to 4 T1 interfaces through the multilink interface.

To set up the multilink interface, do the following beginning in global configuration mode:

Step 1 Specify the multilink interface to be configured.

```
RPM-3(config)# interface multilink number
```

Step 2 Enable multilink PPP operation.

```
RPM-3(config-if)# ppp multilink
```

Step 3 Specify an identification number for the multilink interface.

```
RPM-3(config-if)# multilink-group group-number
```

Step 4 Enable IP processing on a the multilink interface without assigning an explicit IP address to the interface.

```
RPM-3(config-if)# ip unnumbered loopback number
```

Where *number* is the number of the multilink loopback interface that you configured in Configuring Loopback Interfaces.

Configuring IP Address Assignment

A point-to-point interface must be able to provide a remote node with its IP address through the IP Control Protocol (IPCP) address negotiation process. The IP address can be obtained from a variety of sources. The address can be configured through the command line, entered with an EXEC-level command, provided by TACACS+ or the Dynamic Host Configuration Protocol (DHCP), or from a locally administered pool.

IP address pooling uses a pool of IP addresses from which an incoming interface can provide an IP address to a remote node through IPCP address negotiation process. IP address pooling also enhances configuration flexibility by allowing multiple types of pooling to be active simultaneously.

To configure IP address assignment, do the following do the following while still in multilink interface configuration mode:

Step 1 Specify an IP address, an address from a specific IP address pool, or an address from the Dynamic Host Configuration Protocol (DHCP) mechanism to be returned to a remote peer connecting to this interface:

```
RPM-3(config-if)# peer default ip address {ip-address | dhcp | pool [pool-name]}
```

Configuring PPP Multiplexing

To enable and control the multiplexing of PPP frames, do the following while still in multilink interface configuration mode:

Step 1 Enable PPP multiplexing:

```
RPM-3(config-if)# ppp mux
```

Step 2 Specify the parameters of multiplexing.

To set the maximum time delay, enter:

```
RPM-3(config-if)# ppp mux delay integer
```

To set the maximum length of the subframe, enter:

```
RPM-3(config-if)# ppp mux subframe length integer
```

To set maximum length of the superframe, enter:

```
RPM-3(config-if)# ppp mux frame integer
```

To set the maximum number of subframes in a superframe, enter:

```
RPM-3(config-if)# ppp mux subframe count integer
```

To set the default PPP protocol ID, enter:

```
RPM-3(config-if)# ppp mux pid integer
```

Configuring RTP/UDP Compression

Enabling compression on both ends of a low-bandwidth serial link can greatly reduce the network overhead if there is a lot of RTP traffic on that slow link. This compression is beneficial especially when the RTP payload size is small (for example, compressed audio payloads of 20-50 bytes).

Before you can enable RTP header compression, you must configure a serial line that uses PPP encapsulation.

To configure RTP header compression, do the following while still in multilink interface configuration mode:

Step 1 Enable RTP header compression for serial encapsulations:

```
RPM-3(config-if)# ip rtp header-compression
```

Step 2 By default, the software supports a total of 16 RTP header compression connections on an interface. To change that number, enter the following command:

```
RPM-3(config-if)# ip rtp compression-connections number
```

Note The MWR 1900 supports up to 600 RTP header compression connections on an interface.

Configuring Routing Protocol Attributes

When used in the CDMA IP-RAN solution, the multilink interface must be configured to support the OSPF routing protocol.

To configure OSPF routing protocol attributes, do the following while still in interface configuration mode:

Step 1 Enable OSPF Message Digest 5 (MD5) authentication:

```
RPM-3(config-if)# ip ospf message-digest-key key-id md5 key
```

Step 2 Specify the interval between hello packets that the Cisco IOS software sends on the interface:

```
RPM-3(config-if)# ip ospf hello-interval seconds
```

Step 3 Set the interval at which hello packets must not be seen before neighbors declare the router down:

```
RPM-3(config-if)# ip ospf dead-interval seconds
```

Configuring PIM

Because the MWR 1900 is used in a multicast PPP environment, you should configure the PIM mode of the multilink interface.

To configure the PIM mode, do the following while still in interface configuration mode:

Step 1 Enter the following command:

```
RPM-3(config-if)# ip pim {sparse-mode | sparse-dense-mode | dense-mode [proxy-register
{list access-list | route-map map-name}]}
```

Configuring T1 and E1 Interfaces

To configure a T1/E1 multiflex trunk interface, enter the following Cisco IOS commands at the router prompt.

Note Before you begin, disconnect all WAN cables from the router to keep it from trying to run the AutoInstall process. The router tries to run AutoInstall whenever you power it on if there is a WAN connection on both ends and the router does not have a valid configuration file stored in NVRAM (for instance, when you add a new interface). It can take several minutes for the router to determine that AutoInstall is not connected to a remote Transmission Control Protocol/Internet Protocol (TCP/IP) host.

Configuring T1 Interfaces

To configure the T1 interfaces, do the following while still in global configuration mode:

Step 1 Specify the controller that you want to configure. For information about interface numbering, see Understanding Interface Numbering, page 2-1.

```
Router(config)# controller t1 slot/port
```

Step 2 Specify the framing type.

```
Router(config-controller)# framing esf
```

Step 3 Specify the line code format.

```
Router(config-controller)# linecode b8zs
```

Step 4 Specify the channel group and time slots to be mapped. For the VWIC interfaces, you can configure two channel-groups (0 and 1) on the first T1 port or you can configure one channel-group (0 or 1) on each T1 port. Once you configure a channel group, the serial interface is automatically created.

Note The default speed of the channel group is 56. To get full DS0/DS1 bandwidth, you must configure a speed of 64.

```
Router(config-controller)# channel-group 0 timeslots 1-24 speed 64
```

Step 5 Configure the cable length.

```
Router(config-controller)# cablelength feet
```

Note Although you can specify a cable length from 0 to 450 feet, the hardware only recognizes two ranges: 0 to 49 and 50 to 450. For example, entering 35 feet uses the 0 to 49 range. If you later change the cable length to 40 feet, there is no change because 40 is within the 0 to 49 range. However, if you change the cable length to 50, the 50 to 450 range is used. The actual number you enter is stored in the configuration file.

Step 6 Exit controller configuration mode.

```
Router(config-controller)# exit
```

Step 7 Configure the serial interface. Specify the T1 slot (always 0), port number, and channel group.

```
Router(config)# interface serial slot/port:0
```

Step 8 Assign an IP address and subnet mask to the interface. If the interface is a member of a Multilink bundle (MLPPP), then skip this step.

```
Router(config-if)# ip address ip_address subnet_mask
```

Step 9 Before you can enable RTP header compression, you must have configured a serial line that uses PPP encapsulation. Enter the following command to configure PPP encapsulation.

```
Router(config-if)# encapsulation ppp
```

Step 10 Set the carrier delay for the serial interface.

```
Router(config-if)# carrier-delay number
```

Step 11 Return to Step 1 to configure the second port on the VWIC and the ports on any additional VWICs.

Step 12 Exit to global configuration mode.

```
Router(config-if)# exit
```

Configuring E1 Interfaces

To configure the E1 interfaces, do the following while still in global configuration mode:

Step 1 Specify the controller that you want to configure. Controller E1 0/0 maps to the first port of the VWIC in slot 0. Controller E1 0/1 maps to the second port of the VWIC in slot 0.

```
Router(config)# controller e1 slot/port
```

Step 2 Specify the framing type.

```
Router(config-controller)# framing crc4
```

Step 3 Specify the line code format.

```
Router(config-controller)# linecode hdb3
```

Step 4 Specify the channel group and time slots to be mapped. For the VWIC interfaces, you can configure channel-group 0 and 1 on one port or one channel-group (either 0 or 1) on each port. Once you configure a channel group, the serial interface is automatically created.

```
Router(config-controller)# channel-group 0 timeslots 1-24 speed 64
```

Note The default speed of the channel group is 56. To get full DS0/DS1 bandwidth, you must configure a speed of 64.

Step 5 Configure the cable length.

```
Router(config-controller)# cablelength feet
```

Note Although you can specify a cable length from 0 to 450 feet, the hardware only recognizes two ranges: 0 to 49 and 50 to 450. For example, entering 35 feet uses the 0 to 49 range. If you later change the cable length to 40 feet, there is no change because 40 is within the 0 to 49 range. However, if you change the cable length to 50, the 50 to 450 range is used. The actual number you enter is stored in the configuration file.

Step 6 Exit controller configuration mode.

```
Router(config-controller)# exit
```

Step 7 Configure the serial interface. Specify the E1 slot (always 0), port number, and channel group.

```
Router(config)# interface serial slot/port:0
```

Step 8 Assign an IP address and subnet mask to the interface. If the interface is a member of a Multilink bundle (MLPPP), then skip this step.

```
Router(config-if)# ip address ip_address subnet_mask
```

Step 9 Before you can enable RTP header compression, you must have configured a serial line that uses PPP encapsulation. Enter the following command to configure PPP encapsulation.

```
Router(config-if)# encapsulation ppp
```

Step 10 Set the carrier delay for the serial interface.

```
Router(config-if)# carrier-delay number
```

Step 11 Return to Step 1 to configure the second port on the VWIC and the ports on any additional VWICs.

Step 12 Exit to global configuration mode.

```
Router(config-if)# exit
```

Configuring QoS Attributes

To use QoS on the MWR 1900 router, you must first create a class map. The class map defines the criteria that a packet must match to be placed in that class. Once you have created a class map, the router can recognize packets that are subject to QoS. You must then tell the router the action to take on those packets by creating a policy map.Once you have completed the creation of a QoS boilerplate, you can assign it to an interface.

Note The QoS functionality of the MWR 1900 router is built on the same code as the Cisco 10000 ESR (with some exceptions). For more information about the QoS feature, see “Configuring Quality of Service” (http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/10ksw/qosos.htm) and the “Cisco 10000 Series ESR Quality of Service” feature module (http://www.cisco.com/univercd/cc/td/doc/product/aggr/10000/10kfm/fm_qos.htm), as well as the “Cisco IOS Quality of Service Solutions Configuration Guide” and the “Cisco IOS Quality of Service Solutions Command Reference.”

Creating a Class Map

For each class map that you want to create, do the following in global configuration mode:

Step 1 Assign a name to your class map.

```
Router(config)# class-map [match-all | match-any] class_name
```

Where **match-any** means a single match rule is sufficient for class membership and **match-all** means only those packets that have all the attributes you specify are part of the class.

When you enter the class-map command, you are placed in class map configuration mode.

Step 2 Describe the characteristics of the packets that are subject to QoS using one or more of the following.

```
Router(config-cmap)# match access-group number

Router(config-cmap)# match ip dscp number

Router(config-cmap)# match ip precedence number

Router(config-cmap)# match input-interface interface-name
```

- **match access-group** specifies access control list (ACL) that a packet must match.
- **match ip dscp** specifies the IP differentiated service code point (DSCP) that a packet must match.
- **match ip precedence** specifies the precedence values (0-7) that a packet must match.
- **match input-interface** specifies the name of the input interface used as a match criterion.

For more information about these commands, see the "Cisco IOS Quality of Service Solutions Command Reference."

Step 3 Exit class map configuration mode.

```
Router(config-cmap)# exit
```

Creating a Policy Map

To create a policy map, do the following in global configuration mode:

Step 1 Assign a name to your policy map.

```
Router(config)# policy-map policy_name
```

When you enter the policy-map command, you are placed in policy map configuration mode.

Step 2 Associate the policy map with a class map.

```
Router(config-pmap)# class class_name
```

Specify the same *class_name* as you did in Step 1 of Creating a Class Map. When you enter the class command, you are placed in class submode of the policy-map configuration mode.

Step 3 Describe the QoS actions you want the router to perform when the router encounters a packet that has the characteristics described by the class map. Use one or more of the following commands:

```
Router(config-pmap-c)# priority percent number

Router(config-pmap-c)# bandwidth percent number

Router(config-pmap-c)# queue-limit number

Router(config-pmap-c)# priority rate-in-kbps

Router(config-pmap-c)# shape {average | peak} cir [bc] [be]

Router(config-pmap-c)# shape max-buffers number-of-buffers
```

- **priority percent** gives priority to a class of traffic belonging to a policy map and specifies that a certain percentage of the available bandwidth should be reserved for this class.
- **bandwidth percent** specifies the bandwidth allocated for a class belonging to a policy map.
- **queue-limit** specifies the maximum number of packets the queue can hold for a class policy configured in a policy map.
- **priority** enables low-latency priority queuing, which allows you to assign a specified share of the link bandwidth to one queue that receives priority over all others. Low-latency priority queueing minimizes the packet-delay variance for delay-sensitive traffic, such as live voice and video.
- **shape** and **shape max-buffers** are used with class-based weighted fair queuing (CB-WFQ), which allows you to control the traffic going out an interface in order to match its transmission to the speed of the remote target interface.

Note The **bandwidth percent** and **priority percent** commands cannot be used in the same class, within the same policy map. These commands can be used together in the same policy map, however.

For more information about these commands, see the "Cisco IOS Quality of Service Solutions Command Reference."

Step 4 To configure the Class-Based Packet Marking feature, you must configure either an IP Precedence value or an IP differentiated services code point (DSCP). The QOS group is optional.

```
Router(config-pmap-c)# set ip dscp ip-dscp-value

Router(config-pmap-c)# set ip precedence ip-precedence-value

Router(config-pmap-c)# set qos-group qos-group-value
```

- **set ip dscp** marks a packet by setting the IP DSCP value.
- **set ip precedence** marks a packet by setting the IP Precedence bits in the ToS byte.
- **set qos-group** associates a local QoS group value with a packet.

For more information about these commands, see the "Cisco IOS Quality of Service Solutions Command Reference."

Step 5 Repeat Step 2 and Step 3 for each class map.

Step 6 Exit policy map configuration mode.

```
Router(config-pmap-c)# exit
Router(config-pmap)# exit
```

Assigning a QoS Boilerplate to an Interface

To assign a QoS boilerplate to a multilink interface, do the following in global configuration mode.

Step 1 Access the multilink interface configuration mode.

```
Router(config)# interface multilink number
```

Step 2 Assign the QoS boilerplate to the multilink interface.

```
Router(config-if)# service-policy output policy_name
```

Configuring Redundancy

The MWR 1900 router can be used in either a redundant configuration (preferable) or as a stand-alone device.

Note To implement redundancy, you must also configure HSRP under the Fast Ethernet interface. See the "Configuring HSRP Support" section on page 4-6 for more information.

Redundant MWR 1900s

For redundancy, the MWR 1900 router makes use of the existing HSRP feature. However, additional controls are needed for the MWR 1900. In a redundant configuration, the MWR 1900 router must track the status of the health and revertive loopback interfaces as well as the backhaul interface.

To configure an MWR 1900 for use in a redundant configuration, do the following starting in global configuration mode:

Step 1 Disable EADI capabilities on the router.

```
Router(config)# disable-eadi
```

Step 2 Enter redundancy mode.

```
Router(config)# redundancy
```

Step 3 Enter the y-cable mode.

```
Router(config-r)# mode y-cable
```

Step 4 Specify the loopback interface to be used to monitor the health of the router and for revertive purposes.

```
Router(config-r-y)# standby use-interface interface health

Router(config-r-y)# standby use-interface interface revertive
```

Note The interfaces that you specify for the health and revertive interfaces should match those that you configured and tracked in Configuring Loopback Interfaces. (We recommend you use loopback101 for the health and loopback102 for the revertive interface).

Step 5 Specify the interface to be used for backhauling.

```
Router(config-r-y)# standby use-interface interface backhaul
```

Note The interface that you specify for the backhaul must be an MLPPP interface. If you want to use a serial interface as the backhaul, you must first configure that interface to be part of an MLPPP bundle. The interface that you specify for the backhaul interface should match one of those that you configured and tracked in Configuring Loopback Interfaces.

Step 6 Exit y-mode configuration mode.

```
Router(config-r-y)# exit
```

To verify the status of the relays on an MWR 1900 router, use the **show controllers** command.

Stand-Alone MWR 1900

The MWR 1900 router has relays that work with a special "y" cable for redundancy and are controlled by HSRP. You can, however, use the MWR 1900 as a stand-alone device. If you choose not to use the MWR 1900 in a redundant configuration, you should **not** configure HSRP and you must control the relays of the VWIC card manually.

To manually set the relays to open or closed, do the following starting in global configuration mode:

Step 1 Enter redundancy mode.

```
Router(config)# redundancy
```

Step 2 Enter the y-cable mode.

```
Router(config-r)# mode y-cable
```

Step 3 Specify that the router is to be used as a stand-alone device. This command closes the relays.

```
Router(config-r-y)# standalone
```

Step 4 Exit y-mode configuration mode.

```
Router(config-r-y)# exit
```

To verify the status of the relays on an MWR 1900 router, use the **show controllers** command.

Saving Configuration Changes

To prevent the loss of the router configuration, save it to non-volatile random access memory (NVRAM). To save the configuration to NVRAM, do the following:

Step 1 Exit configuration mode.

```
Router(config)# exit
```

Note You can press **Ctrl-z** in any mode to immediately return to enable mode (`Router#`), instead of entering **exit**, which returns you to the previous mode.

Step 2 Save the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.

```
Router# copy running-config startup-config
```

Verifying the Configuration

To verify the configuration of the MWR 1900, enter the following command:

```
MWR1900-1#show running-config

hostname MWR1900-1
!
boot system slot0:mwr-1900-boot
!
! description Loopback IP for O & M
!
interface loopback 0
 ip address 10.1.170.3 255.255.255.255
!
! description Loopback IP for IP Unnumbered
!
interface loopback 2
 ip address 192.168.170.2 255.255.255.255
!
interface loopback101
 description Health Loopback Interface
 no ip address
!
interface loopback102
 description Revertive Loopback Interface
 no ip address
!
enable password cisco
!
memory-size iomem 25
!
disable-eadi
!
redundancy
  mode y-cable
   standby use-interface Loopback101 health
```

```
   standby use-interface Loopback102 revertive
   standby use-interface Multilink2 backhaul
!
controller T1 0/0
 framing esf
 cablelength short 133ft
 clock source internal
 linecode b8zs
 channel-group 0 timeslots 1-1 speed 64
 channel-group 1 timeslots 2-24 speed 64
!
controller T1 0/1
 framing esf
 clock source internal
 linecode b8zs
 cablelength short 133ft
!
!
class-map match-all class1_fch
 match ip dscp cs5
class-map match-all class2_sch
 match ip dscp cs4
class-map match-any class3_paging_ospf
 match ip dscp cs3
match access-group 101
!
policy-map llq-policy
 class class1_fch
  priority percent 68
 class class2_sch
  bandwidth percent 20
  queue-limit 128
 class class3_paging_ospf
  bandwidth percent 2
  queue-limit 128
 class class-default
  queue-limit 512
!
ip dhcp excluded-address 192.168.146.1 192.168.146.3
ip dhcp ping packets 0
!
ip dhcp pool pbts
 network 192.168.146.0 255.255.255.0
 bootfile CENOMIbts.img
 next-server OMCR-IPaddr
 option 43 ascii "Logical-IPaddr CENOMI-IPaddr another-IPaddr SpanMapping"
 default-router 192.168.146.3
 dns-server OMCR-IPaddr
 lease 0 0 1
!
ip routing
ip subnet-zero
ip classless
ip multicast-routing
ip tftp source-interface Loopback 0
cdp run
!
! Setup sys logging to OMCIP-CW2000
!
logging on
logging buffered 4
logging cw4mw
logging trap 5
logging source-interface Loopback0
```

```
!
! Setup SNMP
!
snmp community private rw
snmp community public ro
snmp-server enable traps
snmp-server trap-source Loopback 0
snmp-server host cw4mw public
!
! Setup useful aliases
!
ip host omcr OMCR_ip_address
ip host omcip OMCIP_ip_address
ip host cw4mw CW4MW_ip_address
ip host btsha-other-0 192.168.146.2
ip host btsha-other-1 192.168.147.2
!
!interface Multilink1
description Backhaul Interface
ip unnumbered loopback 2
 cdp enable
 ppp multilink
 ip ospf hello-interval 1
 ip ospf dead-interval 3
 ip ospf message-digest-key 1 md5 mymd5pw
!
interface Multilink2
 description
 ip unnumbered loopback 2
 ip mroute-cache
 ip mtu 256
 cdp enable
 ppp multilink
 ip rtp header-compression
 ip rtp compression-connections 700
 ppp mux
 ppp mux subframe length 64
 ppp mux subrame count 15
 ppp mux frame 256
 ppp mux delay 800
 ppp mux pid 0x2067
 ip ospf hello-interval 1
 ip ospf dead-interval 3
 ip ospf message-digest-key 1 md5 mymd5pw
 ip pim sparse-mode
 ip pim version 2
 service-policy output llq-policy
!
interface FastEthernet0/0
 ip address 192.168.146.1 255.255.255.0
 no ip proxy-arp
 no ip mroute-cache
 keepalive 1
 full-duplex
 speed 100
 ntp broadcast version 3
 standby 1 ip 192.168.146.3
 standby 1 timers 1 3
 standby 1 priority 100
 standby 1 preempt
 standby 1 name one
 standby 1 track FastEthernet0/1 10
 standby 1 track Loopback101 10
 standby 1 track Loopback102 5
```

```
 standby 1 track Multilink2 10
 ip ospf hello-interval 1
 ip ospf dead-interval 3
 ip ospf message-digest-key 1 md5 mymd5pw
 ip pim sparse-mode
 ip pim version 2
 ip pim query-interval 2

interface FastEthernet0/1
 ip address 192.168.147.1 255.255.255.0
 standby 2 timers 1 3
 standby 2 preempt
 standby 2 priority 100
 standby 2 ip 192.168.147.3
 standby 2 name two
 standby 2 track Fa0/0 10
 standby 2 track Multilink2 10
 standby 2 track Loopback101 10
 standby 2 track Loopback102 5
 keepalive 1
 speed 100
 full-duplex
 ntp broadcast version 3
 ip ospf hello-interval 1
 ip ospf dead-interval 3
 ip ospf message-digest-key 1 md5 mymd5pw
 ip pim sparse-mode
 ip pim version 2
 ip pim query-interval 2
!
!
!interface Serial0/0:0
 no ip address
 encapsulation ppp
 keepalive 1
 ppp multilink
 multilink-group 1
!
interface Serial0/1:0
 no ip address
 encapsulation ppp
 keepalive 1
 ppp multilink
 multilink-group 2
!
router ospf 1
 log-adjacency-changes
 area 2 nssa
 area 2 authentication message-digest
 auto-cost reference-bandwidth 10240
 timers spf 1 10
 redistribute ospf 2 metric-type 1 subnets
 redistribute static metric-type 1 subnets
 network 192.168.170.2 0.0.0.3 area 2
 distribute-list 10 out
 distance ospf external 125
 summary-address area-51-prefix mask
!
router ospf 2
 log-adjacency-changes
 auto-cost reference-bandwidth 10240
 area 51 authentication message-digest
 timers spf 1 10
 redistribute ospf 1 metric-type 1 subnets tag 202051
```

```
 network 192.168.146.0 0.0.0.255 area 51
 network 192.168.147.0 0.0.0.255 area 51
 network 10.0.0.0 0.255.255.255 area 51
 default-information originate metric 100 metric-type 1
 distribute-list 11 out
 distance 120
!
ip route 64.102.16.25 255.255.255.255 FastEthernet0/0
ip route 64.102.16.25 255.255.255.255 192.168.1.10
!
```

Notes

- Keepalives must be set for all Ethernet interfaces to ensure proper redundant behavior. A keepalive value of 1 has been selected for maximum responsiveness.
- Configuring **no ip proxy-arp** is helpful to avoid confusion with routes and ARP caches.
- In a redundant configuration, both MWR 1900s share a common IP address for their Multilink interface.

Monitoring and Managing the MWR 1900

You can use Cisco's network management applications, such as CiscoWorks2000 for Mobile Wireless (CW4MW), to monitor and manage aspects of the MWR 1900.

To enable remote network management of the MWR 1900, do the following:

Step 1 At the privileged prompt, enter the following command to access configuration mode:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
```

Step 2 At the configuration prompt, enter the following command to assign a host name to each of the network management workstations:

```
Router(config)# ip host hostname ip_address
```

Where *hostname* is the name assigned to the Operations and Maintenance (O&M) workstation and *ip_address* is the address of the network management workstation.

Step 3 Enter the following commands to create a loopback interface for O&M:

```
Router(config)# interface loopback number
Router(config-if)# ip address ip_address subnet_mask
```

Step 4 Exit interface configuration mode:

```
Router(config-if)# exit
```

Step 5 At the configuration prompt, enter the following command to specify the recipient of a Simple Network Management Protocol (SNMP) notification operation:

```
Router(config)# snmp-server host hostname [traps | informs] [version {1 | 2c | 3 [auth |
noauth | priv]}] community-string [udp-port port] [notification-type]
```

Where *hostname* is the name assigned to the CW4MW workstation with the **ip host** command in Step 2.

Step 6 Enter the following commands to specify the public and private SNMP community names:

```
Router(config)# snmp-server community public RO
Router(config)# snmp-server community private RW
```

Step 7 Enter the following command to enable the sending of SNMP traps:

```
Router(config)# snmp-server enable traps
```

Step 8 Enter the following command to specify the loopback interface from which SNMP traps should originate:

```
Router(config)# snmp-server trap-source loopback number
```

Where *number* is the number of the loopback interface you configured for the O&M in Step 3.

Step 9 At the configuration prompt, press Ctrl-Z to exit configuration mode.

Step 10 Write the new configuration to nonvolatile memory as follows:

```
Router# copy running-config startup-config
```

Show Commands for Monitoring the MWR 1900

To monitor and maintain the MWR 1900 router (including the multilink, VWIC, and FE interfaces) and to view information about the PPP mux and header compression configuration, use the following commands:

Command	Purpose
show ip rtp header-compression	Displays RTP header compression statistics.
show interface fastethernet *slot/port*	Displays the status of the FE interface.
show ppp multilink	Displays MLP and multilink bundle information.
show ppp multilink interface *number*	Displays multilink information for the specified interface.
show ppp mux interface *interface*	Displays statistics for PPP frames that have passed through a given multilink interface.
show controllers fastethernet *slot/port*	Displays information about initialization block, transmit ring, receive ring and errors for the Fast Ethernet controller chip.
show controllers t1	Displays information about the cable length, framing, firmware, and errors associated with the T1. With the MWR 1900, this command also displays the status of the relays on the VWIC.
show redundancy	Displays current redundant setting and recent changes in state.
show standby	Displays HSRP configuration information.
clear counters fastethernet *slot/port*	Clears interface counters.
clear ppp mux *interface*	Clears the PPP mux counters on the specified interface.
clear ip rtp header-compression	Clears RTP header compression structures and statistics.

Command	Purpose
show controllers	Displays all network modules and their interfaces. Displays the status of the VWIC relays when a VWIC is installed.
show interface *type slot/port*	Displays the configuration and status of the specified interface.
show protocols	Displays the protocols configured for the router and the individual interfaces.

Where to Go Next

At this point you can proceed to the following:

- The Cisco IOS software configuration guide and command reference publications for more advanced configuration topics. These publications are available on the Documentation CD-ROM that came with your router, on the World Wide Web from Cisco's home page, or you can order printed copies.
- The *System Error Messages* and *Debug Command Reference* publications for troubleshooting information

Command Reference

This chapter contains information about commands that were introduced specifically in support of the MWR 1900:

The following commands have been added or changed with this release:

- clear ppp mux
- mode y-cable
- ppp mux
- ppp mux delay
- ppp mux frame
- ppp mux pid
- ppp mux subframe length
- ppp mux subframe count
- redundancy
- show ppp mux
- show redundancy
- standalone
- standby use-interface

The following commands were not altered but have been included for your convenience:

- clear ip rtp header-compression
- ip rtp compression-connections
- ip rtp header-compression
- show ip rtp header-compression

clear ip rtp header-compression

To clear Real-Time Transport Protocol (RTP) header compression structures and statistics, use the **clear ip rtp header-compression** EXEC command.

clear ip rtp header-compression [*type number*]

Syntax Description

type number	(Optional) Interface type and number.

Command Modes

EXEC

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

If this command is used without an interface type and number, it clears all RTP header compression structures and statistics.

Examples

The following example clears RTP header compression structures and statistics for multilink interface 1:

```
clear ip rtp header-compression multilink1
```

Related Commands

Command	Description
ip rtp header-compression	Enables RTP header compression.

clear ppp mux

To clear PPP mux statistics, use the **clear ppp mux** EXEC command.

clear ppp mux [**interface** *interface*]

Syntax Description

interface	(Optional) The identifier of the multilink or serial interface for which you want to clear counters.

Defaults

If no interface is specified, statistics for all multilink and serial interfaces are cleared.

Command Modes

EXEC

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

None

Examples

The following example clears PPP mux statistics for multilink interface 1:

```
clear ppp mux interface multilink1
```

Related Commands

Command	Description
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ip rtp compression-connections

To specify the total number of Real-Time Transport Protocol (RTP) header compression connections that can exist on an interface, use the **ip rtp compression-connections** interface configuration command. To restore the default value, use the **no** form of this command.

ip rtp compression-connections *number*

no ip rtp compression-connections

Syntax Description

number	Number of RTP header compression connections the cache supports, in the range from 3 to 600. The default is 16 connections.

Defaults

16 connections

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.
12.0(7)T	For PPP and High-Level Data Link Control (HDLC) encapsulation, the maximum number of connections increased from 256 to 1000. For Frame Relay encapsulation, the maximum number of connections increased to 256. The maximum value for Frame Relay is fixed, not configurable.
12.1(4)E	This command was supported on Cisco 7100 series routers.
12.2(8)MC2	The upper limit for the MWR 1900 is set at 600.

Examples

The following example changes the number of RTP header compression connections supported to 150:

```
interface serial 0
 encapsulation ppp
 ip rtp header-compression
 ip rtp compression-connections 150
```

Related Commands

Command	Description
ip rtp header-compression	Enables RTP header compression.
show ip rtp header-compression	Displays RTP header compression statistics.

ip rtp header-compression

To enable Real-Time Transport Protocol (RTP) header compression, use the **ip rtp header-compression** interface configuration command. To disable RTP header compression, use the no form of this command.

ip rtp header-compression [passive]

no ip rtp header-compression

Syntax Description

passive	(Optional) Compresses outgoing RTP packets only if incoming RTP packets on the same interface are compressed. This option is not applicable on PPP links.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

If you use this command without the passive keyword, the software compresses all RTP traffic.

You can compress IP/UDP/RTP headers and IP/UDP headers to reduce the size of your packets. Compressing headers is especially useful for RTP, because RTP payload size can be as small as 20 bytes, and the uncompressed header is 40 bytes.

RTP header compression is supported on serial lines using PPP encapsulation. You must enable compression on both ends of a serial connection.

Examples

The following example enables RTP header compression on fast ethernet interface 1 and limits the number of RTP header compression connections to 10:

```
interface serial 0
 encapsulation ppp
 ip rtp header-compression
 ip rtp compression-connections 10
```

Related Commands

Command	Description
clear ip rtp header-compression	Clears RTP header compression structures and statistics.
ip rtp compression-connections	Specifies the total number of RTP header compression connections that can exist on an interface.
show ip rtp header-compression	Displays RTP header compression statistics.

mode y-cable

To access the command mode that allows you to manually control the relays on the VWIC card, use the **mode y-cable** command.

mode y-cable

Syntax Description

This command has no parameters, it invokes the y-cable mode.

Defaults

There are no default settings or behaviors.

Command Modes

Redundancy configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Examples

The following example enables y-cable mode.

```
mode y-cable
```

Related Commands

Command	Description
standalone	Indicates whether the MWR 1900 router is being used as a standalone device and manually sets the relays.
standby use-interface	Designates a loopback interface as a health or revertive interface.
redundancy	Invoked redundancy mode.

ppp mux

To enable PPP multiplexing/demultiplexing, use the **ppp mux** command in interface configuration mode. To disable PPP multiplexing/demultiplexing, use the **no** form of this command.

ppp mux

no ppp mux

Syntax Description

This command has no parameters.

Defaults

PPP multiplexing/demultiplexing is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Examples

The following example enables PPP multiplexing/demultiplexing.

```
ppp mux
```

Related Commands

Command	Description
ppp mux delay	Sets the maximum delay.
ppp mux frame	Sets the maximum length of the PPP superframe.
ppp mux pid	Sets the default PPP protocol ID.
ppp mux subframe count	Sets the maximum number of subframes in a superframe.
ppp mux subframe length	Sets the maximum length of the PPP subframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ppp mux delay

To set the maximum time the processor can wait before sending a superframe, use the **ppp mux delay** command in interface configuration mode. To set the maximum delay to the default, use the **no** form of this command.

ppp mux delay *integer*

no ppp mux delay

Syntax Description

integer	The maximum number of microseconds that the processor can wait before sending out a PPP superframe. Possible values are 0 through 4000000 microseconds.

Defaults

The default maximum delay is 0, which indicates that a superframe will be sent when the transmit queue is full.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

To use this command, you must first enable PPP multiplexing/demultiplexing.

Examples

The following example sets the maximum delay to 5 microseconds.

```
ppp mux delay 5
```

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing
ppp mux frame	Sets the maximum length of the PPP superframe.
ppp mux pid	Sets the default PPP protocol ID.
ppp mux subframe count	Sets the maximum number of subframes in a superframe.
ppp mux subframe length	Sets the maximum length of the PPP subframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ppp mux frame

To set the maximum length (in bytes) of the PPP superframes, use the **ppp mux frame** command in interface configuration mode. To set the maximum length to the default, use the **no** form of this command.

ppp mux frame *integer*

no ppp mux frame

Syntax Description

integer	The maximum number of bytes in any multiplexed PPP superframe. Possible values are 1 through 512 bytes.

Defaults

The default maximum length is 197.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

To use this command, you must first enable PPP multiplexing/demultiplexing.

Examples

The following example sets the maximum superframe length to 80 bytes.

```
ppp mux frame 80
```

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing
ppp mux delay	Sets the maximum delay.
ppp mux pid	Sets the default PPP protocol ID.
ppp mux subframe count	Sets the maximum number of subframes in a superframe.
ppp mux subframe length	Sets the maximum length of the PPP subframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ppp mux pid

To set the default receiving PPP protocol ID, use the **ppp mux pid** command in interface configuration mode. To remove this configuration, use the **no** form of this command.

ppp mux pid *integer*

no ppp mux pid

Syntax Description

integer	The default value of the PPP protocol ID. Possible values are 0 through 65534.

Defaults

The default is 33 (0x21), which is the IP protocol.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

To use this command, you must first enable PPP multiplexing/demultiplexing.

Examples

The following example sets the default PPP protocol ID to 8.

```
ppp mux pid 8
```

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing
ppp mux delay	Sets the maximum delay.
ppp mux frame	Sets the maximum length of the PPP superframe.
ppp mux subframe count	Sets the maximum number of subframes in a superframe.
ppp mux subframe length	Sets the maximum length of the PPP subframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ppp mux subframe length

To set the maximum length (in bytes) of the PPP subframes, use the **ppp mux subframe length** command in interface configuration mode. To set the maximum length to the default, use the **no** form of this command.

ppp mux subframe length *integer*

no ppp mux subframe length

Syntax Description

integer	The maximum number of bytes in any single subframe that is to be multiplexed. Possible values are 1 through 512 bytes.

Defaults

The default maximum length is 195.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

To use this command, you must first enable PPP multiplexing/demultiplexing. The maximum length of the subframe should be the maximum length of the superframe minus the length of the L2 header.

Examples

The following example sets the maximum subframe length to 20 bytes.

```
ppp mux subframe length 20
```

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing
ppp mux delay	Sets the maximum delay.
ppp mux frame	Sets the maximum length of the PPP superframe.
ppp mux pid	Sets the default PPP protocol ID.
ppp mux subframe count	Sets the maximum number of subframes in a superframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

ppp mux subframe count

To set the maximum number of PPP subframes that can be contained in a superframe, use the **ppp mux subframe count** command in interface configuration mode. To set the maximum number to the default, use the **no** form of this command.

ppp mux subframe count *integer*

no ppp mux subframe count

Syntax Description

integer	The maximum number of subframes that can be contained in a superframe. Possible values are 1 through 15 bytes.

Defaults

The default maximum is 15.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

To use this command, you must first enable PPP multiplexing/demultiplexing.

Examples

The following example sets the maximum subframe count to 20 bytes.

```
ppp mux subframe count 20
```

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing
ppp mux delay	Sets the maximum delay.
ppp mux frame	Sets the maximum length of the PPP superframe.
ppp mux pid	Sets the default PPP protocol ID.
ppp mux subframe length	Sets the maximum length of the PPP subframe.
show ppp mux	Displays PPP mux counters for the specified multilink interface.

redundancy

To access the command mode that allows you to configure aspects of redundancy, use the **redundancy** command.

redundancy

Syntax Description

This command has no parameters, it invokes the redundancy mode.

Defaults

There are no default settings or behaviors.

Command Modes

Global configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Examples

The following example enables redundancy mode.

```
redundancy
```

Related Commands

Command	Description
mode y-cable	Invoked y-cable mode.
standalone	Indicates whether the MWR 1900 router is being used as a standalone device and manually sets the relays.
standby use-interface	Designates a loopback interface as a health or revertive interface.

show ip rtp header-compression

To show RTP header compression statistics, use the **show ip rtp header-compression** EXEC command.

show ip rtp header-compression [*type number*] **[detail]**

Syntax Description

type number	(Optional) Interface type and number.
detail	(Optional) Displays details of each connection.

Command Modes

EXEC

Command History

Release	Modification
11.3	This command was introduced.
12.1(5)T	The command output was modified to include information related to the Distributed Compressed Real-Time Transport Protocol (dCRTP) feature.

Usage Guidelines

The detail keyword is not available with the **show ip rtp header-compression** command on a Route Switch Processor (RSP). However, the detail keyword is available with the **show ip rtp header-compression** command on a Versatile Interface Processor (VIP). Enter the **show ip rtp header-compression type number detail** command on a VIP to retrieve detailed information regarding RTP header compression on a specific interface.

Examples

The following is sample output from the **show ip rtp header-compression** command:

```
show ip rtp header-compression

RTP/UDP/IP header compression statistics:
 Interface Serial1:
  Rcvd: 0 total, 0 compressed, 0 errors
     0 dropped, 0 buffer copies, 0 buffer failures
  Sent: 430 total 429 compressed
     15122 bytes saved, 0 bytes sent
     0 efficiency improvement factor
  Connect: 16 rx slots, 16 tx slots, 0 long searches, 1 misses
     99% hit ratio, five minute miss rate 0 misses/sec, 0 max.
```

Table 5-1 describes the significant fields shown in the display.

Table 5-1 show ip rtp header-compression Field Descriptions

Field	Description
Interface Serial1	Type and number of interface.
Rcvd: total	Number of packets received on the interface.
compressed	Number of packets with compressed header.
errors	Number of errors.

Table 5-1 show ip rtp header-compression Field Descriptions (continued)

Field	Description
dropped	Number of dropped packets.
buffer copies	Not applicable to the MWR 1900 router.
buffer failures	Not applicable to the MWR 1900 router.
Sent: total	Total number of packets sent.
compressed	Number of packets sent with compressed header.
bytes saved	Total savings in bytes due to compression.
bytes sent	Not applicable to the MWR 1900 router.
efficiency improvement factor	Efficiency achieved through compression.
Connect: rx slots	Total number of receive slots.
tx slots	Total number of transmit slots.
long searches	Not applicable to the MWR 1900 router.
misses	Number of new states that were created.
hit ratio	Number of times existing states were revised.
five minute miss rate	Average miss rate.
max.	Maximum miss rate.
negative cache	Not applicable to the MWR 1900 router.

Related Commands

Command	Description
ip rtp compression-connections	Specifies the total number of RTP header compression connections that can exist on an interface.
ip rtp header-compression	Enables RTP header compression.

show ppp mux

To display counters for a multilink interface on the MWR 1900, use the **show ppp mux** command in EXEC mode.

show ppp mux [**interface** *interface*]

Syntax Description

interface *interface*	(Optional) The identifier of the multilink or serial interface for which you want to view counters.

Defaults

If no interface is specified, statistics for all multilink and serial interfaces are displayed.

Command Modes

EXEC

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

This command is only valid when issued against multilink or PPP interfaces.

Examples

The following is an example of the output generated by this command.

```
show ppp mux interface multilink 1

PPP Multiplex Statistics on Interface Multilink1:

Multiplex:
 Total input packets:0
 Errored input packets:0
 Valid input bytes:0
 Total output packets:0
 Multiplexed output packets:0
 Output bytes:0
 Efficiency improvement factor:0%

Demultiplex:
 Total input packets:0
 Multiplexed input packets:0
 Errored input packets:0
 Valid input bytes:0
 Total output packets:0
 Output bytes:0
 Efficiency improvement factor:0%
```

Table 5-2 describes the significant fields shown in the display.

Table 5-2 show ppp mux Field Descriptions

Field	Description
Total output packets	Number of outbound packets
Multiplexed output packets	Number of outbound multiplexed superframes
Output byte count	Number of outbound bytes
Total input packets	Number of inbound packets
Errored input packets	Number of inbound packets discarded due to error
Efficiency improvement factor	Percentage of efficiency improvement achieved through multiplexing or demultiplexing

The efficiency improvement factor is calculated as follows:

Multiplex efficiency improvement factor = 100 * (Total bytes saved) / (Total bytes received)

Where total bytes saved = bytes_received_at_muxer - bytes_sent_at_muxer.

Demultiplex efficiency improvement factor = 100 * (Total bytes saved) / (Total bytes sent)

Where total bytes saved = bytes_sent_at_demuxer - bytes_received_at_demuxer.

Related Commands

Command	Description
ppp mux	Enables PPP multiplexing/demultiplexing

show redundancy

To display information about the current redundant configuration and recent changes in states, use the **show redundancy** command in EXEC mode.

show redundancy

Syntax Description

This command has no attributes.

Command Modes

EXEC

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

In the **standby** *group* **name** *group-name* command, if you omit the *group-name* or if you enter a group name that doesn't begin with one or two, the configuration will fail and there will be a mismatch in the information displayed by the **show redundancy** and **show standby** commands.

Examples

The following is an example of the output generated by this command.

```
show redundancy
MWR1900 is the Active Router
Previous States with most recent at bottom

 INITL_INITL     Dec 31 19:00:00.000
 LISTN_INITL     Feb 28 19:00:15.568
 LISTN_LISTN     Feb 28 19:00:15.568
 SPEAK_LISTN     Feb 28 19:00:18.568
 SPEAK_SPEAK     Feb 28 19:00:18.568
 STDBY_SPEAK     Mar 19 08:54:26.191
 ACTIV_SPEAK     Mar 19 08:54:26.191
 ACTIV_STDBY     Mar 19 08:54:26.191
 ACTIV_ACTIV     Mar 19 08:54:26.191
 INITL_ACTIV     Mar 19 08:56:22.700
 INITL_INITL     Mar 19 08:56:22.700
 INITL_LISTN     Mar 19 08:56:28.544
 LISTN_LISTN     Mar 19 08:56:28.652
 LISTN_SPEAK     Mar 19 08:56:31.544
 SPEAK_SPEAK     Mar 19 08:56:31.652
 SPEAK_STDBY     Mar 19 08:56:34.544
 SPEAK_ACTIV     Mar 19 08:56:34.544
 STDBY_ACTIV     Mar 19 08:56:34.652
 ACTIV_ACTIV     Mar 19 08:56:34.652
 INITL_ACTIV     Mar 19 10:20:41.455
 INITL_INITL     Mar 19 10:20:41.455
 INITL_LISTN     Mar 19 10:20:49.243
 LISTN_LISTN     Mar 19 10:20:49.299
 LISTN_SPEAK     Mar 19 10:20:52.244
 SPEAK_SPEAK     Mar 19 10:20:52.300
 SPEAK_STDBY     Mar 19 10:20:55.244
```

```
STDBY_STDBY     Mar 19 10:20:55.300
ACTIV_STDBY     Mar 19 10:21:01.692
ACTIV_ACTIV     Mar 19 10:21:01.692
```

Related Commands

Command	Description
mode y-cable	Invokes y-cable mode.
redundancy	Invokes redundancy mode.
standalone	Specifies whether the MWR 1900 router is used in a redundant or stand-alone configuration.
standby	Sets HSRP attributes
standby use-interface	Specifies the interfaces to be used for health and revertive interfaces.

standalone

To specify that the MWR 1900 is being used in a stand-alone configuration (which impacts the relays on the VWIC), use the **standalone** command. To use the MWR 1900 in a redundant configuration, use the **no** form of this command.

[**no**] **standalone**

Syntax Description

This command has no attributes.

Defaults

By default, the MWR 1900 is configured to be used in a redundant configuration (**no standalone**) and the relays are open.

Command Modes

Y-cable configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

Issuing the standalone command closes the relays on the VWICs installed in the MWR 1900.

Examples

The following example closes the relays so that the MWR 1900 can be used as a stand-alone device.

```
standalone
```

Related Commands

Command	Description
mode y-cable	Invokes y-cable mode.
standby use-interface	Specifies the interfaces to be used for health and revertive interfaces.

standby use-interface

To designate a loopback interface as a health or revertive interface, use the **standby use-interface** command.

standby use-interface *interface* {**health | revertive | backhaul**}

Syntax Description

interface	Indicates the interface to be used with the specified parameter. For **health** and **revertive**, this is the loopback interface specified in the **standby track** command. For **backhaul**, the interface must be an MLPPP interface. If you want to use a serial interface as the backhaul, you must first configure that interface to be part of an MLPPP bundle.
health	Indicates the interface to monitor for an over temperature condition, the state of the processor, and the state of the T1/E1 firmware. If any of these watched conditions indicate a failure, this interface is brought down. Otherwise, the health interface remains in the up state.
revertive	Indicates the interface that acts as the revertive interface. If the MWR 1900 router changes state from active to standby, the revertive interface is brought up. If the MWR 1900 router changes state from standby to active, the revertive interface is brought down.
backhaul	Indicates the interface to be used for backhauling.

Defaults

By default, the MWR 1900 is configured to be used in a redundant configuration (**no standalone**) and the relays are open.

Command Modes

Y-cable configuration

Command History

Release	Modification
12.2(8)MC2	This command was introduced.

Usage Guidelines

The loopback interfaces that you specify for health and revertive interfaces must be the same loopback interfaces that you specified in the **standby track** command. In the **standby track** command, the decrement value for the revertive interface should always be less than that for other interfaces. We recommend that you use loopback101 for health and loopback102 for revertive.

The interface that you specify for the backhaul must be an MLPPP interface. If you want to use a serial interface as the backhaul, you must first configure that interface to be part of an MLPPP bundle. We recommend you use multilink1 for the backhaul interface.

Examples

The following example specifies loopback101 as the health interface and loopback102 as the revertive interface.

```
standby use-interface loopback101 health
standby use-interface loopback102 revertive
standby use-interface multilink1 backhaul
```

Related Commands

Command	Description
mode y-cable	Invokes y-cable mode.
redundancy	Invokes redundancy mode.
standalone	Specifies whether the MWR 1900 router is used in a redundant or stand-alone configuration.
standby	Sets HSRP attributes

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