Cisco AS5300 Universal Access Server Software Configuration Guide

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Preface

This chapter discusses the revisions made to this publication, describes how to get the latest version of this publication, the conventions used in this guide, and related documentation.

Cisco documentation and additional literature are available on a CD-ROM, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly; therefore, it might be more up to date than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM is available as a single item or as an annual subscription. You can also access Cisco documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

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Document Objectives

This configuration guide explains the initial and basic software configuration procedures for the Cisco AS5300 Universal Access Server. The guide contains procedures for running the setup script for various Cisco IOS software versions, manually configuring the access server, setting up basic security, managing modems, and how to use the ROM monitor.

After completing the basic configuration procedures covered in this guide, you can then use the appropriate companion publications to more completely configure your system. For information on other publications available, see the section “Related Documentation.”

Changes to This Guide

New/Changed Feature	Description
Setup script for Cisco IOS Release 12.02(XD)	The setup script has been updated to reflect the changes for the Cisco IOS Release 12.02(XD).
Serial interfaces for WAN support	Procedures include how to enable the serial interface, specify IP routing, and set up external clock timing on a DCE or DTE interface.
BERT	Briefly describes the Bit Error Rate Tester (BERT) feature used to test T1 or E1 links.

New/Changed Feature	Description
ISDN PRI	Provides an updated list of the switches and also two new commands used to monitor Non-Facility Associated Signaling (NFAS) groups and ISDN service and channels.
Resource pooling and session counting	Describes how to construct unique customer profiles, groups of DNIS numbers, and tabulate the number of active connections, calls accepted, calls rejected for each customer profile, and system resources over specific time.
T1 CAS and E1 R2 signaling.	Describes how to configure T1 CAS and E1 R2 signaling with Voice over IP (VoIP).
COT	Describes how use to use Continuity Test (COT) required by the SS7 network to conduct loopback and tone check testing on the path before a circuit is established. It is required for North American SS7 compliance.
RLM	Describes how to use Redundant Link Manager (RLM), which provides a virtual link management over multiple IP networks so that the Q.931 signaling protocol and other proprietary protocols can be transported on top of multiple redundant links between the Cisco signaling controller and the access server.

Document Organization

This configuration guide is organized into the following chapters and appendixes:

- Chapter 1, “First-Time Configuration,” describes how to run the setup script to do a basic configuration.
- Chapter 2, “Using Cisco IOS Software,” is a brief overview of how to use the command-line interface (CLI) to configure the access server.
- Chapter 3, “Basic Configuration,” provides instructions for configuring the various features of the access server using the CLI.
- Chapter 4, “Access Service Security,” describes the basic access server authentication, authorization, and accounting (AAA) security facility.
- Appendix A, “Managing Modems,” describes how to manage your modems using monitoring, polling, and troubleshooting commands.
- Appendix B, “ROM Monitor,” describes how to use the Cisco AS5300 ROM monitor to isolate or rule out hardware problems encountered when installing your access server.
- Appendix C, “Using Setup on Cisco IOS Releases 11.2 or 11.3(2)T,” describes the setup script for Cisco IOS releases 11.2 and 11.3(2)T.

Where to Get the Latest Version of This Guide

The hard copy of this guide is updated at major releases only and does not always contain the latest material for enhancements occurring between major releases. You are shipped separate release notes or configuration notes for spares, hardware, and software enhancements occurring between major releases.

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Conventions

This publication uses the following conventions:

- The symbol ^ represents the key labeled *Control*. For example, the key combination ^z means hold down the *Control* key while you press the *z* key.

Command descriptions use these conventions:

- Examples that contain system prompts denote interactive sessions, indicating the commands that you should enter at the prompt. The system prompt indicates the current level of the EXEC command interpreter. For example, the prompt `router>` indicates that you should be at the *user* level, and the prompt `router#` indicates that you should be at the *privileged* level. Access to the privileged level usually requires a password.
- Commands and keywords are in **boldface** font.
- Arguments for which you supply values are in *italic* font.
- Elements in square brackets ([ ]) are optional.
- Alternative but required keywords are grouped in braces ({ }) and separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and sample console screen displays are in `screen` font.
- Information you enter is in **`boldface screen`** font.
- Nonprinting characters, such as passwords, are in angle brackets (< >).
- Default responses to system prompts are in square brackets ([ ]).
- Exclamation points (!) at the beginning of a line indicate a comment line.

Caution Means *reader be careful*. You are capable of doing something that might result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Tips Means *the following information might help you solve a problem*.

Warning This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

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Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du vare oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

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Related Documentation

Refer to the following publications for additional information, available online:

- *Cisco AS5300 Universal Access Server Chassis Installation Guide*
- *Cisco AS5300 Universal Access Server Module Installation Guide*
- *Voice Over IP for Cisco AS5300 Software Configuration Guide*
- *System Error Messages* and *Debug Command Reference* publications
- *Dial Solutions Configuration Guide*
- *Dial Case Study*
- *Cisco SS7/CCS7 Dial Access Solution System Integration*
- Cisco IOS software configuration guide, feature modules, and command reference publications

These publications are available on the documentation CD that came with your access server, on the World Wide Web from Cisco's home page, or in orderable printed format.

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- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and connection rates up to 28.8 kbps.

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First-Time Configuration

This chapter describes how to power ON the Cisco AS5300 universal access server and configure it using the prompt-driven setup script (also called the System Configuration dialog). The following sections are included:

- Using the Setup Script
- Where to Go Next

If you prefer to configure the access server manually, proceed to the next chapter “Using Cisco IOS Software” to familiarize yourself with the command-line interface (CLI) and then proceed to the following chapter “Basic Configuration” for step-by-step instructions.

Using the Setup Script

The setup script in this section uses the latest release version of Cisco IOS software.

Note If your system is running Cisco IOS Release 11.2 or 11.3(2)T, see the appendix “Using Setup on Cisco IOS Releases 11.2 or 11.3(2)T” for intructions and screen displays.

Getting Started

Before you power on the access server and begin to use the setup script in the System Configuration dialog, make sure you have already connected the cables to the access server and configured your PC terminal emulation program for 9600 baud, 8 data bits, no parity, and 2 stop bits. All configuration will be performed from your PC terminal emulation program window.

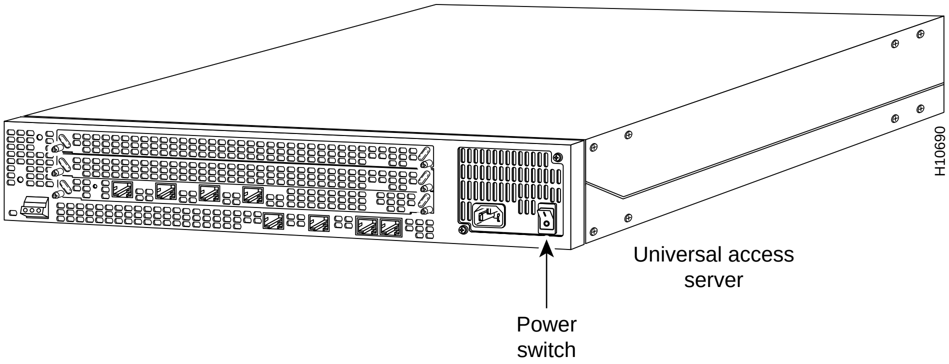
The prompts and resulting messages vary depending on your responses. For most configurations, you can press **Enter** to accept the default entries displayed in square ([]) brackets.

Note Information that you enter is in this **`boldface`** font. Also note that if you make a mistake during the configuration, exit and run the System Configuration dialog again by pressing **Ctrl-c**, and then type **setup** at the enable prompt (`5300#`).

To use the setup script take the following steps:

Step 1 Power ON the access server. The power switch is on the rear panel, at the upper right corner near the power cord, as shown in Figure 1-1.

Figure 1-1 Power Switch Location



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 will be interpreted as the first command typed when the messages stop, which might cause you to power cycle the access server and start over. It will take a few minutes for the messages to stop.

The messages look similar to the following:

Note The displayed messages depend on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and might not exactly reflect the messages on your console.

```
System Bootstrap, Version 12.0(3)T, RELEASED SOFTWARE
Copyright (c) 1994-1998 by cisco Systems, Inc.
AS5300 processor with 32768 Kbytes of main memory

rommon 3 > b flash:2:
program load complete, entry point: 0x80008000, size: 0x5d7b5c
Self decompressing the image :
#################################################################################
###################]

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           170 West Tasman Drive
           San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) 5300 Software (C5300-JS-M), Released Version 12.0(19981001:221340)
[ayeh-wk_0_6_0 100]
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Thu 01-Oct-98 15:13 by ayeh
Image text-base: 0x600088E8, data-base: 0x609F6000
cisco AS5300 (R4K) processor (revision A.14) with 32768K/16384K bytes of memory.
Processor board ID 05433592
R4700 processor, Implementation 33, Revision 1.0 (512KB Level 2 Cache)
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.1.
Backplane revision 2
Manufacture Cookie Info:
 EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x30,
 Board Hardware Version 1.0, Item Number 73-2414-2,
 Board Revision 3, Serial Number 05433592,
 PLD/ISP Version 255.255, Invalid Date code.
1 Ethernet/IEEE 802.3 interface(s)
1 FastEthernet/IEEE 802.3 interface(s)
4 Serial network interface(s)
120 terminal line(s)
4 Channelized T1/PRI port(s)
128K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash partition 1 (Read/Write)
8192K bytes of processor board System flash partition 2 (Read/Write)
4096K bytes of processor board Boot flash (Read/Write)

--- System Configuration Dialog ---
```

Step 2 When the following message appears, enter **yes** to continue:

```
Continue with configuration dialog? [yes/no]: yes

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 3 When the following message appears, enter **No** to configure all interfaces. Note that if you enter **Yes**, your system will not be configured correctly:

```
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]: no
```

Step 4 When the following message appears, press **Enter** to see the current interface summary:

```
First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid configuration

Interface              IP-Address      OK? Method Status                Protocol
Ethernet0              171.69.90.18    YES NVRAM  up                    down
FastEthernet0          unassigned      YES unset  administratively down down
Group-Async1           171.69.90.18    YES unset  down                  down
Serial0                unassigned      YES unset  administratively down down
Serial1                unassigned      YES unset  administratively down down
Serial2                unassigned      YES unset  administratively down down
Serial3                unassigned      YES unset  administratively down down
```

```
Serial0:0              unassigned      YES unset  down                  down
Serial0:1              unassigned      YES unset  down                  down
.
.
.
Serial3:21             unassigned      YES unset  down                  down
Serial3:22             unassigned      YES unset  down                  down
Serial3:23             171.69.90.18    YES unset  down                  down
```

Step 5 Enter a host name for the access server:

```
Configuring global parameters:

  Enter host name [Router]: 5300

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.
```

Step 6 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when viewing the configuration:

```
  Enter enable secret: lab

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

Step 7 Enter an enable password. This password is *not* encrypted (less secure) and can be seen when viewing the configuration:

```
  Enter enable password: guessme

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

Step 8 Enter the virtual terminal password, which is used for remote console access:

```
  Enter virtual terminal password: guessagain
```

Step 9 Enter **yes** to the system management prompt if you want the access server to be managed by the system controller. If you enter yes, you need to also enter the shelf ID and the system controller's IP addresss and password. The system controller uses the shelf-id to identify an access server or dial shelf. The shelf ID is a number from 1 to 999 and must be unique in the POP management domain. The system controller password is used to authenticate messages between the system controller and managed shelves.

```
Configure System Management? [yes/no]: yes
    Shelf-id [0]:
    System Controller IP address: 172.87.98.01
    System Controller password: sctest
```

Step 10 Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [no]: yes
  Community string [public]:
Configure LAT? [yes]:
Configure AppleTalk? [no]: yes
  Multizone networks? [no]: yes
Configure DECnet? [no]:
Configure IP? [no]:

  Configure IGRP routing? [yes]:
    Your IGRP autonomous system number [1]: 15
```

Note If you answer no to IGRP, you will be prompted to configure RIP.

```
Configure CLNS? [no]:
Configure IPX? [no]: yes
Configure Vines? [no]:
Configure XNS? [no]:
Configure Apollo? [no]:
```

Step 11 Configure the asynchronous serial lines for the integrated modems on the modules installed in the access server. (If you want to allow users to dial in through the integrated modems, you must configure the async lines.)

```
Async lines accept incoming modems calls. If you will have users dialing in via
modems, configure these lines.

Configure Async lines? [yes]:
```

Note We recommend that you do not change the async line speed for modems. However, for V.110 terminal adapters, we recommend that the speed not go above 19200.

```
  Async line speed [115200]:
Will you be using the modems for inbound dialing? [yes]:
```

Note If your asynchronous interfaces will be using the same basic configuration parameters, we recommend that you group them so that they can be configured as a group. Otherwise, you will need to configure each interface separately.

```
Would you like to put all async interfaces in a group and configure them all at
one time ? [yes]
```

Note Dynamic IP addresses permit dial-in users to choose a static IP address when they dial in. If you do not allow dynamic IP addresses, the access server will provide IP addresses from an IP address pool that you set up later in the next prompt.

```
Allow dial-in users to choose a static IP address? [no]:
Configure for TCP header compression? [yes]:
Configure for routing updates on async links? [no]:
```

Note Make sure the starting and ending addresses of the IP pool are in the same subnet.

```
Enter the starting address of IP local pool? [X.X.X.X]: 172.20.30.40
Enter the ending address of IP local pool? [X.X.X.X]: 172.20.30.88

You can configure a test user to verify that your dial-up service is working
properly.
```

```
What is the username of the test user? [user]:
What is the password of the test user? [passwd]:

Will you be using the modems for outbound dialing? [no]:
Configure for Async IPX? [yes]: no
Configure for Appletalk Remote Access (ARA)? [no]: yes
  AppleTalk Network for ARAP clients [1]:
  Zone name for ARAP clients [ARA Dialins]:
  Allow ARAP "Guest" logins? [yes/no]: yes
```

Step 12 Enter the letter corresponding to the ISDN switch type that matches your telco switch type or press **Enter** to accept the default:

```
Do you want to configure ISDN switch type? [yes]:
  The following ISDN switch types are available:
   [a] primary-4ess
   [b] primary-5ess
   [c] primary-dms100
   [d] primary-net5
   [e] primary-ntt
   [f] primary-ts014
  Enter the switch type [b]:
```

Step 13 Press **Enter** to allow users to dial in via ISDN or analog modems:

```
Next, you will be prompted to configure controllers.
These controllers enable users to dial in via ISDN or analog modems.

Do you intend to allow users to dial in? [yes]:

There are 8 controllers on this access server. If you want to use
the full capacity of the access server configure all controllers.

Controller T1 0,1,..etc  in software corresponds to Port 0,1,..etc
on the back of the access server.

PRI configuration can be configured to controllers all at once
based on your PRI controllers selection. Where as CAS configuration
will be configured individually for each controller.
```

Step 14 Enter the number of controllers you will be using for the PRI configuration or press **Enter** to configure all controllers:

```
Enter # of controllers, you will be using for PRI configuration [8]:

Configuring controller parameters:
```

Step 15 Set the CAS configuration options for the first controller you are configuring. First, press Enter to set robbed-bit signaling on the controller:

```
Configuring controller T1 2:
  Will you be using CT1 (robbed bit signaling) on this controller? [yes]:
```

Step 16 Enter your telco framing type:

```
The following framing types are available: esf | sf
  Enter the framing type [esf]:
```

Step 17 Enter your telco line code type:

```
The following linecode types are available: ami | b8zs
  Enter the line code type [b8zs]:
```

Step 18 Enter the letter corresponding to the signaling type to support modem pooling over the T1 lines or press **Enter** to accept the default:

```
The following line signaling types are available:
    [a] e&m-fgb
    [b] e&m-fgd
    [c] e&m-immediate-start
    [d] fxs-ground-start
    [e] fxs-loop-start
    [f] sas-ground-start
    [g] sas-loop-start
  Enter the line signaling type [a]:
```

Step 19 Enter the tone signaling type:

```
The following tone signaling types are available: dtmf | mf
  Enter the tone signal type [dtmf]:
```

Step 20 Press **Enter** to configure digital number identification service (DNIS) over T1 lines:

```
Do you want to provision DNIS address information? [yes]:
```

Step 21 Repeat Step 15 to Step 20 to configure the remaining controllers.

Step 22 Enter **yes** to configure the Ethernet 0 interface (this is the Ethernet 10BaseT port) if you plan to use this interface to manage and monitor the access server:

```
Configuring interface parameters:

Do you want to configure Ethernet0  interface? [no]: yes
  Configure IP on this interface? [no]: yes
    IP address for this interface: 172.21.40.10
    Subnet mask for this interface [255.0.0.0] :
    Class B network is 172.21.0.0, 16 subnet bits; mask is /16
  Configure LAT on this interface? [no]:
  Configure AppleTalk on this interface? [no]:
  Configure IPX on this interface? [no]:
```

Step 23 Press **Enter** or enter **yes** to configure the Fast Ethernet 0 interface (this is the Ethernet 100BaseT port) to connect the access server to a LAN:

```
Do you want to configure FastEthernet0 interface? [yes]: yes
```

Note Full duplex mode enables simultaneous data transfer between a sending and a receiving station.

```
Operate in full-duplex mode? [no]: yes
Operate at 100 Mbps speed? [yes]:
Configure IP on this interface? [yes]:
  IP address for this interface [X.X.X.X]: 172.22.50.10
  Subnet mask for this interface [255.255.0.0] :
  Class B network is 172.22.0.0, 16 subnet bits; mask is /16
Configure LAT on this interface? [no]:
Configure AppleTalk on this interface? [no]:
Configure IPX on this interface? [no]:
```

Step 24 Configure your serial intefaces by responding to the following prompts:

```
Do you want to configure Serial0  interface? [no]: yes
```

Note If using the serial interfaces to route data from the T1/PRI or E1/PRI ports to a WAN, you need to configure IP on the interface. Enter the IP address of the WAN device to which the data will be routed.

```
Configure IP on this interface? [no]: yes
Configure IP unnumbered on this interface? [no]:
    IP address for this interface: 173.20.30.40
    Subnet mask for this interface [255.255.0.0] :
    Class B network is 173.20.0.0, 16 subnet bits; mask is /16
Configure LAT on this interface? [no]:
Configure AppleTalk on this interface? [no]:
Configure IPX on this interface? [no]:
```

Step 25 Repeat Step 24 to configure the other three serial interfaces, if necessary.

Step 26 Configure the PRI D-channel (signaling channel):

```
Do you want to configure Serial0:23 (PRI D-channel) interface? [no]: yes
  Configure IP on this interface? [no]: yes
  Configure IP unnumbered on this interface? [no]:
    IP address for this interface: 173.20.30.40
    Subnet mask for this interface [255.255.0.0] :
    Class B network is 173.20.0.0, 16 subnet bits; mask is /16
  Configure LAT on this interface? [no]:
  Configure AppleTalk on this interface? [no]:
  Configure IPX on this interface? [no]:
```

Step 27 Repeat Step 26 for each D-channel.

After you complete the configuration script, messages similar to the following appear.

```
The following configuration command script was created:

hostname 5300
enable secret 5 $1$WVLB$YD0zbQsu3nqZh/bnN2fwX0
enable password guessme
line vty 0 4
password guessagain
syscon shelf-id 0
syscon address 172.87.98.1 sctest
snmp-server community public
!
appletalk routing
no decnet routing
no ip routing
no clns routing
ipx routing
no vines routing
no xns routing
no apollo routing
!
line 1 120
speed 115200
 flowcontrol hardware
login local
autoselect during-login
autoselect ppp
```

```
modem dialin
ip local pool setup_pool 172.20.30.40 172.20.30.88
!
username user password passwd
!
arap network 1 ARA Dialins
line 1 120
arap enable
autoselect arap
!
! Turn off IPX to prevent network conflicts.
interface Ethernet0
no ipx network
interface FastEthernet0
no ipx network
interface Serial0
no ipx network
interface Serial1
no ipx network
interface Serial2
no ipx network
interface Serial3
no ipx network
interface Serial0:23
no ipx network
interface Serial1:23
no ipx network
interface Serial2:23
no ipx network
interface Serial3:23
no ipx network
!
isdn switch-type primary-5ess
!
controller T1 0
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 1
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 2
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 3
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 4
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 5
```

```
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 6
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 7
 no shutdown
framing esf
linecode b8zs
cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
scheduler interval 1000
line console 0
logging synchronous
!
interface Ethernet0
no shutdown
ip address 172.21.40.10 255.255.0.0
no lat enabled
no mop enabled
!
interface FastEthernet0
duplex full
speed 100
ip address 172.22.50.10 255.255.0.0
no lat enabled
no mop enabled
!
interface Serial0
no shutdown
ip address 173.20.30.40 255.255.0.0
no lat enabled
no mop enabled
!
interface Serial1
shutdown
no ip address
!
interface Serial2
shutdown
no ip address
!
interface Serial3
shutdown
no ip address
!
interface Serial0:23
no shutdown
no ip address
no lat enabled
no mop enabled
!
interface Serial1:23
no shutdown
ip address 173.20.30.40 255.255.0.0
no lat enabled
no mop enabled
!
interface Serial2:23
no shutdown
no ip address
no lat enabled
no mop enabled
no shutdown
no ip address
no lat enabled
no mop enabled
!
Interface Group-Async1
group-range 1 120
ip unnumbered FastEthernet0
encapsulation ppp
ppp authentication chap pap
peer default ip address pool setup_pool
ip tcp header-compression passive
async mode interactive
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
end
end
```

Step 28 Enter 0, 1, or 2 when the following prompt is displayed:

```
[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]:

Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to down
%LINK-3-UPDOWN: Interface Serial1, changed state to down

<Additional messages omitted.>
```

Step 29 When the messages stop displaying on your screen, press **Enter** to get the following prompt:

```
5300>
%AT-6-ONLYROUTER: Ethernet0: AppleTalk port enabled; no neighbors found
```

Note If you see this message, it means that no other routers were found on the network attached to the port.

Step 30 The `5300>` prompt indicates that you are now at the command-line interface (CLI) and you have just completed the basic access server configuration. However, this is not a complete configuration. At this point you have two options:

- Run the setup script in the System Configuration dialog again and create another configuration. Enter the following commands to repeat the setup script:

```
5300> enable
Password: <password>
5300# setup
```

- Modify the existing configuration or configure additional features with the CLI as described in the *Dial Solutions Configuration Guide*, the *Dial Solutions Command Reference Guide* the Cisco IOS software configuration guide, and command reference publications.

Where to Go Next

At this point you can proceed to:

- The next chapter “Using Cisco IOS Software” to learn how to use the CLI to configure additional features.
- The chapter “Access Service Security” to configure security on the access server.
- The chapter “Basic Configuration” for step-by-step instructions to configure the access server manually. You can also refer to 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 arrived with your access server, on the World Wide Web from Cisco’s home page, or you can order printed copies. If using Cisco’s home page, refer to the topic **Configuring Selected (feature) Cisco IOS Features**, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/sw_conf/index.htm

CHAPTER 2

Using Cisco IOS Software

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

- Getting Help
- Understanding Command Modes
- How to Find Command Options
- Undoing a Command or Feature
- Saving Configuration Changes
- Where to Go Next

Understanding these concepts will save you time later. If you have never used the Cisco IOS software or need a refresher, take a few minutes to read this chapter now.

If you are already familiar with the Cisco IOS software, proceed to the next chapter, “Basic Configuration.”

Getting Help

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

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

  ```
  5300> ?
  ```

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

  ```
  5300> s?
  ```

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

  ```
  5300> 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

You will need to use many different command modes to use to configure the access server. Each command mode restricts you to a subset of commands. If you are having trouble 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.

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

```
5300> enable
5300> password
5300# configure terminal
5300(config)# interface ethernet 0
5300(config-if)# line 0
5300(config-line)# controller t1 0
5300(config-controller)# exit
5300(config)# exit
5300#
%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 5300> prompt.

Note You can press **Ctrl-Z** at any time to immediately return to enable mode (5300#), instead of entering **exit**, which returns you to the previous mode.

How to Find Command Options

This section explains how to display options for a command. To display options for a command, enter a **?** at the configuration prompt, or after entering part of a command followed by a space. The configuration parser displays options available with the command. For example, if you were in global configuration mode, typed the command **arap**, and wanted to see all the keywords and arguments for that command, you would type **arap ?**.

Table 2-1 shows examples of this function.

Table 2-1 How to Find Command Options

Step	Command	Purpose

1	`5300> enable`
	`Password: <password>`
	`5300#`
		Enter enable mode.
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300# config terminal`
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode and the prompt changes to `5300(config)#`.

3	`5300(config)# controller t1 ?`
	`<0-3>  Controller unit number`
	`5300(config)# controller t1 1`
		Specify the T1 controller that you want to configure using the **controller T1** number global configuration command.

Table 2-1 How to Find Command Options (Continued)

Step	Command	Purpose

4	5300(config-controller)# **?**
	Controller configuration commands:
	  cablelength Specify cable length for a DS1 link
	  cas-group Configure the specified timeslots
	                for CAS(Channel Associate Signals)
	  channel-group Specify timeslots to channel-group
	                mapping for an interface
	  clock Specify the clock source for a DS1
	                link
	  default Set a command to its defaults
	  description Controller specific description
	  ds0 ds0 commands
	  exit Exit from controller configuration
	                mode
	  fdl Specify the FDL standard for a DS1
	                data link
	  framing Specify the type of Framing on a DS1
	                link
	  help Description of the interactive help
	               system
	  linecode Specify line encoding method for
	               a DS1 link
	  loopback Put the entire T1 line into loopback
	  no Negate a command or set its defaults
	  pri-group Configure specified timeslots for
	               PRI
	  shutdown Shut down a DS1 link (send Blue
	                 Alarm)
		Display controller configuration commands.

5	5300(config-controller)# **cas-group ?** <0-23> Channel number	Display the options for the cas-group controller configuration command. This command is used to configure the channel-associated signaling on a T1 controller.
6	5300(config-controller)# **cas-group 1 ?** timeslots List of timeslots in the cas-group	Display the only command (**timeslots**) available in **cas-group 1**.
7	5300(config-controller)# **cas-group 1 timeslots ?** <1-24> List of timeslots which comprise the cas-group	Display the range for the timeslot option. Specify a timeslot range of values from 1 to 24. You can specify timeslot ranges (for example, 1-24), individual timeslots separated by commas (for example 1, 3, 5), or a combination of the two (for example 1-3, 8, 17-24). The 16th timeslot is not specified in the command line, because it is reserved for transmitting the channel signaling.
8	5300(config-controller)# **cas-group 1 timeslots 1-24** **?** service Specify the type of service type Specify the type of signaling	Display the two commands (**service** and **type**) available for the timeslots.

Table 2-1 How to Find Command Options (Continued)

Step	Command	Purpose

9	5300(config-controller)# **cas-group 1 timeslots 1-24 type ?**
	  e&m-fgb E & M Type II FGB
	  e&m-fgd E & M Type II FGD
	  e&m-immediate-start E & M Immediate Start
	  fxs-ground-start FXS Ground Start
	  fxs-loop-start FXS Loop Start
	  sas-ground-start SAS Ground Start
	  sas-loop-start SAS Loop Start
		List supported signaling types.

10	5300(config-controller)# **cas-group 1 timeslots 1-24 type e&m-fgb ?**
	  dtmf DTMF tone signaling
	  mf MF tone signaling
	  service Specify the type of service
	  <cr>
		Display the types of channel-associated signaling available for the e&m-fgb type.

11	5300(config-controller)# **cas-group 1 timeslots 1-24 type e&m-fgb dtmf ?**
	  dnis DNIS addr info provisioned
	  service Specify the type of service
	  <cr>
		Display the options supported for the DTMF tone signaling option.

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

Enter the **copy running-config startup-config** command to save your configuration changes to nonvolatile random-access memory (NVRAM) so that they will not be lost if there is a system reload or power outage. For example:

```
5300# 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]
5300#
```

Where to Go Next

Now that you have learned some Cisco IOS software basics, you can begin to configure the access server 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 are having 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.

- If you want 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 that they will not be lost if there is a system reload or power outage.

Proceed to the next chapter “Basic Configuration” to begin configuring the access server.

Basic Configuration

This chapter describes how to use the Cisco IOS software command-line interface (CLI) to configure basic access server functionality, including:

- LAN and WAN configuration (including Integrated Services Digital Network [ISDN], Primary Rate Interface [PRI], and channelized T1 and E1)
- Modem configuration
- Voice-over IP (VoIP) configuration

Follow the procedures in this chapter to configure the access server manually or if you want to change the configuration after you have run the setup script (described in the chapter "First-Time Configuration").

This chapter does not describe every configuration possible—only a small portion of the most commonly used configuration procedures. For advanced configuration topics and procedures, refer to the topic **Configuring Cisco IOS Features** online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/index.htm

You can also view these publications on the Documentation CD-ROM that arrived with your access server, or you can order printed copies separately.

If you are experienced using the Cisco IOS software, you might find the "Comprehensive Configuration Examples" section at the end of this chapter a useful reference for configuration.

Note If you skipped the previous chapter, "Using Cisco IOS Software," and you have never configured a Cisco access server, go back to that chapter and read it now. This chapter provides important information you will need to succeed with the configuration.

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 access servers from each other. Setting an encrypted password allows you to prevent unauthorized configuration changes.

Configure

Table 3-1 Configuring the Host Name and Passwords

Step	Command	Purpose
1	Router> **enable** Password: <*password*> Router#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to `5300#`.
2	Router# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `Router(config)#`.
3	Router(config)# **hostname 5300** 5300(config)#	Change the name of the access server to a meaningful name. Substitute your host name for `5300`.
4	5300(config)# **enable secret guessme**	Enter an enable secret password. This password provides access to privileged EXEC mode. When a user types **enable** at the EXEC prompt (`5300>`), they must enter the enable secret password to gain access to configuration mode. Substitute your enable secret for **guessme**.
5	5300(config)# **line con 0**	Enter line configuration mode to configure the console port. When you enter line configuration mode, the prompt changes to `5300(config-line)#`.
	5300(config-line)# **exec-timeout 0 0**	Prevent the access server's EXEC facility from timing out if you do not type any information on the console screen for an extended period.
	5300(config-line)# **exit** 5300(config)#	Exit back to global configuration mode.

Verify

To verify that you configured the right host name and passwords:

- Enter the **show config** command:

```
5300(config)# show config
Using 1888 out of 126968 bytes
```

```
!
version XX.X
.
.
!
hostname 5300
!
enable secret 5 $1$60L4$X2JYOwoDc0.kqa1loO/w8/
.
```

Check the host name and encrypted password displayed near the top of the command output.

- Exit global configuration mode and attempt to reenter it using the new enable password:

```
5300# exit

5300 con0 is now available
Press RETURN to get started.
5300> enable
Password: guessme
5300#
```

Tips

If you are having trouble:

- Make sure **Caps Lock** is off.
- Make sure you entered the correct passwords. Passwords are case sensitive.

Configuring Alarms

Facility alarm currently monitors the following failure events:

- Interface down
- T1/E1 Controller down
- Modem card failure
- Redundant Power Supply (RPS) failure

IOS polls every second to detect the failure events that you have configured and will turn ON the alarm when any one of the failure events is detected. By default, facility alarm in OFF. Users have to configure one of the following commands to enable monitoring of the failure conditions.

Enter **[no]** before the full command to disable any of the alarm commands.

Configure

Table 3-2 Configuring Ethernet 10BaseT

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

Table 3-2 Configuring Ethernet 10BaseT (Continued)

Step	Command	Purpose
2	5300# **facility-alarm detect interface ethernet 0**	Turn ON alarm when interface goes down (interfaces are "ethernet 0" or "fastethernet 0" or "serial <0-3>").
3	5300# **facility-alarm detect controller t1 0**	Turn ON alarm when controller goes down (values are "t1 <0-7>" or "e1 <0-7>").
4	5300# **facility-alarm detect modem-board 1**	Turn ON alarm when modem board present in slot# fails.
5	5300# **facility-alarm detect rps**	Turn ON alarm when RPS failure event is detected, any of the following failures will turn ON the alarm. • i/p voltage failure • o/p voltage failure • thermal failure • fan failure • overvoltage condition • multiple failures

Verify

To see the status of the alarms:

- Enter the **show facility-alarm** command:

```
5300# show facility-alarm
 Device              State
 Ethernet0           UP
 FastEthernet0       OWN
 Facility Alarm is ON
5300#
```

Tips

If you are having trouble:

- Make sure the cable connections are not loose or disconnected.
- Make sure you are using Number 12 or 14 AWG copper wires to connect to the alarm port terminal blocks.
- Make sure your alarm is operational.

Configuring Ethernet 10BaseT

Assign an IP address to the Ethernet 10BaseT interface of your access server so that it can be recognized as a device on the Ethernet LAN.

Configure

Table 3-3 Configuring Ethernet 10BaseT

Step	Command	Purpose
1	5300> **enable** Password: *<password>* 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to 5300#.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered the global configuration mode when the prompt changes to 5300(config)#.
3	5300(config)# **interface ethernet 0** 5300(config-if)#	Enter Ethernet interface configuration mode.
4	5300(config-if)# **ip address 172.16.254.254 255.255.255.0**	Assign an IP address and subnet mask to the interface.
5	5300(config-if)# **no shutdown**	Without issuing this command, you will not have a connection to the network.
6	5300(config-if)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Verify

To verify you have assigned the correct IP address:

- Enter the **show arp** command:

```
5300# show arp
Protocol  Address          Age (min)  Hardware Addr    Type   Interface
Internet 172.16.254.254           _   0800.207e.bead   ARPA   Ethernet0
5300#
```

Tips

If you are having trouble:

- Make sure the cable connections are not loose or disconnected.
- Make sure you are using the correct IP address.

Configuring Ethernet 100BaseT

Assign an IP address to the Ethernet 100BaseT interface of your access server so that it can be recognized as a device on the Ethernet LAN. The Fast Ethernet interface supports 10- and 100-Mbps speeds with the 100BaseT and 10BaseT routers, hubs, and switches.

Configure

Table 3-4 Configuring Ethernet 100BaseT

Step	Command	Purpose
1	5300> **enable** Password: <*password*> 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to 5300#.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
3	5300(config)# **interface fastethernet 0** 5300(config-if)#	Enter Ethernet interface configuration mode.
4	5300(config-if)# **ip address 172.16.254.250 255.255.255.0**	Assign an IP address and subnet mask to the interface.
5	5300(config-if)# **speed 100**	Assigns speed 100 Mbps to Fast Ethernet. This is the default value. See Table 3-4 for details on using different combinations of speed and duplex options.
6	5300(config-if)# **duplex full**	Sets Fast Ethernet to operate at full duplex. Note: To use the auto-negotiation capability (that is, detect speed and duplex modes automatically), you must set both speed and duplex to auto. Setting speed to auto negotiates speed only, and setting duplex to auto negotiates duplex only. See Table 3-4 for details on using different combinations of duplex and speed.
7	5300(config-if)# **no shutdown**	Without issuing this command, you will not have a connection to the network.
8	5300(config-if)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Table 3-5 Using Different Duplex and Speed Options

Duplex Mode	Speed Mode	Action
auto	auto	Auto negotiates speed and duplex modes.
auto	100/10	Auto negotiates duplex mode.
half/full	auto	Auto negotiates speed mode.
half	10	Sets 10 Mbps for speed and half-duplex for duplex.

Table 3-5 Using Different Duplex and Speed Options

Duplex Mode	Speed Mode	Action
full	10	Sets 10 Mbps for speed and full-duplex for duplex.
half	100	Sets 100 Mbps for speed and half-duplex for duplex.
full	100	Sets 100 Mbps for speed and full-duplex for duplex.

Verify

To verify the IP address, configured and actual speed, and configured and actual duplex operations:

- Enter the **show arp** command to verify the IP address:

```
5300# show arp
Protocol  Address      Age (min)  Hardware Addr    Type    Interface
Internet 172.16.254.250      _    0800.207e.bead   ARPA    FastEthernet0
```

- Enter the **show interface fastethernet 0** command to verify the configured speed:

```
5300# show interface fastethernet 0
FastEthernet0 is up, line protocol is up
Hardware is DEC21140, address is 00e0.1e3e.c125 (bia 00e0.1e3e.c125)
Internet address is 2.2.2.2/8
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 2/255
Encapsulation ARPA, loopback not set, keepalive set (10 sec), auto duplex,
100BaseTX/FX,  100Mb/s
```

- Enter the **show controller fastethernet 0** command to verify actual speed or duplex if speed or duplex are configured as auto:

```
5300# show controller fastethernet 0
DEC21140
Setup Frame
(0) 00e0.1e3e.c125
(1) 0100.0ccc.cccc
dec21140_ds=0x606A0078, registers=0x3C210000, ib=0x4002F75C, ring entries=128
rxring=0x4002F844, rxr shadow=0x606F5168, rx_head=47, rx_tail=47
txring=0x4003006C, txr shadow=0x606F5388, tx_head=63, tx_tail=63, tx_count=0
tx_size=128, rx_size=128
PHY link up
Duplex mode sensed by auto-negotiation is half-duplex and Fast Ethernet speed is 100
Mbps.
```

- Enter the **show interface fastethernet 0** command to verify the configured duplex operation:

```
5300# show interface fastethernet 0
FastEthernet0 is up, line protocol is up
Hardware is DEC21140, address is 00e0.1e3e.c125 (bia 00e0.1e3e.c125)
Internet address is 2.2.2.2/8
MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 2/255
Encapsulation ARPA, loopback not set, keepalive set (10 sec), auto duplex,
100BaseTX/FX, auto speed
```

Tips

If you are having trouble:

- Make sure the cable connections are not loose or disconnected.
- Make sure you are using the correct IP address.

Configuring Synchronous Serial Interfaces for WAN Support

Configure the synchronous serial interfaces on the E1 or T1 PRI card to connect to a WAN through a CSU/DSU.

This section describes how to enable the serial interface, specify IP routing, and set up external clock timing on a DCE or DTE interface. To use a port as a DTE interface, you need only connect a DTE adapter cable to the port. When the system detects the DTE mode cable, it automatically uses the external timing signal. To use a port in DCE mode, you must connect a DCE interface cable and set the clock speed with the **clock rate** configuration command. You must also set the clock rate to perform a loopback test.

Note The four serial interfaces each support a clock rate of 2 Mbps; you can support a rate of 8 Mbps on serial interface 0 by shutting down the other three interfaces using the **e2-clockrate** command on serial interface 0.

Configure

Table 3-6 Configuring Serial Interfaces

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`interface serial 0`**	Specify the first interface to be configured.
4	`5300(config-int)#` **`ip address 145.22.4.67 255.255.255.0`**	If IP routing is enabled, assign an IP address and subnet mask to the interface.
5	`5300(config-int)#` **`clock rate 2015232`**	Configure the external clock signal only if you are configuring a DCE interface. The available options include 1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 64000, 128000, and 2015232.
6	`5300(config-int)#` **`no shutdown`**	Change the shutdown state to up and enable the interface.

7	`5300(config-controller)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify you have configured the interfaces correctly:

- Specify one of the new serial interfaces with the **show interfaces serial** *port* command and verify that the first line of the display specifies the interface with the correct slot number. Also verify that the interface and line protocol are in the correct state: up or down.

```
5300# show interfaces serial 0
Serial0 is up, line protocol is up
  Hardware is 4T
  Internet address is 120.0.0.1/8
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliablility 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set, keepalive set (10 sec)
  Last input 00:00:08, output 00:00:04, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     392 packets input, 33312 bytes, 0 no buffer
     Received 392 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     358 packets output, 25157 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

- Display the entire system configuration file with the **show configuration** command. Verify that the configuration is accurate for the system and each interface.

- Enter the **show controller t1 [0-7] clock** or **show controller e1 [0-7] clock** command to display the history of primary clock changes, the events that caused the change, and the controller currently selected as the primary clock source:

```
5300# show controllers e1 0 clock

            Clock selected: Controller E1 0

                         CLOCK CHANGE HISTORY
                         ----- ------ -------

CLOCK     Event                                    Time
-----     -----                                    ----
Freerun   Firmware Initialization                  02:09:10 PDT8 Sat Apr 5 2003
E1 0      Clock Select Algorithm Initialization   02:09:13 PDT8 Sat Apr 5 2003
```

Tips

If you are having trouble:

- Make sure the network interface is properly connected and terminated.

Configuring Channelized T1 or E1

Configure the access server for channelized T1 or E1 lines.

Configure

Note By default, synchronized clocking is set with controller 0 as the primary clock source and controllers 1 to 7 as secondary clocks. (Synchronized clocking is necessary throughout the network for reliable data transmission.) The secondary clock sources serve as backups in case of the primary clock failure. You can change the clock source using the **clock source line primary** and **clock source line secondary <1-7>**.

Table 3-7 Configuring Channelized T1 or E1

Step	Command	Purpose
1	5300> **enable** Password: <*password*> 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to 5300#.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
3	5300(config)# **controller t1 0** 5300(config-controller)#	Enter controller configuration mode to configure your controller port. The controller ports are labeled 0 to 3 on Quad cards and 0 to 7 on Octal cards.
4	5300(config-controller)# **framing esf**	Enter your telco’s framing type.
5	5300(config-controller)# **linecode ami**	Enter your telco’s line code type.
6	5300(config-controller)# **controller t1 X** 5300(config-controller)# **framing esf** 5300(config-controller)# **linecode ami**	Repeat Step 3 to 5 to configure each additional controller (there are 4 in Quad cards and 8 in Octal cards).
7	5300(config-controller)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Verify

To verify your controller is up and running and no alarms have been reported:

- Enter the **show controller t1** or **show controller e1** command and specify the port number:

```
5300# show controller t1 0
T1 0 is up.
  No alarms detected.
  Framing is ESF, Line Code is AMI, Clock Source is Line Primary.
  Version info of slot 2:  HW: 2, Firmware: 14, NEAT PLD: 13, NR Bus PLD: 19
  Data in current interval (476 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
```

```
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
   Total Data (last 24 hours)
      0 Line Code Violations, 0 Path Code Violations,
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

Note the following:

— The controller must report being up.

— No errors should be reported.

- Use Cisco’s bit-error-rate-testing (BERT) solution and time-division multiplexing (TDM) command enhancements to test T1 and E1 facilities.

  Use BERT to test the link from the central office to your local access server, or the remote access server can test the link using pings to the service provider’s local interface (connected from the remote site, looped back at your local site, and returned to the interface on the remote site).

  The following example shows how to set up and start the BERT tests. The **bert profile 1** command in the following example uses these settings: pseudo-random data pattern 211-0.152, error threshold of 10^-6 bit rate, error injection none, and total time for the test 20 minutes.

```
5300(config)# bert profile 1 pattern 211-O.152 threshold 10^-6 error-injection none
duration 20
5300(config)# end
5300# bert controller e1 0 profile 1
5300# show controller e1 0 bert
```

  The TDM subsystem troubleshooting commands are not used during normal system operation. Instead, the Cisco IOS commands show the current status and settings of the TDM backplane, enable debug output for display to the user when TDM programming occurs, and provide a set of test commands to test the functionality of the TDM path. TDM commands are generally used only by a Cisco technical support representative during troubleshooting data continuity problems.

Note For details on these two features (BERT and TDM), refer to the Cisco IOS software configuration guide and command reference publications. These publications are available on the Documentation CD-ROM that came with your access server, on the World Wide Web from Cisco’s home page, or you can order printed copies.

Tips

If you are having trouble:

- Make sure the **show controller t1** or **show controller e1** output is not reporting alarms or violations.

Configuring ISDN PRI

Configure the access server interfaces for ISDN PRI lines.

Configure

Table 3-8 Configuring ISDN PRI

Step	Command	Purpose
1	5300> **enable** Password: <*password*> 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to `5300#`.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.
3	5300(config)# **isdn switch-type primary-4ess**	Enter your telco's switch type. See Table 3-9 for details.
4	5300(config)# **controller t1 0** 5300(config-controller)#	Enter controller configuration mode and port number to configure your controller port. The controller ports are labeled 0 to 3 on the Quad cards and 0 to 7 on the Octal cards.
5	5300(config-controller)# **pri-group timeslots 1-24 nfas_d primary nfas_interfac**e *number* **nfas_group** *number*	Configure all the channels for ISDN and the Non-Facility Associated Signaling (NFAS) primary D channel. Enter **pri-group timeslots 1-24** for T1. If E1, enter **pri-group timeslots 1-31**. Note that you also need to configure the NFAS backup D channel to be used if the primary D channel fails on a different channelized T1 controller.
6	5300(config-controller)# **controller t1 X** 5300(config-controller)# **pri-group timeslots 1-24 nfas_d primary nfas_interfac**e *number* **nfas_group** *number*	Repeats steps 4 and 5 to configure each additional controller (there are 4 on Quad cards and 8 on Octal cards).
7	5300(config-controller)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Table 3-9 lists the supported ISDN switch types.

Table 3-9 ISDN Switch Types for BRI and PRI Interfaces

Keyword	Switch Type
ISDN BRI	
basic-1tr6	German 1TR6 ISDN switches
basic-5ess	AT&T basic rate switches
basic-dms100	NT DMS-100 basic rate switches
basic-net3	NET3 ISDN, Norway NET3, and New Zealand NET3 switches (covers the Euro-ISDN E-DSS1 signaling system and is ETSI-compliant)
basic-ni	National ISDN switches
basic-ts013	Australian TS013 switches

Table 3-9 ISDN Switch Types for BRI and PRI Interfaces (Continued)

Keyword	Switch Type
ntt	Japanese NTT ISDN switches
vn3	French VN3 and VN4 ISDN BRI switches
ISDN PRI	
primary-4ess	AT&T 4ESS switch type for the U.S.
primary-5ess	AT&T 5ESS switch type for the U.S.
primary-dms100	NT DMS-100 switch type for the U.S.
primary-net5	European, New Zealand and Asia ISDN PRI switches (covers the Euro-ISDN E-DSS1 signaling system and is ETSI-compliant)
primary-ni	AT&T National ISDN switch type
primary-ntt	Japanese ISDN PRI switches
primary-ts014	Australia PRI switches

Verify

To verify you have configured the interfaces correctly:

- Enter the **show controller t1** or **show controller e1** command and specify the port number. Verify the controller is up and that you do not have excessive errors otherwise your controller might be going down frequently. This could indicate switch problems.

```
5300# show controller t1 0
T1 0 is up.
  No alarms detected.

  Framing is ESF, Line Code is AMI, Clock Source is Line Primary.
  Version info of slot 2:  HW: 2, Firmware: 14, NEAT PLD: 13, NR Bus PLD: 19
  Data in current interval (476 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Total Data (last 24 hours)
     0 Line Code Violations, 0 Path Code Violations,
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs

5300# sh cont e1 2
 E1 2 is up.
   Applique type is Channelized E1 - balanced
   No alarms detected.
   Version info of Slot 0:  HW: 2, Firmware: 4, PLD Rev: 0

 Manufacture Cookie Info:
  EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x43,
  Board Hardware Version 1.0, Item Number 73-2218-3,
  Board Revision A0, Serial Number 05823468,
  PLD/ISP Version 0.0, Manufacture Date 9-Oct-1997.

   Framing is CRC4, Line Code is HDB3, Clock Source is Line Primary.
   Data in current interval (701 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
   Data in Interval 1:
    0 Line Code Violations, 0 Path Code Violations
```

```
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

- Enter the **show isdn status** command to view layer status information.

```
5300# show isdn status
The current ISDN Switchtype = primary-5ess
ISDN Serial0:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = MULTIPLE_FRAME_ESTABLISHED
    Layer 3 Status:
        No Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
    Total Allocated ISDN CCBs = 0
ISDN Serial1:23 interface
    Layer 1 Status:
        ACTIVE
    Layer 2 Status:
        TEI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
        No Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
    Total Allocated ISDN CCBs = 0
```

Note the following information for Serial 0:23 (the first half of the messages):

— Layer 1 Status should be “Active.”

— Layer 2 Status should be “Multiple_Frame_Established.” (It might take several seconds for Layer 2 status to appear.)

— Layer 3 Status should be “No Active Layer 3 Call(s).”

— The second half of the messages display information for Serial 1:23.

- Monitor NFAS groups by entering the **show isdn nfas group number** command:

```
5300# show isdn nfas group 0
ISDN NFAS GROUP 0x0 ENTRIES:

The primary D is Serial0:23.
The backup D is Serial1:23.

There are 2 total nfas members.
There are 24 total available B channels.
The primary D-channel is DSL 0 in state IN SERVICE.
The backup D-channel is DSL 1 in state STANDBY.
The current active layer 2 DSL is 0.
```

- Monitor ISDN channels and service by entering **show isdn service** command:

```
5300# show isdn service
PRI Channel Statistics:
ISDN Se0:23, Channel (1-31)
  Activated dsl 0
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se1:23, Channel (1-31)
  Activated dsl 1
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se2:23, Channel (1-31)
  Activated dsl 2
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se3:23, Channel (1-31)
  Activated dsl 3
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se4:23, Channel (1-31)
  Activated dsl 4
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se5:23, Channel (1-31)
  Activated dsl 5
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 0 0 0 0 0 0 0 0 0 0 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se6:23, Channel (1-31)
  Activated dsl 6
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
ISDN Se7:23, Channel (1-31)
  Activated dsl 7
  State (0=Idle 1=Propose 2=Busy 3=Reserved 4=Restart 5=Maint)
  2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 0 3 3 3 3 3 3 3 3
  Channel (1-31) Service (0=Inservice 1=Maint 2=Outofservice)
  0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 2 2 2 2 2 2
```

Tips

If you are having trouble:

- Make sure the cable connection is not loose or disconnected if the Layer 1 Status is “Deactivated.” This status message indicates a problem at the physical layer.
- There may be a problem with your telco or the framing and line code types you entered may not match your telco’s. A Layer 2 error indicates that the access server cannot communicate with the telco. There is a problem at the data link layer.

Configuring E1 R2 Signaling

R2 signaling is an international signaling standard that is common to channelized E1 networks. You can configure a channelized E1 interface to support different types of R2 signaling, which is used in older analog telephone networks. Note that this feature is only available for MICA modems.

Note Cisco's implementation of R2 signaling has DNIS support turned on by default. If you enable the ANI option, the collection of DNIS information is still performed. Specifying the ANI option does not disable DNIS collection. DNIS is the number being called. ANI is the caller's number. For example, if you are configuring router A to call router B, then the DNIS number is assigned to router B, the ANI number is assigned to router A. Also, note that ANI is similar to Caller ID.

Configure

Table 3-10 Configuring R2 Signaling

Step	Command	Purpose
1	5300> **enable** Password: *<password>* 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to `5300#`.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.
3	5300(config)# **controller e1 0** 5300(config-controller)#	Enter controller configuration mode to configure your E1 controller port. The E1 controller ports are labeled 0 to 3 on the Quad cards and 0 to 7 on the Octal cards.
4	5300(config-controller)# **cas-group 1 timeslots 1-30 type r2-analog r2-compelled ani**	Configure the timeslots that belong to each E1 circuit for R2 signaling. Sets R2 signaling to R2 ITU Q411, the tone signal to R2 Compelled Register Signaling, and the ANI addr info provisioned option. R2 line signaling options include **r2-analog**, **r2-digital**, and **r2-pulse**. Tone signaling options include **dtmf** (default), **r2-compelled**, **r2-non-compelled**, and **r2-semi-compelled**. You can also set **ani** (ANI addr info provisioned) for any of the above options.
5	5300(config-controller-cas)# **cas-custom 1**	Enter the channel number to customize.

Table 3-10 Configuring R2 Signaling (Continued)

Step	Command	Purpose
6	5300(config-ctrl-cas)# **country** *country* **use-default**	Use defaults for the specified country. Note: To view the parameters for the country (if the country defaults are the same as ITU defaults), enter **write term**. The default setting for all countries is **ITU**. See “Country Codes for R2 Signaling” later in this section for a list of supported countries.
7	5300(config-ctrl-cas)# **answer-signal group-b 6**	Sets the cas custom command answer-signal to group-b to 6. Cas custom commands include **caller-digits**, **category**, **country**, **unused-abcd**, **invert-abcd**, **metering**, **ka**, **kd**, **dnis-digits**, **answer-signal**, and **nc-congestion**.
	[or] 5300(config-ctrl-cas)# **default answer-signal group-b 6**	Sets answer-signal group-b to the default ITU value.
	[or] 5300(config-ctrl-cas)# **no answer-signal group-b 6**	Resets answer-signal group-b 6 to the default value. Note: The parameters you do not set are automatically set to the ITU default by the Cisco AS5300.

	`controller E1 0`
	` clock source line primary`
	` cas-group 0 timeslots 1-15,17-31 type r2-analog`
	` r2-compelled`
	` cas-custom 0`
	`  country singapore use-defaults`
	`  category 2  <--- default category for singapore`
	`  answer-signal group-b 6   <--- default bxfree`
	`  for singapore`
		After you configure a country with default settings, the Cisco AS5300 displays a write term, similar to the one displayed here.

	5300(config-ctrl-cas)# **exit**	Exits the cas-custom mode.
8	5300(config-if)# **exit** 5300(config)#	Return to global configuration mode.
9	5300(config)# **voice-port** *controller-number.channel-number* 5300(config-voiceport)#	(Optional) Enter voice port mode for the port you want to configure. If you have a voice card, you will need to configure the voice ports to match the controller country code.
10	5300(config-voiceport)# **compand-type** {**a-law** | **u-law**}	(Optional)Configure the port for A-law.
11	5300(config-voiceport)# **cptone** *countryname*	(Optional)Configure the regional ring tone.
12	5300(config-voiceport)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Country Codes for R2 Signaling

Table 3-11 lists the country codes supported for R2 signaling.

Table 3-11 Country Codes for R2 Signaling

Country	Code
Argentina	argentina
Australia	australia
Brazil	brazil
China	china
Columbia	columbia
Costa Rica	costarica
East Europe (includes Croatia, Russia, and Slovak Republic)	easteurope
Ecuador ITU	ecuador-itu
Ecuador LME	ecuador-lme
Greece	greece
Guatemala	guatemala
Hong Kong (China variant)	hongkong-china
Indonesia	indonesia
Israel	israel
ITU (default)	itu
Korea	korea
Malaysia	malaysia
New Zealand	newzealand
Paraguay	paraguay
Peru	peru
Philippines	philippines
Saudi Arabia	saudiarabia
Singapore	singapore
South Africa Panafte	southafrica-panaftel l
Telmex (a telephone corporation in Mexico)	telmex
Telnor (a telephone corporation in Norway)	telnor
Thailand	thailand
Uruguay	uruguay
Venezuela	venezuela
Vietnam	vietnam

Verify

To verify your R2 signaling configuration:

- Enter the **show controller e1** command to view the status for all controllers, or enter the **show controller e1 #** to view the status for a particular controller. Make sure the status indicates the controller is up (line 2 in the following example) and no alarms (line 4 in the following example) or errors (lines 9 and 10 in the following example) have been reported.

```
5300# show controller e1 0
E1 0 is up.
  Applique type is Channelized E1 - balanced
  No alarms detected.
  Version info of Slot 0:  HW: 2, Firmware: 4, PLD Rev: 2

Manufacture Cookie is not programmed.

  Framing is CRC4, Line Code is HDB3, Clock Source is Line Primary.
  Data in current interval (785 seconds elapsed):
     0 Line Code Violations, 0 Path Code Violations
     0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
  Total Data (last 13 15 minute intervals):
     0 Line Code Violations, 0 Path Code Violations,
     0 Slip Secs, 12 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins,
     0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 12 Unavail Secs
```

- Enter the **show modem csm** [*slot/modem-port*] command to view status for a specific modem:

```
5300# show modem csm 1/0
MODEM_INFO: slot 1, port 0, unit 0, tone r2-compelled, modem_mask=0x0000,
modem_port_offset=0
tty_hwidb=0x60E63E4C, modem_tty=0x60C16F04, oobp_info=0x00000000, modem_pool=0x60BC60CC
modem_status(0x0002): VDEV_STATUS_ACTIVE_CALL.
csm_state(0x0205)=CSM_IC5_CONNECTED, csm_event_proc=0x600CFF70, current call thru CAS
line
invalid_event_count=0, wdt_timeout_count=0
wdt_timestamp_started is not activated
wait_for_dialing:False, wait_for_bchan:False
pri_chnl=TDM_PRI_STREAM(s0, u3, c7), modem_chnl=TDM_MODEM_STREAM(s1, c0)
dchan_idb_start_index=0, dchan_idb_index=0, call_id=0x0239, bchan_num=6
csm_event=CSM_EVENT_DSX0_CONNECTED, cause=0x0000
ring_no_answer=0, ic_failure=0, ic_complete=3
dial_failure=0, oc_failure=0, oc_complete=0
oc_busy=0, oc_no_dial_tone=0, oc_dial_timeout=0
remote_link_disc=2, stat_busyout=2, stat_modem_reset=0
oobp_failure=0
call_duration_started=00:04:56, call_duration_ended=00:00:00,
total_call_duration=00:01:43
The calling party phone number =
The called party phone number  = 9993003
total_free_rbs_timeslot = 0, total_busy_rbs_timeslot = 0,
total_dynamic_busy_rbs_timeslot = 0, total_static_busy_rbs_timeslot = 0,
min_free_modem_threshold = 0
```

Tips

If the connection does not go up, check the following:

- Loose wires, splices, connectors, shorts, bridge taps, and grounds
- Backwards transmit and receive
- Mismatched framing types (for example, CRC-4 verses no-CRC-4)
- Transmit and receive pair separation (crosstalk)
- Faulty line cards or repeaters
- Noisy lines (for example, power and crosstalk)

If you see errors on the line or the line is going up and down, check the following:

- Mismatched line codes (HDB3 vs. AMI)
- Receive level
- Frame slips because of poor clocking plan

If you are still having trouble, enable the modem management Call Switching Module (CSM) debug mode using the **debug modem csm** command. This is the output of **debug modem csm** for an incoming call:

```
5300# debug modem csm 1/0
*May 15 04:05:46.675: VDEV_ALLOCATE: slot 2 and port 39 is allocated.

*May 15 04:05:46.675: CSM_RX_CAS_EVENT_FROM_NEAT:(04BF):  EVENT_CALL_DIAL_IN at slot 2
and port 39

*May 15 04:05:46.675: CSM_PROC_IDLE: CSM_EVENT_DSX0_CALL at slot 2, port 39

*May 15 04:05:46.675: Mica Modem(2/39): Configure(0x0)
*May 15 04:05:46.675: Mica Modem(2/39): Configure(0x3)
*May 15 04:05:46.675: Mica Modem(2/39): Configure(0x6)
*May 15 04:05:46.675: Mica Modem(2/39): Call Setup
*May 15 04:05:46.891: Mica Modem(2/39): State Transition to Call Setup
*May 15 04:05:46.891: Mica Modem(2/39): Went offhook
*May 15 04:05:46.891: CSM_PROC_IC1_RING: CSM_EVENT_MODEM_OFFHOOK at slot 2, port 39
.
.
.
```

When the E1 controller comes up, you will see the following messages:

```
%CONTROLLER-3-UPDOWN: Controller E1 0, changed state to up

It also shows these messages for individual timeslots:

%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 1 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 2 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 3 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 4 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 5 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 6 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 7 is up
%DSX0-5-RBSLINEUP: RBS of controller 1 timeslot 8 is up
```

Configuring the Asynchronous Group Interface

You can assign the asynchronous interfaces to a group so that you can configure them as a group, instead of individually.

Timesaver Because there are so many asynchronous interfaces on the access server, configuring them as a group will save you time.

Configure

Table 3-12 Configuring the Asynchronous Group Interface

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password:` *`<password>`*
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`interface group-async 1`**
	`5300(config-if)#`
		Place all asynchronous interfaces in a single group, so that you configure the same parameters quickly on all interfaces at one time.

4	`5300(config-if)#` **`ip unnumbered ethernet 0`**	To conserve IP addresses, configure the asynchronous interfaces as unnumbered, and assign the IP address of the Ethernet interface to them.
5	`5300(config-if)#` **`encapsulation ppp`**	Enable PPP to run on the set of interfaces in the group.
6	`5300(config-if)#` **`async mode interactive`**	Configure interactive mode on the asynchronous interface.
7	`5300(config-if)#` **`ppp authentication chap pap`**	Enable CHAP and PAP authentication on the interface.
	`5300(config-if)#` **`peer default ip address pool default`**	Support dial-in PC clients. At the global level, define the pool of addresses.

8	`5300(config-if)#` **`group-range 1 48`**
	`Building configuration...`
	`5300(config-if)#`
		Define the group range of the interface. The number you use with the **group-range** command depends on the number of asynchronous interfaces you have on your access server. That is, if your access server has 48 asynchronous interfaces, you can specify **group-range 1 48**. If 60, specify **group-range 1 60**.

9	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify your group interface configuration:

- Enter the **show interface async** command to check if the protocol is up:

```
5300# show interface async 1
Async1 is up, line protocol is up
modem(slot/port)=1/0, csm_state(0x00000204)=CSM_IC4_CONNECTED, bchan_num=18
modem_status(0x0002): VDEV_STATUS_ACTIVE_CALL.

  Hardware is Async Serial
  Interface is unnumbered.  Using address of FastEthernet0 (15.0.0.60)
  MTU 1500 bytes, BW 115 Kbit, DLY 100000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
  DTR is pulsed for 5 seconds on reset
  LCP Open
  Open: IPCP
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/5, 0 drops; input queue 1/5, 0 drops
  5 minute input rate 37000 bits/sec, 87 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     31063 packets input, 1459806 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     33 packets output, 1998 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

- Enter the **show dialer map** command to make sure the dialer map is up:

```
5300# show dialer maps
Dynamic dialer map ip 10.10.10.2 name remote-isdn on Serial1
```

Tips

If you are having trouble:

- Enter the **show async status maps** command to check for errors and local and remote addresses:

```
5300# show async status maps
Async protocol statistics:
  Rcvd: 27887 packets, 1294133 bytes
        0 format errors, 0 checksum errors, 0 overrun, 0 no buffer
  Sent: 2141 packets, 117673 bytes, 0 dropped

 Int           Local          Remote Qd     InPack     OutPac Inerr  Drops  MTU
*  1       15.0.0.60        50.2.8.1  0        542         35     0      0 1500
*  2       15.0.0.60        50.3.8.1  0        544         35     0      0 1500
*  3       15.0.0.60       100.2.1.1  0        542         35     0      0 1500
*  4       15.0.0.60        50.1.1.1  0        544         35     0      0 1500
*  5       15.0.0.60        99.2.7.1  0        542         34     0      0 1500
*  6       15.0.0.60        99.1.4.1  0        543         34     0      0 1500
*  7       15.0.0.60       100.2.3.1  0        451         34     0      0 1500
*  8       15.0.0.60       100.2.5.1  0        451         34     0      0 1500
*  9       15.0.0.60       100.2.6.1  0        452         34     0      0 1500
* 10       15.0.0.60       100.2.8.1  0        452         34     0      0 1500
* 11       15.0.0.60        30.2.6.1  0        449         34     0      0 1500
* 12       15.0.0.60        30.3.5.1  0        450         34     0      0 1500
.
.
.
```

- You can also view debug messages for PPP negotiation and authentication using the **debug ppp negotiation** and **debug ppp authentication** commands. When you finish viewing the messages, turn off the messages by entering **no debug ppp negotiation and no debug ppp authentication commands.**

```
5300# debug ppp negot
5300# debug ppp authen
Aug 28 15:40:40.963: ppp: sending CONFREQ, type = 2 (CI_ASYNCMAP), value = 0xA0000
Aug 28 15:40:40.967: ppp: sending CONFREQ, type = 3 (CI_AUTHTYPE), value = 0xC023
Aug 28 15:40:40.967: ppp: sending CONFREQ, type = 5 (CI_MAGICNUMBER), value =
0xC9BAE6A0
Aug 28 15:40:41.091: PPP Async1: state = REQsent fsm_rconfack(0xC021): rcvd id 3
Aug 28 15:40:41.095: ppp: config ACK received, type = 2 (CI_ASYNCMAP), value = 0xA0000
Aug 28 15:40:41.099: ppp: config ACK received, type = 3 (CI_AUTHTYPE), value = 0xC023
Aug 28 15:40:41.099: ppp: config ACK received, type = 5 (CI_MAGICNUMBER), value =
0xC9BAE6A0
Aug 28 15:40:41.103: ppp: config ACK received, type = 7 (CI_PCOMPRESSION)
Aug 28 15:40:41.103: ppp: config ACK received, type = 8 (CI_ACCOMPRESSION)
Aug 28 15:40:42.271: PPP Async1: received config for type = 2 (ASYNCMAP) value =
0xA0000 acked
Aug 28 15:40:42.275: PPP Async1: received config for type = 5 (MAGICNUMBER) value =
0xA0149 acked
Aug 28 15:40:42.275: PPP Async1: received config for type = 7 (PCOMPRESSION) acked
Aug 28 15:40:42.279: PPP Async1: received config for type = 8 (ACCOMPRESSION) acked
Aug 28 15:40:42.283: PPP Async1: received config for type = 13 (CALLBACK) rejected
Aug 28 15:40:42.391: PPP Async1: received config for type = 2 (ASYNCMAP) value =
0xA0000 acked
Aug 28 15:40:42.395: PPP Async1: received config for type = 5 (MAGICNUMBER) value =
0xA0149 acked
Aug 28 15:40:42.399: PPP Async1: received config for type = 7 (PCOMPRESSION) acked
Aug 28 15:40:42.399: PPP Async1: received config for type = 8 (ACCOMPRESSION) acked
Aug 28 15:40:42.515: PPP Async1: PAP receive authenticate request poolme
Aug 28 15:40:42.523: PPP Async1: PAP authenticating peer poolme
Aug 28 15:40:42.575: PPP Async1: Remote passed PAP authentication sending Auth-Ack.
.
.
.
```

Configuring the D Channels for Modem Signaling

Configure the ISDN D channels, which carry the control and signaling information for ISDN calls, for each ISDN PRI line.

Configure

Table 3-13 Configuring the D Channels for Modem Signaling

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`interface serial 0:23`**
	`5300(config-if)#`
		Enter serial interface configuration mode. After configuring the controller, a corresponding D channel serial interface is created instantly. For example, serial interface 0:23 is the D channel for controller 0. You must configure each serial interface to receive incoming and send outgoing modem signaling.

4	`5300(config-if)#` **`ip address 172.16.253.254 255.255.255.0`**	Assign an IP address and subnet mask to the interface.
5	`5300(config-if)#` **`isdn incoming-voice modem`**	Configure all incoming voice calls to go to the modems.
6	`5300(config-if)#` **`dialer-group 1`**	Assign serial interface to dialer group 1. The dialer group number is used with the **dialer-list** command to determine which packets will be meet the criteria specified by the **dialer-list** command and activate the ISDN connection.
7	`5300(config-if)#` **`encapsulation ppp`**	Changes the default to encapsulation ppp so you can enter ppp commands.
8	`5300(config-if)#` **`ppp multilink`**	Enable PPP[1] multilink on the serial interface.
9	`5300(config-if)#` **`ppp authentication chap pap`**	Enable CHAP[2] and PAP[3] authentication on the serial interface.
10	`5300(config-if)#` **`peer default ip address pool default`**	Support dial-in PC clients.

11	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

[1] PPP = Point-to-Point Protocol.

[2] CHAP = Challenge Handshake Authentication Protocol.

[3] PAP = Password Authentication Protocol.

Verify

To verify your D-channel configuration:

- Enter the **show interface** command and make sure the line protocol is up and you are using the correct IP interface. Also, make sure that excessive errors are not being reported.

```
5300# show interface 1:23
Serial1:23 is up, line protocol is up
  Hardware is DSX1
  Interface is unnumbered.  Using address of FastEthernet0 (15.0.0.60)
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     54 packets input, 214 bytes, 0 no buffer
     Received 0 broadcasts, 10 runts, 0 giants, 0 throttles
     10 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     53 packets output, 211 bytes, 0 underruns
     0 output errors, 0 collisions, 10 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions
  Timeslot(s) Used:24, Transmitter delay is 0 flags
```

Tips

If you are having trouble:

- Make sure the serial interface and protocol are up by entering the **show interface serial** command. Also, check the IP address.

```
5300(config)# show interface serial 0:23
Serial0:23 is up, line protocol is up
  Hardware is DSX1
  Internet address is 61.0.0.2/8
  MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set
  Last input 00:00:02, output 00:00:02, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     6442 packets input, 25855 bytes, 0 no buffer
     Received 0 broadcasts, 8 runts, 0 giants, 0 throttles
     8 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     6439 packets output, 25875 bytes, 0 underruns
     0 output errors, 0 collisions, 8 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier trnsitions
  Timeslot(s) Used:24, Transmitter delay is 0 flags
```

- Enter the **debug dialer** command to view the error messages (Table 3-14). You can also use the **debug dialer events** or **debug dialer packets** messages to view event or packet messages. When you finish viewing the messages, enter the **no debug dialer** command to turn off the messages.

```
5300# debug dialer
PRI0: Dialing cause: PRI0: ip PERMIT
PRI0: No dialer string defined.  Dialing cannot occur..
PRI0: Dialing cause: PRI0: ip PERMIT
```

Table 3-14 Debug Dialer Messages

Message	Description
`PRI0: No dialer string defined. Dialing cannot occur`	Displayed when a packet is received that should cause a call to be placed. However, there is no dialer string configured, so dialing cannot occur. This message usually indicates a configuration problem. Re-enter the **dialer-group** command in step 6 in the “Configure” section.
`PRI0: Attempting to dial xxxxxxxxxx`	Indicates that a packet has been received that passes the dial-on-demand access lists. That packet causes dialing of a phone number. The xxxxxxxxxx variable is the number being called.
`PRI0: Unable to dial xxxxxxxxxx`	Displayed if the phone call could not be placed. This can be due to a lack of memory, full output queues, or other problems.
`PRI0: disconnecting call`	Displayed when the Cisco AS5300 attempts to hang up a call.

`PRI0: idle timeout`
`PRI0: re-enable timeout`
`PRI0: wait for carrier timeout`
	One of these three messages is displayed when their corresponding dialer timer expires. They are mostly informational, but are useful when debugging a disconnected call or call failure.

- If dialing cannot occur, check the configuration by entering the **debug isdn q931** command. When you finish viewing the messages, enter **no debug isdn q931** to turn off the messages. See Table 3-15 for explanations of the error messages.

```
5300# debug isdn q931
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1/0:22, changed state to up
ISDN Event: Call to 9086154535 dsl 3 at 64 Kb/s
TX ->  SETUP dsl = 3 pd = 8  callref = 0x188C
          Bearer Capability i = 0x8890
          Channel ID i = 0xE1808397
          Called Party Number i = 0xA1, '95163287448'
RX <-  RELEASE_COMP dsl = 3 pd = 8  callref = 0x988C
          Cause i = 0x83E020 - Mandatory IE missing
ISDN PRI 3: entering process_rxstate, CALL_CLEARED
ISDN PRI 3: received message 1F
ISDN Event: Hangup call to call id 0xCE2 on dsl 2
```

Table 3-15 Debug ISDN Messages

Message	Description
`TX ->`	Indicates this message is being transmitted from the local router (user side) to the network side of the ISDN interface.
`RX <-`	Indicates this message is being received by the user side of the ISDN interface from the network side.
`SETUP`	Indicates the SETUP message has been sent to initiate call establishment between peer network layers. The message can be sent from the local router or network.
`pd`	Indicates the protocol discriminator. The protocol discriminator distinguishes messages for call control over the user-network ISDN interface from other ITU-T1[1]-defined messages, including other Q.931 messages. The protocol discriminator is 8 for call control messages such as SETUP.

Table 3-15 Debug ISDN Messages (Continued)

Message	Description
`callref`	Indicates the call reference number in hexadecimal. The field value indicates the number of calls made from the router (outgoing calls) or the network (incoming calls). Note that the originator of the SETUP message sets the high-order bit of the call reference number to 0. The destination of the connection sets the high-order bit to 1 in subsequent call control messages, such as the CONNECT message. For example, callref = 0x04 in the request becomes callref = 0x84 in the response.
`Bearer Capability`	Indicates the requested bearer service to be provided by the network.
`Cause i`	Indicates the Information Element Identifier. The value depends on the field it is associated with. Refer to the ITU-T Q.931 specification for details about the possible values associated with each field for which this identifier is relevant.
`Channel ID`	Indicates the Channel Identifier. The value 83 indicates any channel, 89 indicates the B1 channel, and 8A indicates the B2 channel. For more information about the Channel Identifier, refer to ITU-T Q.931.
`Called Party Number`	Identifies the called party. This field is only present in outgoing SETUP messages. It can be replaced by the Keypad facility field. This field uses the IA5 character set.
`RELEASE`	Indicates that the sending equipment will release the channel and call reference. The recipient of this message should prepare to release the call reference and channel.
`RELEASE_COMP`	Indicates that the sending equipment has received a RELEASE message and has now released the call reference and channel.

[1] ITU-T = International Telecommunication Union Telecommunication Standardization Sector.

Configuring the Modems

Configure the modems to allow users to dial in to your network.

Configure

Table 3-16 Configuring the Modems

Step	Command	Purpose
1	5300> **enable** Password: *<password>* 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to `5300#`.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.
3	5300(config)# **modem country mica** *country name* [or] 5300(config)# **modem country microcom_hdms** *country name*	Specify the country to set the modem parameters (including country code and encoding) for MICA modems. The default is **usa** if the access server is configured with T1 interfaces and **e1-default** if the access server has E1 interfaces. Specify the country to set the modem parameters (including encoding) for Microcom modems. The default is **usa**. Note that the access server will reset the Microcom modems for the command to take effect. For a list of country codes, see Table 3-17 and Table 3-18 later in this section.
4	5300(config-if)# **line 1 48** 5300(config-line)#	Enter the number of modem lines to configure. If you have 48 modems, enter **line 1 48**. If 60, enter **line 1 60**. Note: There are 12 modems on each 12-port module, and 6 modems on each MICA 6-port module.
5	5300(config-line)# **transport input all**	Allow all protocols to be used when connecting to the line.
6	5300(config-line)# **autoselect ppp**	Enable remote IP users running a PPP application to dial in, bypass the EXEC facility, and connect directly to the network.
7	5300(config-line)# **modem inout**	Enable incoming and outgoing calls.
8	5300(config-line)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Country Code Tables

Table 3-17 lists the current Microcom modem codes.

Table 3-17 Microcom Modem Codes

Country	Code	Country	Code
Argentina	`argentina`	Italy	`italy`
Australia	`australia`	Japan	`japan`
Austria	`austria`	Korea	`korea`
Belgium	`belgium`	Malaysia	`malaysia`
Brazil	`brazil`	Mexico	`mexico`
Canada	`canada`	Netherlands	`netherlands`
Chile	`chile`	New Zealand	`new-zealand`
China	`china`	Norway	`norway`
Columbia	`columbia`	Peru	`peru`
Czech/Slovak Republic	`czech-republic`	Philippines	`philippines`
Denmark	`Denmark`	Poland	`poland`
Finland	`Finland`	Portugal	`portugal`
France	`France`	Saudi Arabia	`saudi-arabia`
Germany	`Germany`	Singapore	`singapore`
Greece	`Greece`	South Africa	`south-africa`
Hong Kong	`hong-kong`	Spain	`spain`
Hungary	`hungary`	Sweden	`sweden`
India	`india`	Switzerland	`switzerland`
indonesia	`indonesia`	Taiwan	`taiwan`
Ireland	`ireland`	Thailand	`thailand`
Israel	`israel`	United Kingdom	`united-kingdom`
USA	`usa`		

Table 3-18 lists the current MICA modem codes.

Table 3-18 MICA Modem Codes

Country	Code	Country	Code
Australia	`australia`	Netherlands	`netherlands`
Austria	`austria`	New Zealand	`new-zealand`
Belgium	`belgium`	Norway	`norway`
China	`china`	Poland	`poland`
Cyprus	`cyprus`	Portugal	`portugal`
Czech/Slovak Republic	`czech-republic`	Russia	`russia`
Denmark	`denmark`	Singapore	`singapore`
Default E1 (A Law)	`e1-default`	South Africa	`south-africa`
Finland	`finland`	Spain	`spain`

Table 3-18 MICA Modem Codes (Continued)

Country	Code	Country	Code
France	`france`	Sweden	`sweden`
Germany	`germany`	Switzerland	`switzerland`
Hong Kong	`hong-kong`	Default T1	`t1-default`
India	`india`	Taiwan	`taiwan`
Ireland	`ireland`	Thailand	`thailand`
Israel	`israel`	Turkey	`turkey`
Italy	`italy`	United Kingdom	`united-kingdom`
Japan	`japan`	USA	`usa`
Malaysia	`malaysia`		

Resetting to Default Values for Country Codes

To reset to default settings for country codes, enter the following commands in global configuration mode:

- **no modem country mica**—Resets to default MICA setting.
- **no modem country microcom-hdms**—Resets to default Microcom setting.

Verify

To verify your modem configuration:

- Enter the **show line** command to display a summary for all the lines:

```
5300# show line
 Tty Typ     Tx/Rx     A Modem  Roty AccO AccI  Uses    Noise   Overruns
*  0 CTY               -    -      -    -    -     0        0        0/0
I  1 TTY 115200/115200 - inout     -    -    -     0        0        0/0
I  2 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   3 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   4 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   5 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   6 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   7 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   8 TTY 115200/115200 - inout     -    -    -     0        0        0/0
   9 TTY 115200/115200 - inout     -    -    -     0        0        0/0
  10 TTY 115200/115200 - inout     -    -    -     0        0        0/0
.
.
.
  90 VTY               -    -      -    -    -     0        0        0/0
```

- Enter the **show line #** command to display a summary for a single line:

```
5300# show line 1
 Tty Typ     Tx/Rx     A Modem  Roty AccO AccI  Uses    Noise   Overruns
I  1 TTY 115200/115200 - inout     -    -    -     0        0        0/0

Line 1, Location: "", Type: ""
Length: 24 lines, Width: 80 columns
Baud rate (TX/RX) is 115200/115200, no parity, 1 stopbits, 8 databits
Status: none
Capabilities: Hardware Flowcontrol In, Hardware Flowcontrol Out
```

```
  Modem Callout, Modem RI is CD, Line usable as async interface
Modem state: Idle
Special Chars: Escape  Hold  Stop  Start  Disconnect  Activation
                ^^x    none   -     -       none
Timeouts:      Idle EXEC    Idle Session   Modem Answer  Session   Dispatch
               00:10:00        never                        none     not set
                            Idle Session Disconnect Warning
                              never
Modem type is unknown.
Session limit is not set.
Time since activation: never
Editing is enabled.
History is enabled, history size is 10.
DNS resolution in show commands is enabled
Full user help is disabled
Allowed transports are pad telnet rlogin.  Preferred is telnet.
No output characters are padded
No special data dispatching characters
modem(slot/port)=1/0, csm_state(0x00000100)=CSM_IDLE_STATE, bchan_num=-1
modem_status(0x0000): VDEV_STATUS_UNLOCKED

Modem hardware state: CTS noDSR  DTR RTS
```

Tips

If you are having trouble:

- If you are having problems with making or receiving calls, make sure you turned on the protocols for connecting to the lines (step 4 in the previous configuration table) and configured for incoming and outgoing calls (step 6 in the previous configuration table).
- If the calls are not coming up at all, turn on the **debug modem**, **debug modem csm**, and **debug isdn q931** commands to check for problems. When you finish viewing the messages, turn off the messages by entering the **no debug modem** command.

```
5300# debug modem
5300# debug modem csm
5300# debug isdn q931
5300# no debug modem
5300# no debug modem csm
5300# no debug isdn q931
```

The following is the sample output for a MICA modem for an outgoing ISDN voice call:

```
5300# 1.17.30.12 2004
Trying 1.17.30.12, 2004 ... Open

TTY4: asserting DTRatdt1000
Mica Modem(2/3): Rcvd Dial String(1000)
CSM_PROC_IDLE: CSM_EVENT_MODEM_OFFHOOK at slot 2, port 3

CSM_PROC_OC3_COLLECT_ALL_DIGIT: CSM_EVENT_GET_ALL_DIGITS at slot 2, port 3

CSM_PROC_OC3_COLLECT_ALL_DIGIT: called party num: (1000) at slot 2, port 3

ISDN Se0:23: TX ->  SETUP pd = 8  callref = 0x0001
        Bearer Capability i = 0x8090A2
        Channel ID i = 0xE1808397
        Called Party Number i = 0xA1, '1000'
ISDN Se0:23: RX <-  CALL_PROC pd = 8  callref = 0x8001
        Channel ID i = 0xA98397
EVENT_FROM_ISDN::dchan_idb=0x60DD2D74, call_id=0xA001, ces=0x1
   bchan=0x16, event=0x3, cause=0x0
```

```
EVENT_FROM_ISDN:(A001): DEV_CALL_PROC at slot 2 and port 3

CSM_PROC_OC4_DIALING: CSM_EVENT_ISDN_BCHAN_ASSIGNED at slot 2, port 3

Mica Modem(2/3): Configure(0x1)
Mica Modem(2/3): Configure(0x0)
Mica Modem(2/3): Configure(0x6)
Mica Modem(2/3): Call Setup
ISDN Se0:23: RX <-  ALERTING pd = 8  callref = 0x8001
Mica Modem(2/3): State Transition to Call Setup
ISDN Se0:23: RX <-  CONNECT pd = 8  callref = 0x8001
EVENT_FROM_ISDN::dchan_idb=0x60DD2D74, call_id=0xA001, ces=0x1
   bchan=0x16, event=0x4, cause=0x0

EVENT_FROM_ISDN:(A001): DEV_CONNECTED at slot 2 and port 3

CSM_PROC_OC5_WAIT_FOR_CARRIER: CSM_EVENT_ISDN_CONNECTED at slot 2, port 3

Mica Modem(2/3): Link Initiate
ISDN Se0:23: TX ->  CONNECT_ACK pd = 8  callref = 0x0001
Mica Modem(2/3): State Transition to Connect
Mica Modem(2/3): State Transition to Link
Mica Modem(2/3): State Transition to Trainup
CONNECT 16800 /V.42/V.42bis

Mica Modem(2/3): State Transition to EC Negotiating
Mica Modem(2/3): State Transition to Steady State
```

This is the sample output for an incoming ISDN voice call on a MICA modem:

```
ISDN Se0:23: RX <-  SETUP pd = 8  callref = 0x0065
        Bearer Capability i = 0x8090A2
        Channel ID i = 0xE1808381
        Called Party Number i = 0xA1, '1000'
ISDN Se0:23: Incoming call id = 0x3
EVENT_FROM_ISDN::dchan_idb=0x60DD2D74, call_id=0x3, ces=0x1
   bchan=0x0, event=0x1, cause=0x0

VDEV_ALLOCATE: slot 2 and port 2 is allocated.

EVENT_FROM_ISDN:(0003): DEV_INCALL at slot 2 and port 2

CSM_PROC_IDLE: CSM_EVENT_ISDN_CALL at slot 2, port 2

Mica Modem(2/2): Configure(0x0)
Mica Modem(2/2): Configure(0x0)
Mica Modem(2/2): Configure(0x6)
Mica Modem(2/2): Call Setup
ISDN Se0:23: TX ->  CALL_PROC pd = 8  callref = 0x8065
        Channel ID i = 0xA98381
ISDN Se0:23: TX ->  ALERTING pd = 8  callref = 0x8065
Mica Modem(2/2): State Transition to Call Setup
Mica Modem(2/2): Went offhook
CSM_PROC_IC1_RING: CSM_EVENT_MODEM_OFFHOOK at slot 2, port 2

ISDN Se0:23: TX ->  CONNECT pd = 8  callref = 0x8065
ISDN Se0:23: RX <-  CONNECT_ACK pd = 8  callref = 0x0065
EVENT_FROM_ISDN::dchan_idb=0x60DD2D74, call_id=0x3, ces=0x1
   bchan=0x0, event=0x4, cause=0x0
.
.
.
```

- Enter the **debug modem ?** command for list of additional modem debugging commands:

```
5300# debug modem ?
  b2b          Modem Special B2B
  csm          CSM activity
  maintenance  Modem maintenance activity
  mica         MICA Async driver debugging
  oob          Modem out of band activity
  tdm          B2B Modem/PRI TDM
  trace        Call Trace Upload
```

Configuring Modem Pooling

Use modem pooling to define, select, and use separate pools of modems within a single access server to enable different dial-in services for different customers. The primary application is to allocate specific modems based on called party numbers and a predetermined number of modem ports based on Dialed Number Information Service (DNIS).

If you do not configure any modem pools, all the modems are placed into a single pool. There is no restriction on the number of modem pools that you can configure. A pool can contain a minimum of one modem and a maximum equal to all the modems in the system.

This section briefly shows how to set up a minimum configuration. For detailed information on using this feature, refer to the command reference documents shipped with your access server.

Note To support modem pooling over channelized T1 lines, make sure you have configured the lines as described in the section “Configuring Channelized T1 or E1.” If you are using R2 signaling over channelized E1, you do not need any special configuration options because DNIS information is always collected.

Table 3-19 Configuring Modem Pooling

Step	Command	Purpose

1	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

2	`5300(config)#` **`modem-pool`** *`name`*	Enter the name of the modem to configure for pooling.
3	`5300(config-modem-pool)#` **`pool-range`** *`number-number`*	Defines the range of the modems in the pool. A dash is required between the two numbers.

Table 3-19 Configuring Modem Pooling (Continued)

Step	Command	Purpose
4	5300(config-modem-pool)# **called number** *phone #* **max-conn** *number*	Specifies the DNIS to be used for this modem pool. The DNIS string can have an integer *x* to indicate a do not care digit for that position. The **max-conn** option specifies the maximum number of connections allowed for this DNIS. If you do not specify a **max-conn** value, the default (total number of modems in the pool) is used. The **max-conn** values can range from one to the total number of modems in the pool.
5	5300(config-modem-pool)# **Ctrl-Z** 5300#	Return to enable mode.

Verify

To verify your modem pooling configuration:

- Enter the **show modem-pool** command to view information for all modem pools. To view information for a specific modem pool, enter the **show modem-pool name** command.

```
5300# show modem-pool
modem-pool: System-def-Mpool
modems in pool: 119 active conn: 0
 0 no free modems in pool

modem-pool: test
modems in pool: 1 active conn: 0
 0 no free modems in pool
called_party_number: 1000
 0 max-conn exceeded, 0 no free modems in pool
```

Tips

If you are having trouble:

- Make sure you have not configured the same called party number for multiple pools.
- Make sure you have not placed modems in multiple pools.

Configuring Resource Pooling and Session Counting

The Cisco resource pooling and session counting feature allows you to do the following:

- Construct unique customer profiles that specify the types and amounts of system resources to be used by a customer's dial service plan.
- Create groups of DNIS numbers to be used in specific customer profiles. Customer profiles use DNIS to recognize their own callers.
- Tabulate the number of active connections, calls accepted, and calls rejected for each customer profile and system resource over a period of time. This feature allows the billing scheme to be based on actual port and channel usage (not time or a fixed monthly rate).
- Display all the customer profiles and resource groups set up on the access server.

Note This feature supports calls made over ISDN PRI (no CE1 or CT1 support).

Configure

To configure resource pooling and session counting, you must first set up DNIS and resource groups. After this, you can create customer profiles.

A DNIS group is a pool of individual DNIS numbers that are grouped together and then assigned a name. A resource group is pool of resources, such as HDLC framers or modems, that are used to provide services to one or more customer profiles.

Table 3-20 Setting up DNIS and Resource Groups

Step	Command	Purpose
1	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
2	5300(config)# **resource-manager group dnis name**	Create a DNIS resource group, which enables a set of specific DNIS numbers to be recognized by a specific customer profile.[1] Replace the *name* variable with a name for the DNIS group. DNIS groups are also used to facilitate configuration when sharing or moving a group of DNIS numbers between customer profiles.
3	5300(config-dnis-group)# **dnis-number number**	Add DNIS numbers to the DNIS group created in Step 2. This collection of DNIS numbers are assigned to a specific customer. Replace the *number* variable with an actual DNIS number. Reissue this command each time you need to add a DNIS number to a DNIS group. Enter as many DNIS numbers as you want. There is no limit.

Table 3-20 Setting up DNIS and Resource Groups (Continued)

Step	Command	Purpose
4	`5300(config-dnis-group)#` **exit**	Return to global configuration mode.
5	`5300(config)#` **`resource-manager group resource name`**	Create one or more resource groups, which identify the resources to be shared between one or more customer profiles. For example, create a resource group that includes only modems. Or, create a resource group that passes incoming circuit switched data calls off to the HDLC framers. Replace the *name* variable with an actual name for the resource. The resource groups you create in this step will be associated to one or more customer profiles, which are configured later in the Table 3-21.

6	`5300(config-resource-group)#` **`range port slot/port-slot/port`**
	or
	`5300(config-resource-group)#` **`range limit number`**
		For a resource group comprised of modems and V.110 terminal adapters, specify a range of modems to include as members in the resource group. To do this, enter the **range port slot/port-slot/port** command.[2]
		or
		For resources that are not pooled and have a 1-to-1 correspondence between DS0s, B channels, and HDLC framers use the **range limit number** command.[2] Circuit switched data calls and V.120 calls have similar characteristics and use these kinds of resources.

5	`5300(config-resource-group)#` **`Ctrl-Z`**
	`5300#`
		Return to enable mode.

1. The configuration procedure for setting up customer profiles is described in the next table in this section.
2. The number of sessions you want to allow for particular customers is defined in the individual customer profiles using the **limit size** command. More than one customer profile can consume resources from a single physical resource group. For example, you can have one large 56K modem resource pool that provides services to two customer profiles. To view the slot/port modem numbering scheme on the access server, enter the **show modem** EXEC command.

After setting up DNIS groups and physical resources groups, you can now set up the customer profiles and maximum connection limits, as shown in Table 3-21. A customer profile is a customized set of access services and physical resources given to a customer. A customer profile can contain a selection of physical resources (such as a range of HDLC framers and modems), a group of DNIS numbers, and a defined limit of simultaneous connections.

Table 3-21 Creating Customer Profiles

Step	Command	Purpose
1	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.
2	5300(config)# **resource-manager profile customer name**	Create a profile for a specific customer. Within this profile, you can set maximum simultaneous connection limits, define the physical resources that will be provide to the customer profile, and assign a specific DNIS group to be allowed into the customer profile.
3	5300(config-customer-profile)# **resource name {digital | speech | v110 | v120}**	Include a group of physical resources and call type(s) in the customer profile.[1] Replace the **name** variable with the name of a physical group resource that you created using the **resource-manager group resource name** command.
4	5300(config-customer-profile)# **limit size number**	Define the maximum number of simultaneous connections that can be performed by the sum total of all the physical resources in the customer profile. This size limit applies to all the call types allowed into the profile, such as digital, speech, V.110, and V.120).
5	5300(config-customer-profile)# **dnis-group name name**	Identify the DNIS group that you want to include in this customer profile. Replace the **name** variable with the name of a DNIS group that was created using the **resource-manager group dnis** *name* command.[2]
5	5300(config-customer-profile)# **Ctrl-Z** 5300#	Return to enable mode.

[1] The **digital** call type specifies synchronous data calls that terminate on a HDLC framers, such as a ISDN circuit switched data call initiated by a terminal adapter connected to a PC (unlike an asynchronous analog modem call using start and stop bits). The **speech** call type specifies normal voice calls, such as calls initiated by analog modems. The **v110** and **v120** call types specify V.110 and V.120 calls.

[2] Use the **dnis-group default** command to allow a customer profile to accept any DNIS number and use only the call-type to discriminate (for example, digital, speech, V.110, and V.120).

Verify

To verify that you correctly configured the system resources and customer profiles, use the following commands:

- View the physical and logical group resources that you created by entering the **show rminfo resource** *name* command:

```
5300# show rminfo resource
List of Resources:
    System-def-Phy-Pool
    acmeisdn
    acmemodem
```

- View the customer profile you created by entering the **show rminfo customer** *name* command:

```
5300# show rminfo customer acme
    0 active connections
    0 calls accepted
    0 calls rejected due to profile limits
    0 calls rejected due to resource unavailable

  Detailed breakup for each resource:
    acmeisdn                      [digita]: 0 calls accepted, 0 calls rejected
    acmemodem                     [speech]: 0 calls accepted, 0 calls rejected
```

- Display call status information for all the physical resources and customer profiles set up in the access server by entering the **show rminfo call-status** command.

```
router# show rminfo call-status
Int Chn State     Resource Name            Customer Profile Name
--- --- -----     -------------            ---------------------
0   18  Conn      modempool1                acmeprofile
----------------------------------
Total number of active calls = 1
```

Configuring Voice Network Data

Use the procedures in this section only if you have a VoIP feature card installed in your access server. Configure the voice network data by creating a number expansion table to map (or associate) individual extensions with their full E.164 telephone numbers.

Configure

Table 3-22 Configuring Voice Network Data

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`config term`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300#` **`num-exp 6.... 310766....`**	Create a number extension table where the extension is 6 and the expanded telephone number associated with the access server is 310 766-xxxx. **Note:** The dots (....) represent variables in the telephone number.

4	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify your voice network data configuration:

- Enter the **show dialplan number phone_number** command to see how a phone number maps to a dial-peer. In the following sample configuration, 3 maps to dial-peer 103.

```
dial-peer voice 103 voip
 destination-pattern +1408523
 codec g711ulaw
 session target ipv4:1.13.23.1
!
num-exp 6.... 310766....
!
```

The following example shows how to test this configuration.

```
5300# show dialplan number 31001
Macro Exp.: 14085231001

VoiceOverIpPeer103
  tag = 103, destination-pattern = `1408523',
  answer-address = `',
  group = 103, Admin state is up, Operation state is up
  incoming called-number = `', connections/maximum = 0/unlimited
  application associated:
  type = voip, session-target = `ipv4:1.13.23.1',
  technology prefix:
  ip precedence: 0        UDP checksum = disabled
  session-protocol = cisco, req-qos = best-effort,
  acc-qos = best-effort,
  fax-rate = voice, codec = g711ulaw,
  Expect factor = 10, Icpif = 30,
  VAD = enabled, Poor QOV Trap = disabled,
  Connect Time = 3118, Charged Units = 0
  Successful Calls = 3, Failed Calls = 0
  Accepted Calls = 3, Refused Calls = 0
  Last Disconnect Cause is "10"
  Last Disconnect Text is "user  busy."
  Last Setup Time = 5033507
Matched: 14085231001   Digits: 7
Target: ipv4:1.13.23.1
```

Note In the above example, the num-exp rule maps 31001 to 14085231001 and 14085231001 matches the destination pattern for dial-peer 103.

- If you run **show dial-plan number** without a match, you will see something similar to the following example.

```
5300# sh dialplan number 7870
Macro Exp.: 7870
No match, result=-1
```

In this case, there is no number expansion for 7870, and there is no dial-peer with a 7870 destination pattern. The user would have to verify that the number they entered (7870) is correct, that they (optionally) have number expansion for 7870 or some wildcard match for 7870 that expands to the full number they want, and finally a dial peer that matches 7870, or if using num-exp, matches the expansion of 7870.

Tips

If you are having trouble:

- Enter the **show num-exp** command to verify that you have mapped the telephone numbers correctly.

```
5300# sh num-exp
 Dest Digit Pattern = '6....'    Translation =
                                 '310766....'
```

Configuring T1 CAS for VoIP

This section describes how to configure T1 Channel Associated Signaling (CAS) and E1 R2 signaling with the Voice over IP (VoIP).

Note Cisco IOS Release 12.0(3)T and later releases require VCWare level 2.5 code.

Configure

This configuration is an example of how to configure the voice ports as a *cas-group* for the channelized T1 lines.

Table 3-23 Configuring Service Provider T1 CAS

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password:` *`<password>`*
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`config term`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the `5300#` prompt changes to `5300(config)#`.

3	`5300(config)#` **`controller t1 0`**	Enter controller configuration mode to configure your controller port. The controller ports are labeled 0 through 3 on the Quad T1/PRI and E1/PRI cards.
4	`5300(config-controller)#` **`cas-group 1 timeslots 1-24 type e&m-fgb dtmf dnis`**	Configure all channels for E&M, FXS, and SAS analog signaling. Enter **1-24** for T1. If E1, enter **1-31**. Signaling types include **e&m-fgb**, **e&m-fgd**, **e&m-immediate-start**, **fxs-ground-start**, **fxs-loop-start**, **sas-ground-start**, and **sas-loop-start**. You must use the same type of signaling that your central office uses. For E1 using the Anadigicom converter, use **cas e&m-fgb** signaling.

5	`5300(config-controller)#` **`controller t1 1`**
	`5300(config-controller)#` **`cas-group 2 timeslots 1-24 type e&m-fgb`**
		Repeat steps 3 and 4 to configure each additional controller (there are 4 in the Quad cards and 8 in the Octal cards). In this example, note that the controller number is 1, instead of 0. The clock source is secondary, instead of primary. The cas-group is 2, instead of 1.

6	`5300(config-controller)#` **`Ctrl-Z`**	Return to enable mode.

Table 3-23 Configuring Service Provider T1 CAS (Continued)

Step	Command	Purpose
7	5300(config-controller)# **dial-peer voice 3070 pots** **destination-pattern +30...** **port 0:1** **prefix 30**	Enter the dial peer configuration mode to configure a POTS peer. Specify destination pattern for this POTS peer.
8	5300(config-controller)# **dial-peer voice 4080 pots** **destination-pattern +40...** **direct-inward-dial** **port 1:1** **prefix 40**	Specify destination pattern, and direct inward dial for each POTS peer.
9	5300(config-controller)# **dial-peer voice 1050 pots** **destination-pattern +10...** **direct-inward-dial** **prefix 50**	Specify the destination pattern and the direct inward dial for the dial peer.
10	5300(config-controller)# **dial-peer voice 2060 pots** **destination-pattern +20...** **direct-inward-dial** **prefix 60**	Specify the destination pattern and the direct inward dial for the dial peer.
11	5300(config-controller)# **dial-peer voice 5050 voip** **answer-address 10...** **destination-pattern +50...**	Specify destination pattern, and direct inward dial for each VoIP peer.
12	5300(config-if)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console	Return to enable mode. This message is normal and does not indicate an error.

Verify

- To verify your controller is up and running and no alarms have been reported, enter the **show controller t1** or **show controller e1** command and specify the port number.

```
5300# sh cont t1 2
 T1 2 is up.
   No alarms detected.
   Version info of slot 0:  HW: 2, Firmware: 16, PLD Rev: 0

 Manufacture Cookie Info:
  EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x42,
  Board Hardware Version 1.0, Item Number 73-2217-4,
  Board Revision A0, Serial Number 06467665,
  PLD/ISP Version 0.0, Manufacture Date 14-Nov-1997.

   Framing is ESF, Line Code is B8ZS, Clock Source is Internal.
   Data in current interval (269 seconds elapsed):
    0 Line Code Violations, 0 Path Code Violations
      0 Slip Secs, 0 Fr Loss Secs, 0 Line Err Secs, 0 Degraded Mins
      0 Errored Secs, 0 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
```

- To check the validity of your dial peer configuration, enter the **show dial-peer voice** command to verify that the data is configured correctly. Note that you should use this command only if you have relatively few dial peers configured.

```
5300# sh dial-peer voice 4
 VoiceEncapPeer4
   tag = 4, destination-pattern = `+4....',
   answer-address = `',
   group = 4, Admin state is up, Operation state is up
   incoming called-number = `', connections/maximum = 0/unlimited
```

```
type = pots, prefix = `4',
  session-target = `', voice-port = 3:D, direct-inward-dial = disabled
Connect Time = 38992627, Charged Units = 0
Successful Calls = 0, Failed Calls = 35818
Accepted Calls = 35818, Refused Calls = 0
Last Disconnect Cause is "1C"
Last Disconnect Text is "invalid number."
Last Setup Time = 3787365
```

Tips

- Make sure the **show controller t1** output is not reporting alarms or violations.
- If you are having trouble connecting a call and you suspect the problem is associated with dial peer configuration, try the following:
  - — Ping the associated IP address to confirm connectivity. If you cannot successfully ping your destination, refer to the “Configuring IP” chapter in the Cisco IOS Release 12.0 *Network Protocols Configuration Guide*, *Part 1*, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/12cgcr/np1_c/
  - — Enter the **show dial-peer voice** command or the **test dialplan number** command or both on the local and remote routers to verify the data is configured correctly.
  - — If you have configured number expansion, enter the **show num-exp** command to check that the partial number on the local router maps to the correct full E.164 telephone number on the remote router.
  - — If you have configured a **codec** value, there can be a problem if voice-network and voice-telephony dial peers have incompatible **codec** values. Make sure that both voice-telephony and voice-network peers have been configured with the same **codec** value.
  - — Enter the **debug vpm spi** command to verify the output dial string the router dials is correct.
  - — Enter the **debug cch323 rtp** command to check RTP packet transport.
  - — Enter the **debug cch323 h245** command to check logical channel negotiation.
  - — Enter the **debug cch323 h225** command to check the call setup.

Configuring IP Networks for Real-Time Voice Traffic

Use the procedures in this section only if you have a VoIP feature card installed in your access server. You need to configure the RSVP for voice, multilink PPP interleaving, and RTP header compression to improve the voice network performance for your IP network. Some of the options you will use in the steps listed in Table 3-24 depend on the demands of your IP network.

For a detailed discussion of voice over technology, configuration examples, and commands, see the *Voice Over IP Software Configuration Guide*, which includes the following chapters:

- Chapter 1: Voice Over IP for the Cisco AS5300 Configuration Overview
- Chapter 2: Voice Over IP for the Cisco AS5300 Configuration Examples
- Chapter 3: Voice Over IP for the Cisco AS5300 Commands
- Chapter 4: Voice Over IP for the Cisco AS5300 Debug Commands

Configure

Table 3-24 Configuring IP Networks for Real-Time Voice Traffic

Step	Command	Purpose
1	5300> **enable** Password: <*password*> 5300#	Enter enable mode (also called privileged EXEC mode). Enter the password. You have entered enable mode when the prompt changes to `5300#`.
2	5300# **config term** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.
3	5300(config)# **int s0:23**	Enter the config-if mode. You have entered config-if mode when the prompt changes to `5300(config-if)#`.
4	5300(config-if)# **ip rsvp bandwidth interface-kbps single-flow-kbps**	Enable RSVP for IP for the specified interface and set the bandwidth and single-flow limits. If you do not give any parameters, 75% of bandwidth is reserved by default. For RSVP to work, you must configure fair-queuing on the interface and req-qos in the dial-peer that points to the IP address of this interface.
5	5300(config-if)# **fair-queue**	Enable fair-queuing.
6	5300(config-if)# **ip rtp reserve lowest-UDP-port range-of-ports <maximum-bandwidth>**	Reserve a special queue for real-time packet flows to the specified destination User Datagram Protocol (UDP) ports, allowing real-time traffic to have higher priority than other flows. 16384 is the base UDP port for voice.

Table 3-24 Configuring IP Networks for Real-Time Voice Traffic (Continued)

Step	Command	Purpose
7	`5300(config-if)# `**`ip rtp header-compression passive`**	Enable RTP header compression. Enter **passive** to compress outgoing RTP packets only if incoming RTP packets on the same interface are compressed. If you do not enter **passive**, all RTP traffic is compressed.
8	`5300(config-if)# `**`ip rtp compression-connections number`**	Specify the total number of RTP header compression connections supported on an interface. The default is 16.

9	`5300(config-if)# `**`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify you enabled RSVP and RTP on the interface:

- Enter the **show ip rsvp interface** command or the **show ip rtp header-compression** command.

```
5300# show ip rsvp interface s0:23
 interface allocate i/f max  flow max per/255 UDP  IP   UDP_IP   UDP M/C
 Se0:23   0M       48K      48K      0  /255 0    0    0        0

 5300# show ip rtp header-compression s2:23
 RTP/UDP/IP header compression statistics:
   Interface Serial2:23:
     Rcvd:    0 total, 0 compressed, 0 errors
              0 dropped, 0 buffer copies, 0 buffer failures
     Sent:    0 total, 0 compressed,
              0 bytes saved, 0 bytes sent
     Connect: 20 rx slots, 20 tx slots, 0 long searches, 0 misses
```

Tips

If you are having trouble:

- Verify IP connectivity and that data traffic routes using the **ping** command.

```
5300# ping
Protocol [ip]: ip
Target IP address: 1.13.23.1
Repeat count [5]: 100
Datagram size [100]: 1000
Timeout in seconds [2]: 0
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 100, 1000-byte ICMP Echos to 1.13.23.1, timeout is 0 seconds:
......................................................................
Success rate is 0 percent (0/100)
```

Configuring RLM

The goal of Redundant Link Manager (RLM) is to primarily provide a virtual link management over multiple IP networks so that the Q.931 signaling protocol and other proprietary protocols can be transported on top of multiple redundant links between the Cisco signaling controller and the access server.

We recommend that all access servers should use at least two IP interfaces to connect to the primary and alternative IP interfaces of the signaling controller. Otherwise, the control traffic will be impacted by the data traffic by sharing the same interface for both types of traffic.

Configure

Table 3-25 Configuring RLM

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `as5300(config)#`.

3	`5300(config)#` **`rlm group 1`**	Specify the rlm-group (network access server) that you want to configure using the **rlm group** global configuration command.

4	`5300(config-rlm-group)#` **`interface Loopback1`**
	`5300(config-if)#` **`ip address 10.1.1.1 255.255.255.255`**
		Specify the IP address of the first interface.

5	`5300(config-if)#` **`interface Loopback2`**
	`5300(config-if)#` **`ip address 10.1.1.2 255.255.255.255`**
		Specify the IP address of the second interface.

6	`5300(config-if)#` **`rlm group 1`**
	`5300 (config-rlm-group)#`
		Return to rlm group global configuration mode.

7	`5300(config-rlm-group)#` **`server r1-server`**
	`5300(config-rlm-group-sc)#` **`link address 10.1.4.1 source Loopback1 weight 4`**
	`5300(config-rlm-group-sc)#` **`link address 10.1.4.2 source Loopback2 weight 3`**
		Specify the first device name.
		Specify the link addresses and their weighting preferences.

8	`5300(config-rlm-group-sc)#` **`server r2-server`**
	`5300(config-rlm-group-sc)#` **`link address 10.1.5.1 source Loopback1 weight 2`**
	`5300(config-rlm-group-sc)#` **`link address 10.1.5.2 source Loopback2 weight 1`**
		Specify the second device name.
		Specify the link addresses and their weighting preferences.

9	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify you have configured the interfaces correctly:

- Enter the **show rlm group status** command and specify the group number:

```
5300# show rlm group 1 status

RLM Group 1 Status
 User/Port: RLM_MGR/3000
 Link State: Up         Last Link Status Reported: Up
 Next tx TID: 1         Last rx TID: 0
 Server Link Group[r1-server]:
  link [10.1.1.1(Loopback1), 10.1.4.1] = socket[active]
  link [10.1.1.2(Loopback2), 10.1.4.2] = socket[standby]
 Server Link Group[r2-server]:
  link [10.1.1.1(Loopback1), 10.1.5.1] = socket[opening]
  link [10.1.1.2(Loopback2), 10.1.5.2] = socket[opening]
```

Note the following:

— The link state must report being up.

— No errors should be reported.

- Enter the **show isdn status** command to view layer status information.

```
5300# show isdn status

Global ISDN Switchtype = primary-ni
ISDN Serial0:23 interface
        dsl 0, interface ISDN Switchtype = primary-ni
    Layer 1 Status:
        DEACTIVATED
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Activated dsl 0 CCBs = 0
ISDN Serial1:23 interface
        dsl 1, interface ISDN Switchtype = primary-ni
    Layer 1 Status:
        DEACTIVATED
    Layer 2 Status:
        TEI = 0, Ces = 1, SAPI = 0, State = TEI_ASSIGNED
    Layer 3 Status:
        0 Active Layer 3 Call(s)
    Activated dsl 1 CCBs = 0
    Total Allocated ISDN CCBs = 0
```

Note the following information for Serial 0:23 (the first half of the messages):

— Layer 1 Status should be “DEACTIVATED.”

— Layer 2 Status should be “TEI_ASSIGNED.” (It might take several seconds for Layer 2 status to appear.)

— Layer 3 Status should be “0 Active Layer 3 Call(s).”

The second half of the messages display information for Serial 1:23.

Tips

If you are having trouble:

- Make sure the cable connection is not loose or disconnected if the Layer 1 Status is “Deactivated.” This status message indicates a problem at the physical layer.
- There may be a problem with your telco or the framing and line code types you entered may not match your telco’s. A Layer 2 error indicates that the access server cannot communicate with the telco; there is a problem at the data link layer.

Configuring ISL for VLAN Routing

Use the Inter-Switch Link (ISL) to connect multiple Virtual LANs (VLANs) using the Ethernet Media Access Control (MAC) and Ethernet media.

Configure

Table 3-26 Configuring VLAN Routing

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`interface fastethernet 0`**	Enter Ethernet interface configuration mode.
4	`5300(config-if)#` **`no shut`**	Enable Fast Ethernet.
5	`5300(config)#` **`interface fastethernet0.x`**	Enter the Fast Ethernet subinterface *x*, where *x* is an integer value.
6	`5300(config-subif)#` **`encapsulation isl n`**	Set ISL encapsulation to the VLAN identifier (*n* is a value between 1 and 1000).
7	`5300(config-subif)#` **`ipx network 1-fffffffd`**	Set the virtual IPX[1] network number for the VLAN ID.

Table 3-26 Configuring VLAN Routing (Continued)

Step	Command	Purpose

8	`5300(config-subif)# **Ctrl-Z**`
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

[1] IPX = Internetwork Packet Exchange.

Verify

To verify the VLAN setup (VLAN ID, network address, protocol, and packets received and transmitted):

- Enter the **show vlan** command:

```
5300# show vlan
 Virtual LAN ID:  10 (Inter Switch Link Encapsulation)
 vLAN Trunk Interface:   FastEthernet0.10
 Protocols Configured:   Address:              Received:       Transmitted:
          X           10.00e0.1e6b.2f03         3                   5
```

Tips

If packets are not being routed:

- Enter the **debug vlan packets** command. When you finish viewing the messages, enter the **no debug vlan packets** command to turn off the messages.

```
5300# debug vlan packets
Virtual LAN packet information debugging is on

vLAN: ISL packet received bearing color ID 16 on FastEthernet0
      which has no subinterface configured to route or bridge ID 16.
```

Configuring IPX Networks

Configure the IPX networks for dial-in remote IPX users.

Configure

Table 3-27 Configuring IPX Networks

Step	Command	Purpose
1	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
2	5300(config)# **ipx routing** 5300(config)# **interface loopback 0** 5300(config-if)# **ipx network FEFEFE** 5300(config-if)# **exit** 5300(config)# **interface ethernet 0** 5300(config-if)# **ipx network 123ABCD encapsulation SAP** 5300(config-if)# **exit** 5300(config)# **interface group-Async 1** 5300(config-if)# **group-range 1 48** [or] for E1 PRI 5300(config-if)# **group-range 1 60** Building configuration... 5300(config-if)# **ipx ppp-client Loopback 0** 5300(config-if)# **exit**	Enable IPX clients to access network resources by dialing through the access server over ISDN.
3	5300(config)# **interface dialer 1** 5300(config-if)# **ipx ppp-client Loopback 0**	Create a dialer interface. This is the parent interface for all of the ISDN interfaces (this was set using the dialer **rotary-group 1** command in the IP configuration).
4	5300(config)# **dialer-list 1 protocol ipx permit** 5300(config)# **exit**	Enable IPX packets to reset the idle timer.
5	5300# **copy running-config startup-config** #########[OK]	This completes the configuration for IPX. Save the running configuration to the start-up configuration. The access server will boot with your configuration at the next power up.

Verify

To verify the IPX routing is enabled:

- Enter the **show ipx interface serial** command:

```
5300# configure terminal
5300(config)# show ipx interface serial 1:23
Serial1:23 is up, line protocol is up
  IPX address is 2A.00e0.1e6b.2f6e [up]
  Delay of this IPX network, in ticks is 6 throughput 0 link delay 0
  IPXWAN processing not enabled on this interface.
  IPX SAP update interval is 1 minute(s)
  IPX type 20 propagation packet forwarding is disabled
  Incoming access list is not set
  Outgoing access list is not set
  IPX helper access list is not set
  SAP GNS processing enabled, delay 0 ms, output filter list is not set
  SAP Input filter list is not set
  SAP Output filter list is not set
  SAP Router filter list is not set
  Input filter list is not set
  Output filter list is not set
  Router filter list is not set
  Netbios Input host access list is not set
  Netbios Input bytes access list is not set
  Netbios Output host access list is not set
  Netbios Output bytes access list is not set
  Updates each 60 seconds, aging multiples RIP: 3 SAP: 3
  SAP interpacket delay is 55 ms, maximum size is 480 bytes
  RIP interpacket delay is 55 ms, maximum size is 432 bytes
  Watchdog spoofing is disabled, SPX spoofing is disabled, idle time 60
  IPX accounting is disabled
  IPX fast switching is configured (disabled)
  RIP packets received 0, RIP packets sent 1
  SAP packets received 0, SAP packets sent 0
```

Tips

If you are having trouble:

- Check for compression errors, events, packet activity errors, and IPX activity by using the **debug ipx** commands:
    - Enter the **debug ipx ?** command to see a list of IPX debug options available:

```
5300(config)# debug ipx ?
  compression     IPX compression
  eigrp           IPX EIGRP packets
  ipxwan          Novell IPXWAN events
  nasi            NASI server functionality
  nlsp            IPX NLSP activity
  packet          IPX activity
  redistribution  IPX route redistribution
  routing         IPX RIP routing information
  sap             IPX Service Advertisement information
  spoof           IPX and SPX Spoofing activity
  spx             Sequenced Packet Exchange Protocol
```

    - Enter a debug command from the above list to view the debug information.

Configuring AppleTalk

Configure AppleTalk to enable Macintosh clients to access network resources by dialing through the access server over ISDN.

Configure

Table 3-28 Accessing AppleTalk Networks

Step	Command	Purpose
1	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
2	5300(config)# **appletalk routing** 5300(config)# **appletalk virtual-net 2 ATCP Zone**	Enable AppleTalk routing and set the AppleTalk zone ATCP[1] on network 2 (your network number and zones may differ). All users that dial in to the system will belong to the AppleTalk network 2 in the AppleTalk zone ATCP Zone. All the dial-in users will look as though they are on a single network. Links will not have their own network numbers. This applies to configurations using PPP instead of ARAP[2] encapsulation.
3	5300(config)# **appletalk cable-range 1-1 1.120** 5300(config-if)# **appletalk zone Ethernet** 5300(config-if)# **exit** 5300(config)# **exit**	Set the AppleTalk cable range and the AppleTalk zone on the Ethernet interface.
4	5300# **copy running-config startup-config** #########[OK]	Completes configuration for AppleTalk operation. Save the running configuration to the startup configuration.

1. ATCP = AppleTalk Control Protocol.
2. ARAP = AppleTalk Remote Access Protocol.

Verify

To verify the AppleTalk interface is up and running:

- Enter the **show appletalk interface serial** command:

```
5300# show appletalk interface serial 1:23
Serial1:23 is up, line protocol is up
  AppleTalk address is 10.1, Valid
  AppleTalk zone is "dolzone"
  AppleTalk discarded 37 packets due to output errors
  AppleTalk address gleaning is not supported by hardware
  AppleTalk route cache is disabled, Dial on Demand specified
```

Tips

If you are having trouble, you can troubleshoot the AppleTalk protocol by using its debug commands to view information for the errors, events, and packets and check the Gateway name, NAS name, and if the virtual access interface is up.

- Enter the **debug ppp negotiation** command:

```
5300# debug ppp negot
PPP protocol negotiation debugging is on
5300#
%LINK-3-UPDOWN: Interface Async1, changed state to up
PPP Async1: treating connection as a dedicated line
ppp: sending CONFREQ, type = 2 (CI_ASYNCMAP), value = 0xA0000
ppp: sending CONFREQ, type = 3 (CI_AUTHTYPE), value = 0xC223/5
ppp: sending CONFREQ, type = 5 (CI_MAGICNUMBER), value = 0xAB1BAB3
PPP Async1: state = REQsent fsm_rconfack(0xC021): rcvd id 7
ppp: config ACK received, type = 2 (CI_ASYNCMAP), value = 0xA0000
ppp: config ACK received, type = 3 (CI_AUTHTYPE), value = 0xC223
ppp: config ACK received, type = 5 (CI_MAGICNUMBER), value = 0xAB1BAB3
ppp: config ACK received, type = 7 (CI_PCOMPRESSION)
ppp: config ACK received, type = 8 (CI_ACCOMPRESSION)
PPP Async1: received config for type = 1 (MRU) value = 1500 acked
PPP Async1: received config for type = 2 (ASYNCMAP) value = 0x0 acked
PPP Async1: received config for type = 5 (MAGICNUMBER) value = 0x565CFA6A acked
PPP Async1: received config for type = 7 (PCOMPRESSION) acked
PPP Async1: received config for type = 8 (ACCOMPRESSION) acked
ipcp: sending CONFREQ, type = 2 (CI_COMPRESSTYPE), slots = 15, csid = 0
ipcp: sending CONFREQ, type = 3 (CI_ADDRESS), Address = 171.60.199.193
Resetting ATCP
atcp: sending CONFREQ, type = 6 (CI_AT_SERVERINFO), values = 119132, 6
atcp: sending CONFREQ, type = 7 (CI_AT_ZONEINFO), values = 1191B3, 9
atcp: sending CONFREQ, type = 8 (CI_AT_DEFAULT_ROUTER), values = 5, C7
.
.
.
```

- Enter the **show interface async 1** command:

```
5300# show int async 1
Async1 is up, line protocol is up
  Hardware is Async Serial
  Interface is unnumbered.  Using address of Ethernet0 (171.60.199.193)
  MTU 1500 bytes, BW 38 Kbit, DLY 100000 usec, rely 255/255, load 1/255
  Encapsulation PPP, loopback not set, keepalive not set
  DTR is pulsed for 5 seconds on reset
  LCP Open
  Open: IPCP, ATALKCP
  Last input 00:00:01, output 00:00:08, output hang never
  Last clearing of "show interface" counters 07:17:22
  Input queue: 1/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations  0/9 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     753 packets input, 22232 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     638 packets output, 37821 bytes, 0 underruns
     0 output errors, 0 collisions, 3 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

- Enter the **show apple interface async 1** command:

```
5300# show apple int async 1
Async1 is up, line protocol is up
  AppleTalk port is in client-mode
  AppleTalk discarded 3 packets due to input errors
  AppleTalk address gleaning is not supported by hardware
  AppleTalk route cache is disabled, port down
```

- You can also set the access server to display events messages for the AppleTalk interface by using the **debug appletalk events** command. When done troubleshooting, enter the **no debug appletalk events** to turn off the messages.

```
5300# debug appletalk events
AppleTalk Events debugging is on
*Aug 15:56:06.907: AT: RTMP GC complete (0 PDBs freed, 0 PDBs waiting)
*Aug 15:17:56:06.927: AT: Connected GC complete (0 PDBs freed, 0 PDBs waiting)
```

- Enter the **debug appletalk ?** command for a list of the appletalk debug commands:

```
5300# debug appletalk ?
   arp                           Appletalk address resolution protocol
   aurp-connection               AURP connection
   aurp-packet                   AURP packets
   aurp-update                   AURP routing updates
   domain                        AppleTalk Domain function
   eigrp-all                     All AT/EIGRP functions
   eigrp-external                AT/EIGRP external functions
   eigrp-hello                   AT/EIGRP hello functions
   eigrp-packet                  AT/EIGRP packet debugging
   eigrp-query                   AT/EIGRP query functions
   eigrp-redistribution          AT/EIGRP route redistribution
   eigrp-request                 AT/EIGRP external functions
   eigrp-target                  Appletalk/EIGRP for targeting address
   eigrp-update                  AT/EIGRP update functions
   errors                        Information about errors
   events                        Appletalk special events
   fs                            Appletalk fast-switching
   iptalk                        IPTalk encapsulation and functionality
   load-balancing                AppleTalk load-balancing
   macip                         MacIP functions
   nbp                           Name Binding Protocol (NBP) functions
   packet                        Per-packet debugging
   redistribution                Route Redistribution
   remap                         AppleTalk Remap function
   responder                     AppleTalk responder debugging
   routing                       (RTMP&EIGRP) functions
   rtmp                          (RTMP) functions
   zip                           Zone Information Protocol functions
```

Configuring MMP

If you have multiple access servers stacked together to provide a frontend for receiving access calls, you can configure Multichassis Multilink Point-to-Point Protocol (MMP) so that Multilink PPP (MP) call processing can be offloaded to other access servers.

MMP support on a group of access servers requires that each access server be configured to support:

- Stack Group Bidding Protocol (SGBP)
- Virtual templates used for cloning interface configurations to support MMP
- Multilink PPP

Configure

Table 3-29 Configuring MMP

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <password>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`sgbp group stackq`**	Create a stack group and assign this access server to it.

4	`5300(config)#` **`sgbp member systemb 172.16.188.2`**
	`5300(config)#` **`sgbp member systemc 172.16.189.254`**
		Specify the host name and IP address of the peer member of the stack group. In this example there are two peers: systemb and systemc.

5	`5300(config)#` **`sgbp seed-bid offload`**	Set the bidding level for a stack group member. Offload indicates that this access server is a relatively higher powered stack group member. The access server will function as an offload server and host the master bundle interface.
6	`5300(config)#` **`multilink virtual-template number`**	Define a virtual template[1] for the stack group.
7	`5300(config)#` **`ip local pool default ip-address`**	Specify an IP address pool by using any pooling mechanism—for example, IP local pooling or DHCP[2] pooling.
8	`5300(config)#` **`interface virtual-template number`**	Create a virtual template interface, and enter interface configuration mode.
9	`5300(config-if)#` **`ip unnumbered ethernet 0`**	If dialers are not configured on the physical interfaces, identify the virtual template interface type and number on the LAN.
10	`5300(config-if)#` **`encapsulation ppp`**	Enable PPP encapsulation on the virtual template interface.

Table 3-29 Configuring MMP (Continued)

Step	Command	Purpose
11	`5300(config-if)#` **`ppp multilink`**	Enable Multilink PPP on the virtual template interface.
12	`5300(config-if)#` **`ppp authentication chap`**	Enable PPP authentication on the virtual template interface.

13	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

[1] A virtual template is a serial interface configuration with no hardware association.

[2] DHCP = Dynamic Host Configuration Protocol.

Verify

To verify the MMP configuration on each server:

- Enter the **show sgbp command**:

```
5300# show sgbp
Group Name: test Ref: 0x4780B252
Seed bid: default, 50, default seed bid setting

  Member Name: 5300-3 State: active Id: 9
  Ref: 0x4780B54D
  Address: 172.22.21.8

5300# show sgbp
Group Name: test Ref: 0x4780B54D
Seed bid: default, 50, default seed bid setting

  Member Name: 5300-7 State: active Id: 1
  Ref: 0x4780B252
  Address: 172.22.21.12
```

Note the following:

— Check to make sure State is active. State set to idle indicates there is a misconfiguration on either side.

— Check to make sure the username and password are configured for the sgbp group; otherwise the servers will not be able to talk to each other.

Tips

If you are having trouble:

- Enter the **debug sgbp ?** command to view a list of available debugging commands:

```
5300# debug sgbp ?
  errors    SGBP errors
  events    SGBP events
  hellos    SGBP connection hellos
  messages  SGBP messages
  queries   SGBP mastership queries
```

- Enter the **debug sgbp errors** command to view error messages. When you finish viewing the messages, enter the **no debug sgbp errors** to turn off the messages.

  ```
  5300# debug sgbp errors
  *Mar  4 11:55:24.105 EST: %SGBP-1-MISSCONF: Possible misconfigured member 5300-6 using
  172.22.21.11

  *Mar  4 11:55:41.185 EST: %SGBP-7-NORESP: Fail to response to 5300-3 group test, may
  not have password
  ```

  Error messages are displayed if one server 5300-6 shows an sgbp group configured but the group is not configured for another server in the group. Error messages are also displayed if the password is not configured for the sgbp group.

- Enter the **debug sgbp events** command to view event messages. When you finish viewing the messages, enter the **no debug sgbp events** to turn off the messages.

  ```
  5300# debug sgbp events
  *Mar  4 12:26:46.441 EST: %SGBP-7-CLOSE: Closing pipe for member 5300-3
  *Mar  4 12:26:46.445 EST: %SGBP-5-LEAVING: Member 5300-3 leaving grouptest
  ```

  The above event message indicates that the sgbp connection went down and 5300-3 is no longer part of the 5300-7 sgbp group. You can check 5300-3 for the reasons why the sgbp connection went down. Possibly, the sgbp member entry for 5300-7 was removed or there is no communication between 5300-7 and 5300-3.

Creating Authentication Accounts

You can create authentication accounts for other routers in an MMP stack. If your stack name is STACK1, you need to create a user account called STACK1 on each router with the same password.

```
username STACK1 password cisco
sgbp group STACK1
sgbp member other_router_name other_router_IP_address
```

Configuring VPDN

Virtual private dial-up networking (VPDN) enables users to configure secure networks that take advantage of Internet service providers (ISPs) that tunnel a company's remote access traffic through the ISP cloud.

Remote offices or mobile users can connect to their home network using local third-party dial-up services. The dial-up service provider agrees to forward the company's traffic from the ISP point of presence (POP) to a company-run home gateway. Network configuration and security remains in the control of the client. The dial-up service provider provides a virtual connection between the company's sites.

Note The MMP feature uses VPDN to connect multiple PPP sessions for which individual dial-in calls have arrived on different stack group members. VPDN provides speed and reliability for the setup and shutdown of Multilink PPP.

Configure

Table 3-30 Configuring VPDN

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`vpdn enable`**	Enable virtual private dial-up networking.

4	`5300(config)#` **`vpdn outgoing domain1.com nas1 ip 172.21.9.18`**
	`5300(config)#` **`vpdn outgoing domain2.com nas2 ip 173.22.10.19`**
		Specify the name and IP address of the remote host and the name to use when authenticating a tunnel for forwarding traffic to the remote host on a virtual private dial-up network. In this example, two remote hosts are specified.

5	`5300(config-line)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Verify

To verify your VPDN configuration:

- Enter the **show vpdn** command to make sure the tunnels are active (see line 2 in the following example):

```
5300# show vpdn
Active L2F tunnels = 2
```

```
NAS Name        Gateway Name    NAS CLID   Gateway CLID   State
test-mmp        test-gateway       272          272        open
192.168.1.99    192.168.1.119

L2F MIDs = 10
Name                       NAS Name      Interface    MID      State
rw56                       test-mmp       Vi238        1       open
rw55                       test-mmp       Vi240        3       open
rw54                       test-mmp       Vi242        4       open
rw57                       test-mmp       Vi246        7       open
rw57                       test-mmp       Vi248        8       open
rw54                       test-mmp       Vi245        13      open
rw55                       test-mmp       Vi244        14      open
rw16                       test-mmp       Vi249        97      open
rw16                       test-mmp       Vi251        98      open
rw56                       test-mmp       Vi250        100     open
```

Tips

If you are having trouble:

- Troubleshoot the VPDN protocol by using its debug commands to view information for the errors, events, and packets and check the Gateway name, network access server (NAS) name, and if the virtual access interface is up.
    - Enter **debug vpdn ?** command to view a list of debug vpdn commands:

```
5300# debug vpdn ?
  error        VPDN Protocol errors
  event        VPDN event
  l2f-errors   L2F protocol errors
  l2f-events   L2F protocol events
  l2f-packets  L2F protocol packets
  packet       VPDN packet
```

    - Enter debug commands to view error information. When you finish viewing the messages, enter **no debug vpdn** command to turn off the debug messages:

This is sample output for the **debug vpdn event** command:

```
5300# debug vpdn event
  VPN events debugging is on
     *May 15 17:55:49.367: %LINK-3-UPDOWN: Interface Virtual-Access239,
  changed state to down
  *May 15 17:55:49.547: Virtual-Access249 VPN reset
  *May 15 17:55:49.547: %LINK-3-UPDOWN: Interface Virtual-Access249,
  changed state to down
```

This is sample output for the **debug vpdn l2f-events** command:

```
5300# debug vpdn l2f-events
  L2F protocol events debugging is on
  *May 15 17:56:46.259: L2F_OPEN received
  *May 15 17:56:46.263: L2F Got a MID management packet
  *May 15 17:56:46.339: %LINK-3-UPDOWN: Interface Virtual-Access239,
  changed state to up
```

This is sample output for the **debug vpdn l2f-errors** command:

```
5300# debug vpdn l2f-errors
  L2F protocol errors debugging is on
  *May 15 17:57:57.827: %LINK-3-UPDOWN: Interface Virtual-Access251,
  changed state to down
```

Creating Authentication Accounts

You can create authentication accounts for other routers between the NAS and the HGW for VPDN.

On the NAS, an example is:

```
username NAS password cisco
username HGW password cisco
vpdn enable
vpdn outgoing cisco.com NAS ip X.X.X.X
```

On the HGW, an example is:

```
username NAS password cisco
username HGW password cisco
vpdn enable
vpdn incoming NAS HGW virtual-template 1
```

Using Continuity Test (COT)

The COT subsystem supports the Continuity Test (COT), which is required by the SS7 network to conduct loopback and tone check testing on the path before a circuit is established. Continuity testing (COT) will detect any failure of DS0 channels. It is required for North American SS7 compliance.

Note You must have installed MICA 2.6.1.0 portware, which supports the COT feature.

Configure

There are no configuration tasks.

Verify

Use the following commands to verify COT:

- Display information about the COT DSP (Digital Signal Processor) configuration or current status by entering the **show cot dsp status** or **config** command:

```
5300# show cot dsp status 1/1
Rx Freq 2010 Hx
Tx Freq 1780 Hx
Tx then Rx mode
in WaitRxOn state

5300# show cot dsp config 1/1
Rx Freq 2010 Hx
Tx Freq 1780 Hx
Tx then Rx mode
Timeout value:0
```

- Display information about the COT request by entering the **show cot request** command:

```
5300# show cot request 1/1
00:19:29:COT Request@ 0x61064A20, CDB@ 0x60EBB48C, Params@0x61123DBC
00:19:29:  request type = COT_CHECK_TONE_ON
00:19:29:  shelf 0 slot 0 appl_no 1 ds0 1
00:19:29:  duration 100000 key FFF1 freqTx 1780 freqRx 2010
00:19:29:  state COT_WAIT_TD_ON_CT
00:19:29:  event_proc(0x6093B55C)
```

- Display information about the COT activity by entering the **show cot summary** command:

```
5300# show cot summary

router#
08:23:24:  COT Subsystem - Request Statistics

08:23:24: COT Request Type = COT_DS0_LOOPBACK_ON
08:23:24: # of request(s)           : 4         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 4         # of invalid request(s)   : 0
08:23:24: # of cot timeout(s)       : 0         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0

08:23:24: COT Request Type = COT_DS0_LOOPBACK_OFF
08:23:24: # of request(s)           : 4         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 4         # of invalid request(s)   : 0
08:23:24: # of cot timeout(s)       : 0         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0

08:23:24: COT Request Type = COT_CHECK_TONE_ON
08:23:24: # of request(s)           : 7         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 3         # of invalid request(s)   : 2
08:23:24: # of cot timeout(s)       : 1         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0

08:23:24: COT Request Type = COT_CHECK_TONE_OFF
08:23:24: # of request(s)           : 0         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 0         # of invalid request(s)   : 0
08:23:24: # of cot timeout(s)       : 0         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0


08:23:24: COT Request Type = COT_CUT_IN_TRANSPONDER
08:23:24: # of request(s)           : 0         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 0         # of invalid request(s)   : 0
08:23:24: # of cot timeout(s)       : 0         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0

08:23:24: COT Request Type = COT_CUT_OUT_TRANSPONDER
08:23:24: # of request(s)           : 0         # of restart requests(s)  : 0
08:23:24: # of successful request(s): 0         # of invalid request(s)   : 0
08:23:24: # of cot timeout(s)       : 0         # of dsp error(s)         : 0
08:23:24: # of no dsp(s)            : 0
```

- Use the **debug cot api** command to display information about the COT API, the **debug cot detail** command to display information about COT internal detail, and **debug cot api** command to display related to the COT/DSP interface. Typical DSP (Digital Signal Processor) functions include: data modems, voice CODECS, fax modems, and CODECs, and low-level signaling such as CAS/R2. Use the **no** debug cot command to disable debugging output.

```
5300# debug cot api
COT API debugging is on
08:29:55: cot_request_handler(): CDB@0x60DEDE14, req(COT_CHECK_TONE_ON):
08:29:55:     shelf 0 slot 0 appl_no 1 ds0 1
08:29:55:     freqTX 2010 freqRX 1780 key 0xFFF1 duration 60000


5300# debug cot detail
00:04:57:cot_request_handler():CDB@0x60EBB48C, req(COT_CHECK_TONE_ON):
00:04:57:    shelf 0 slot 0 appl_no 1 ds0 1
00:04:57:    freqTX 1780 freqRX 2010 key 0xFFF1 duration 1000
00:04:57:COT:DSP (1/0) Allocated
00:04:57:COT:Request Transition to COT_WAIT_TD_ON
00:04:57:COT(0x60EBB48C):Adding new request (0x61123DBC) to In
```

```
Progress Q
00:04:57:COT(0x60EBB48C):Adding COT(0x61123DBC) to the Q head
00:04:57:COT:Start Duration Timer for Check Tone Request
00:04:58:COT:Received Timer Event
00:04:58:COT:T24 Timer Expired
00:04:58:COT Request@ 0x61123DBC, CDB@ 0x60EBB48C, Params@0x61123E08
00:04:58:  request type = COT_CHECK_TONE_ON
00:04:58:  shelf 0 slot 0 appl_no 1 ds0 1
00:04:58:  duration 1000 key FFF1 freqTx 1780 freqRx 2010
00:04:58:  state COT_WAIT_TD_ON_CT
00:04:58:  event_proc(0x6093B55C)
00:04:58:Invoke NI2 callback to inform COT request status
00:04:58:In cot_callback
00:04:58:  returned key 0xFFF1, status = 0
00:04:58:Return from NI2 callback
00:04:58:COT:Request Transition to IDLE
00:04:58:COT:Received DSP Q Event
00:04:58:COT:DSP (1/0) Done
00:04:58:COT:DSP (1/0) De-allocated


5300# debug cot dsp
00:10:42:COT:DSP (1/1) Allocated
00:10:43:In cot_callback
00:10:43:  returned key 0xFFF1, status = 0
00:10:43:COT:Received DSP Q Event
00:10:43:COT:DSP (1/1) Done
00:10:43:COT:DSP (1/1) De-allocated


5300# debug cot queue
00:11:26:COT(0x60EBB48C):Adding new request (0x61123DBC) to In
Progress Q
00:11:26:COT(0x60EBB48C):Adding COT(0x61123DBC) to the Q head
00:11:27:In cot_callback
00:11:27:  returned key 0xFFF1, status = 0
```

- Use the **clear cot summary** command to reset the counters.

Saving Configuration Changes

To prevent the loss of the access server configuration, save it to NVRAM.

Configure

Table 3-31 Saving Configuration Changes

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`copy running-config startup-config`**	Save the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.

3	`5300(config-if)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Comprehensive Configuration Examples

This section includes three sample outputs of the **show config** command. If you are experienced with the Cisco IOS software, you might find this a useful reference for configuration.

Octal E1/PRI Card with Four Serial Interfaces

```
5300# show config
Building configuration...

Current configuration:
!
version 12.0
service timestamps debug datetime msec localtime
service timestamps log datetime localtime show-timezone
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
hostname elnino_uut
!
no logging buffered
logging monitor notifications
enable password lab
!
bert profile default pattern 220-O.151QRSS threshold 10^-6 error-injection none
duration 10
ip subnet-zero
ip ftp source-interface Ethernet0
ip ftp username melai
no ip domain-lookup
ip domain-name cisco.com
!
isdn switch-type primary-net5
chat-script dial "" "ATDT\T" TIMEOUT 120 CONNECT \p
```

```
modemcap entry mymica:MSC=0s21=0s24=0
clock timezone PDT8 -8
clock summer-time PDT8 recurring
partition flash 2 8 8
!
!
!
controller E1 0
 clock source line primary
 pri-group timeslots 1-31
!
controller E1 1
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 2
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 3
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 4
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 5
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 6
 clock source line secondary 2
 pri-group timeslots 1-31
!
controller E1 7
 clock source line secondary 2
 pri-group timeslots 1-31
!
!
interface Serial0
 ip address 10.1.1.1 255.255.255.0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 no keepalive
 no fair-queue
 no cdp enable
!
interface Serial1
 ip address 11.1.1.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 no keepalive
 no fair-queue
 no cdp enable
!
interface Serial2
 ip address 12.1.1.1 255.255.255.0
 no ip directed-broadcast
 encapsulation frame-relay
 no ip mroute-cache
 no keepalive
 no fair-queue
 frame-relay map ip 12.1.1.2 100 broadcast
```

```
!
interface Serial3
 ip address 13.1.1.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 no keepalive
 no fair-queue
 no cdp enable
!
interface Serial0:15
 ip address 20.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
!
interface Serial1:15
 ip address 21.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
!
interface Serial2:15
 ip address 22.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
!
interface Serial3:15
 ip address 23.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
!
```

```
interface Serial4:15
 ip address 24.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
 hold-queue 75 in
!
interface Serial5:15
 ip address 25.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
 hold-queue 75 in
!
interface Serial6:15
 ip address 26.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
 hold-queue 75 in
!
interface Serial7:15
 ip address 27.0.0.1 255.0.0.0
 no ip directed-broadcast
 encapsulation ppp
 no keepalive
 dialer idle-timeout 4000
 dialer load-threshold 5 either
 dialer-group 1
 isdn switch-type primary-net5
 isdn incoming-voice modem
 no fair-queue
 no cdp enable
 ppp authentication chap
 hold-queue 75 in
!
interface FastEthernet0
 ip address 15.0.0.1 255.0.0.0
 no ip directed-broadcast
 ip route-cache same-interface
 no ip mroute-cache
 no keepalive
 duplex full
 no cdp enable
!
interface Group-Async1
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 1 30
 hold-queue 10 in
!
interface Group-Async2
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 31 60
 hold-queue 10 in
!
interface Group-Async3
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 61 90
 hold-queue 10 in
!
interface Group-Async4
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 91 120
 hold-queue 10 in
!
interface Group-Async5
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 121 150
 hold-queue 10 in
!
interface Group-Async6
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 151 180
 hold-queue 10 in
!
interface Group-Async7
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 181 210
 hold-queue 10 in
!
interface Group-Async8
 ip unnumbered FastEthernet0
 no ip directed-broadcast
 encapsulation ppp
 no ip mroute-cache
 async default routing
 async mode interactive
 no peer default ip address
 no fair-queue
 no cdp enable
 ppp authentication chap
 group-range 211 240
 hold-queue 10 in
!
no ip classless
ip route 200.0.0.0 255.0.0.0 15.0.0.2
ip route 210.1.1.0 255.255.255.0 10.1.1.2
ip route 211.1.1.0 255.255.255.0 11.1.1.2
ip route 212.1.1.0 255.255.255.0 12.1.1.2
ip route 213.1.1.0 255.255.255.0 13.1.1.2
!
access-list 101 deny   igrp any any
access-list 101 permit ip any any
dialer-list 1 protocol ip list 101
no cdp run
!
!
line con 0
```

```
 exec-timeout 0 0
 logging synchronous
 transport input none
line 1 240
 no exec
 autoselect ppp
 modem InOut
 modem autoconfigure discovery
 transport input all
line aux 0
 exec-timeout 0 0
 logging synchronous
line vty 0 4
 no exec
 login
!
scheduler interval 1000
end
```

Octal T1/PRI Card With Four Serial Interfaces

```
5300# show config
Building configuration...

Current configuration:
!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname elnino_elnino1
!
boot system flash c5300-js-mz.0.13.0
no logging console
enable secret 5 $1$anWm$O2KfOHriUEkgs.eu.JFfl/
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 1
 framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 2
 framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 3
 framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24

!
controller T1 4
framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 5
 framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 6
 framing esf
 clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
controller T1 7
 framing esf
clock source line secondary 1
 linecode b8zs
 pri-group timeslots 1-24
!
!
!
interface Ethernet0
 ip address 24.1.3.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 no keepalive
!
interface Serial0
 ip address 120.0.0.1 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
interface Serial1
ip address 26.1.2.5 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
interface Serial2
 ip address 130.4.3.2 255.255.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
 clockrate 2015232
!
interface Serial3
ip address 192.5.3.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
 clockrate 2015232
!
```

Octal T1/PRI Card With CAS and Four Serial Interfaces

```
5300# show config
Building configuration...

Current configuration:
```

```
!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 5300_copan
!
no logging console
enable secret 5 $1$baqI$5qjqlk1fd/gP9SR5jBTZ50
enable password lab
!
bert profile default pattern 220-O.151QRSS threshold 10^-6 error-injection
 none duration 10
ip subnet-zero
no ip domain-lookup
ip host Elnino_copan 45.0.0.4
!
!
!
controller T1 0
 framing esf
 linecode b8zs
 clock source line primary
 cas-group 1 timeslots 1-24 type e&m-fgb
!
controller T1 1
 framing esf
 clock source line secondary 1
 linecode b8zs
 cas-group 2 timeslots 1-24 type e&m-fgb

controller T1 2
 framing esf
 clock source line secondary 1
 linecode b8zs

 cas-group 3 timeslots 1-24 type e&m-fgb
!
controller T1 3
 framing esf
 clock source line secondary 1
 linecode b8zs
 cas-group 4 timeslots 1-24 type e&m-fgb
!
controller T1 4
 framing esf
 clock source line secondary
 linecode b8zs
 cas-group 5 timeslots 1-24 type e&m-fgb
!
!
controller T1 5
 framing esf
 clock source line secondary 1
 linecode b8zs
 cas-group 6 timeslots 1-24 type e&m-fgb
!
controller T1 6
 framing esf
 clock source line secondary 1
 linecode b8zs
 cas-group 7 timeslots 1-24 type e&m-fgb
!
controller T1 7
```

```
 framing esf
 clock source line secondary 1
 linecode b8zs
 cas-group 8 timeslots 1-24 type e&m-fgb
!
!
interface Serial0
 ip address 120.0.0.1 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
interface Serial1
 ip address 26.0.0.2 255.0.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
interface Serial2
 ip address 130.4.3.2 255.255.0.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
!
interface Serial3
 ip address 192.5.3.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 no fair-queue
!
interface FastEthernet0
 no ip address
 no ip directed-broadcast
 shutdown
!
```

Where to Go Next

At this point you can proceed to:

- The chapter “Access Server Security” to configure security on your access server.
- The Cisco IOS software configuration guide, feature modules, command reference publications, and *Dial Solutions Configuration Guide* for more advanced configuration topics. These publications are available on the documentation CD that came with your access server, on the World Wide Web from Cisco’s home page, or you can order printed copies. Check out the topic **Configuring Cisco IOS Features** on this url on Cisco’s home page: http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/index.htm
- For troubleshooting information, refer to the *System Error Messages* and *Debug Command Reference* publications.

Access Service Security

The access service security paradigm presented in this guide uses the authentication, authorization, and accounting (AAA) facility:

- Authentication—Requires dial-in users to identify themselves and prove their identity. Requiring authentication before users can access the network prevents users from either accessing lines on the access server or connecting through the lines directly to network resources. You need to secure every access point.
- Authorization—Prevents each user from gaining access to services and devices on the network that they do not need to or should not access.
- Accounting—Provides records for billing and other recording purposes of who is connected and how long they have been connected. This chapter does not describe how to configure accounting.

This chapter describes how to configure security using a local database resident on the access server or using a remote security database for Terminal Access Controller Access Control System (TACACS+) and Remote Authentication Dial-In User Service (RADIUS). To understand the concept of local versus remote authentication, refer to the section “Local Versus Remote Server Authentication” later in this chapter.

This chapter includes the following sections:

- Assumptions
- Local Versus Remote Server Authentication
- Configuring Authentication
- Configuring Authorization
- Security Examples

Caution This chapter does not provide a comprehensive security overview. For example, it does not describe how to configure TACACS, Extended TACACS, Kerberos, or access lists. It presents the most commonly used security mechanisms to prevent unauthenticated and unauthorized access to network resources through Cisco access servers. For a comprehensive overview of Cisco security tools, refer to the *Security Configuration Guide*, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Assumptions

This chapter assumes the following:

- You know which network protocols will be allowed access to your network. For example, you know if you will be allowing customers to dial in using modems to access IP, IPX, or AppleTalk networks.
- You are not an advanced user of the Cisco AAA security facility.

Local Versus Remote Server Authentication

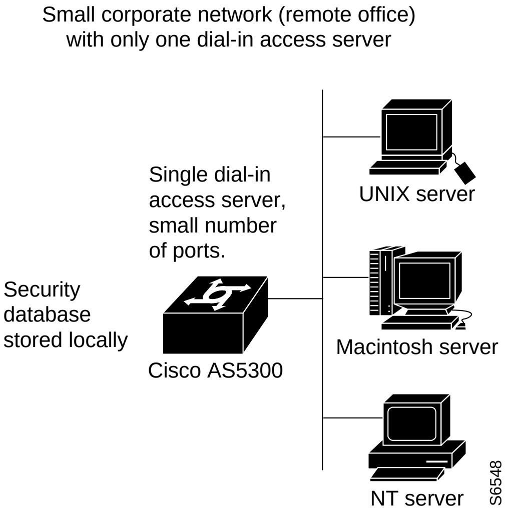
This section describes the differences between local and remote security databases and the basic authentication process for each. Remote security databases described in this chapter include TACACS+ and RADIUS.

Generally the size of the network and type of corporate security policies determines whether you use a local or remote security database.

Local Security Database

If you have one or two access servers providing access to your network, you should store username and password security information on the Cisco access server. This is referred to as local authentication. (See Figure 4-1.)

Figure 4-1 Local Security Database Authentication


Small corporate network (remote office) with only one dial-in access server
Single dial-in access server, small number of ports.
Security database stored locally
Cisco AS5300
UNIX server
Macintosh server
NT server
S6548

A local security database is useful if you have very few access servers providing network access. A local security database does not require a separate (and costly) security server.

Remote Security Database

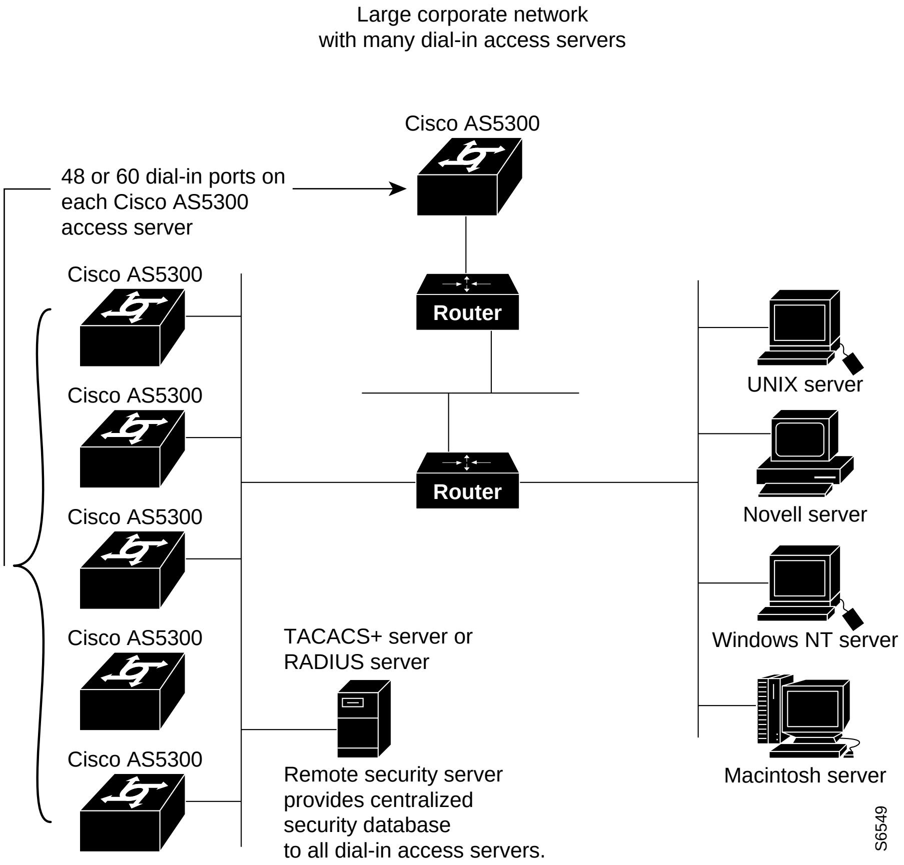
As your network expands, you need a centralized security database that provides username and password information to each of the access servers on the network. This centralized security database resides in a security server. (See Figure 4-2.)

An example of a security server is the CiscoSecure Access Control Server, a UNIX security daemon that enables administrators to create databases that define network users and their privileges. CiscoSecure uses a central database that stores user and group profiles with authentication and authorization information.

The Cisco AS5300 exchanges user authentication information with a TACACS+ or RADIUS database on the security server by transmitting encrypted TACACS+ or RADIUS packets across the network.

For specific information about the interaction between security servers and access servers, refer to the *Security Configuration Guide*, available online at
http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Figure 4-2 Remote Security Database



A remote, centralized security database is useful when you have a large number of access servers providing network access. It prevents having to update each access server with new or changed authentication and authorization information for thousands of dial-in network users. A centralized security database also helps establish consistent remote access policies throughout a corporation.

Configuring Authentication

You can use the AAA facility to authenticate users with either a local or a remote security database. Whether you maintain a local or remote security database, or use TACACS+ or RADIUS authentication and authorization, the process of configuring the access server for these different databases and protocols is similar. The basic process of configuring the Cisco IOS software for authentication requires the following tasks:

1. Securing Access to Privileged EXEC and Configuration Mode
2. Communicating Between the Access Server and the Security Server
3. Configuring Authentication on a TACACS+ Server
4. Enabling AAA Globally on the Access Server
5. Defining Authentication Method Lists
    - Enter the aaa authentication Command
    - Specify Protocol or Login Authentication
    - Identify a List Name
    - Specify the Authentication Method
    - Populate the Local Username Database if Necessary
6. Applying Authentication Method Lists

Securing Access to Privileged EXEC and Configuration Mode

The first step to configuring authentication is to secure access to privileged EXEC (also called enable) mode. Enable mode provides access to configuration mode, which enables any type of configuration change to the access server. To secure Privileged EXEC mode, use one of the commands listed in Table 4-1.

Table 4-1 Privileged EXEC Mode Commands

Command	Description
enable password *password*	Requires that network administrators enter a password to access enable mode. Do not provide access to users who are not administrators.
enable secret *password*	Specifies a secret password that is encrypted, so that the password cannot be read when crossing a network. After you enter this command, the encryption cannot be reversed. The encrypted version of the password appears in output of the **show running-config** and **show startup-config** commands. The enable secret password has precedence over the enable password. Do not enter the same password as the enable password. If the two passwords are the same, the enable secret password is not a secret, because the enable password is not encrypted and appears in output of **show running-config** and **show startup-config** commands.

For more information about the **enable password** and **enable secret** commands and their complete syntax, refer to the *Security Command Reference*, available online at http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Caution If you use the **enable secret** command and specify an encryption type, you *must* enter the *encrypted version* of a specific password. Do not enter the cleartext version of the password after specifying an encryption type. You must comply with the following procedure when you specify an encryption type or you will be locked irretrievably out of privileged EXEC (enable) mode. The only way to regain access to privileged EXEC mode will be to erase the contents of NVRAM, erase your entire configuration, and reconfigure the access server.

To enter an encryption type with the **enable secret** command, follow the steps listed in Table 4-2.

Table 4-2 Entering an Encryption Type

Step	Command	Description
1	5300> **enable** Password: <*password*> 5300#	Enter enable mode. Enter the password. You have entered enable mode when the prompt changes to 5300#.
2	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
3	5300(config)# **enable secret guessme**	Enter a secret enable password. This password provides access to privileged EXEC mode. Substitute your own enable secret password instead of using **guessme**.
4	5300(config-if)# **Ctrl-Z** 5300# %SYS-5-CONFIG_I: Configured from console by console 5300#	Return to enable mode. This message is normal and does not indicate an error.
5	5300# **show running-config** Building configuration... Current configuration: ! version XX.X . . . enable secret 5 $1$h7dd$VTNs4.BAfQMUU0Lrvw6570	View the encrypted password. In this example, the encrypted password follows "enable secret 5" and is shown as "$1$h7dd$VTNs4.BAfQMUU0Lrvw 6570."
6	5300# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. 5300(config)#	Re-enter global configuration mode. You have entered global configuration mode when the prompt changes to 5300(config)#.
7	5300(config)# **enable secret 5 $1$h7dd$VTNs4.BAfQMUU0Lrvw6570**	Enter the encryption type (5 is the only valid encryption type for the enable secret password). Then copy and paste in the encrypted version of the password that was displayed in the output of the **show running-config** command in Step 5.

Table 4-2 Entering an Encryption Type (Continued)

Step	Command	Description

8	`5300(config)# Ctrl-Z`
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
	`5300#`
		Return to enable mode.
		This message is normal and does not indicate an error.

9	`5300# copy running-config startup-config`	Save the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.

You can also specify additional protection for privileged EXEC mode:

- Privilege levels for Cisco IOS commands
- Privileged EXEC passwords for different privilege levels
- Privilege levels for specific lines on the access server
- Encrypt passwords using the **service password-encryption** commands

For more information about these security tools, refer to the *Security Configuration Guide*, available online at
http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Communicating Between the Access Server and the Security Server

This section describes the Cisco IOS software commands that enable the access server to communicate with a security server. This process is similar for communicating with TACACS+ and RADIUS servers.

If you are using local authentication, refer to the section “Enabling AAA Globally on the Access Server,” later in this chapter.

If you are using a remote security server for authentication and authorization, you must configure the security server before performing the tasks described in this chapter. The section “Security Examples” at the end of this chapter shows some typical TACACS+ and RADIUS server entries corresponding to the access server security configurations.

Communicating with a TACACS+ Server

To enable communication between the TACACS+ security (database) server and the access server, enter the commands listed in Table 4-3.

Table 4-3 Enabling Communication with a TACACS+ Server

Step	Command	Description

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode.
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)#` **`tacacs-server host alcatraz`**	Enter the IP address or host name of the remote TACACS+ server host. The host is typically a UNIX system running TACACS+ software. In this example, the host name is alcatraz.
4	`5300(config)#` **`tacacs-server key abra2cad`**	Enter a shared secret text string to be used between the access server and the TACACS+ server. The access server and TACACS+ server use the shared secret text string to encrypt passwords and exchange responses. In this example, the shared secret text string is abra2cad.

5	`5300(config)#` **`Ctrl-Z`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
	`5300#`
		Return to enable mode.
		This message is normal and does not indicate an error.

6	`5300#` **`copy running-config startup-config`**	Save the configuration changes to NVRAM so that they are not lost during resets, power cycles, or power outages.

For more information about these commands, refer to the *Security Command Reference*, available online at
http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Communicating with a RADIUS Server

To enable communication between the RADIUS security (database) server and the access server, enter the commands listed in Table 4-4.

Table 4-4 Establishing Communication with a RADIUS Security Server

Step	Command	Description

1	`5300> enable`
	`Password: <password>`
	`5300#`
		Enter enable mode.
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300# configure terminal`
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode. You have entered global configuration mode when the prompt changes to `5300(config)#`.

3	`5300(config)# radius-server host alcatraz`	Enter the IP address or host name of the remote RADIUS server host. This host is normally a UNIX system running RADIUS software. In this example, the host name is alcatraz.
4	`5300(config)# radius-server key abra2cad`	Specifies a shared secret text string used between the access server and the RADIUS server. The access server and RADIUS server use this text string to encrypt passwords and exchange responses. In this example, the shared secret text string is abra2cad.

5	`5300(config)# Ctrl-Z`
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
	`5300#`
		Return to enable mode.
		This message is normal and does not indicate an error.

You can use any of the following optional commands to interact with the RADIUS server host:

- **radius-server retransmit** *number*

  This command specifies the number of times that the access server transmits each RADIUS request to the server before the access server gives up.

- **radius-server timeout** *seconds*

  This command specifies the number of seconds that the access server waits for a reply to a RADIUS request before the access server retransmits the request. The default is 5 seconds. If the RADIUS server's response is slow (because of support for a large number of users or large network latency), increase the timeout value.

For more information about these commands, refer to the *Security Command Reference*, available online at
http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Configuring Authentication on a TACACS+ Server

On most TACACS+ security servers, there are three ways to authenticate a user for login:

- Include a cleartext (DES) password for a user or for a group the user is a member of (each user can belong to only one group). Note that ARAP, CHAP, and global user authentication must be specified in cleartext.

  The following is the configuration for global authentication:

  ```
  user = spaulson {global = cleartext "spaulson global password"}
  ```

  To assign different passwords for ARAP, CHAP, and a normal login, you must enter a string for each user. Each string must specify the security protocols, state whether the password is cleartext, and specify if the authentication is performed via a DES card. The following example shows a user aaaa, who has authentication configured for ARAP, CHAP, and login. The user's ARAP and CHAP passwords, "arap password" and "chap password," are shown in cleartext. The login password has been encrypted.

  ```
  user = aaaa {arap  = cleartext "arap password"
         chap  = cleartext "chap password"
         login = des XQj4892fjk}
  ```

- Use password (5) files instead of entering the password into the configuration file directly.

  The default authentication is to deny authentication. You can change this at the top level of the configuration file to have the default user password (5) file, by issuing the following command:

  ```
  default authentication = /etc/passwd
  ```

- Authenticate using an s/key. If you have built and linked in an s/key library and compiled TACACS+ to use the s/key, you can specify that a user be authenticated via the s/key, as shown in the following example:

  ```
  user= bbbb {login = skey}
  ```

  On the access server, configure authentication on all lines including the vty and console lines by entering the following commands, beginning in privileged EXEC mode:

  ```
  5300# configure terminal
  5300(config)# aaa new-model
  5300(config)# aaa authentication login default tacacs+ enable
  ```

Caution When you enter the **aaa authentication login default tacacs+ enable** command, you are specifying that if your TACACS+ server fails to respond (because it is set up incorrectly), you can log in to the access server by using your enable password. If you do not have an enable password set on the access server, you will not be able to log in to it until you have a functioning TACACS+ daemon configured with usernames and passwords. The enable password in this case is a last-resort authentication method. You can also specify **none** as the last-resort method, which means that no authentication is required if all other methods failed.

Enabling AAA Globally on the Access Server

To use the AAA security facility in the Cisco IOS software, you must enter the **aaa new-model** command from global configuration mode.

When you enter the **aaa new-model** command, all lines on the access server receive the implicit **login authentication default** method list, and all interfaces with PPP enabled have an implicit **ppp authentication pap default** method list applied.

Caution If you intend to authenticate users via a security server, make sure you do not inadvertently lock yourself out of the access server ports after you enter the **aaa new-model** command. Enter line configuration mode and enter the **aaa authentication login default tacacs+ enable** global configuration command. This command specifies that if your TACACS+ (or RADIUS) server is not functioning properly, you can enter your enable password to log in to the access server. In general, make sure you have a last-resort access method before you are certain that your security server is set up and functioning properly. For more information about the **aaa authentication** command, refer to the next section "Defining Authentication Method Lists."

Note Cisco recommends that you use CHAP authentication with PPP, rather than PAP. CHAP passwords are encrypted when they cross the network, whereas PAP passwords are cleartext when they cross the network. The Cisco IOS software selects PAP as the default, so you must manually select CHAP. The process for specifying CHAP is described in the "Applying Authentication Method Lists" section, later in this chapter.

For example, enter the following commands to enable AAA in the Cisco IOS software:

```
5300# configure terminal
5300(config)# aaa new-model
```

Defining Authentication Method Lists

After you enable AAA globally on the access server, you need to define authentication method lists, which you then apply to lines and interfaces. These authentication method lists are security profiles that indicate the protocol (ARAP or PPP) or login and authentication method (TACACS+, RADIUS, or local authentication).

To define an authentication method list, follow these steps, which are described in detail in the next sections:

Step 1 Enter the **aaa authentication** command.

Step 2 Specify protocol (ARAP or PPP) or login authentication.

Step 3 Identify a list name or **default**. A list name is any alphanumeric string you choose. You assign different authentication methods to different named lists.

Step 4 Specify the authentication method. You can specify multiple methods, such as **tacacs+**, followed by **local** in case a TACACS+ server is not available on the network.

Step 5 Populate the local username database if you specified **local** as the authentication method (or one of the authentication methods). To use a local username database, you must enter the **username** global configuration command. Refer to the section "Populate the Local Username Database if Necessary," later in this chapter.

After defining these authentication method lists, apply them to one of the following:

- Lines—vty lines or the console port for login and asynchronous lines (in most cases) for ARA
- Interfaces—Interfaces (synchronous or asynchronous) configured for PPP

The section "Applying Authentication Method Lists" later in this chapter describes how to apply these lists.

Enter the aaa authentication Command

To define an authentication method list, start by entering the **aaa authentication** global configuration command, as shown in the following example:

```
5300# configure terminal
5300(config)# aaa authentication
```

Specify Protocol or Login Authentication

After you enter **aaa authentication**, you must specify one of the following dial-in protocols as applicable for your network:

- If you are enabling dial-in PPP access, specify **ppp**
- If you are enabling dial-in ARA access, specify **arap**
- If you are enabling users to connect to the EXEC facility, specify **login**

You can specify only one dial-in protocol per authentication method list. However, you can create multiple authentication method lists with each of these options. You must give each list a different name, as described in the next section "Identify a List Name."

If you specify the **ppp** option, the default authentication method for PPP is PAP. For greater security, specify CHAP. The full command is **aaa authentication ppp chap**. For example:

```
5300# configure terminal
5300(config)# aaa authentication ppp
```

If you specify the **arap** option, the authentication method built into ARA is used. The full command is **aaa authentication arap**.

Identify a List Name

A list name identifies each authentication list. You can choose either to use the keyword **default**, or choose any other name that describes the authentication list. For example, you might give it the name ppp-radius if you intend to apply it to interfaces configured for PPP and RADIUS authentication. The list name can be any alphanumeric string. The **default** method list is automatically applied to all lines and interfaces. Named method lists must be applied to specific lines or interfaces.

You can create different authentication method lists and apply them to lines and interfaces selectively. You can even create a named authentication method list that you do not apply to a line or interface, but which you intend to apply at some later point, such as when you deploy a new login method for users.

After you define a list name, you must identify additional security attributes (such as local authentication versus TACACS+ or RADIUS).

In the following example, the default authentication method list for PPP dial-in clients uses the local security database:

```
5300# configure terminal
5300(config)# aaa authentication ppp default
```

In the following example, the PPP authentication method list name is insecure:

```
5300# configure terminal
5300(config)# aaa authentication ppp insecure
```

In the following example, the ARA authentication method list name is callback (because asynchronous callback is used on the access server):

```
5300# configure terminal
5300(config)# aaa authentication arap callback
```

In the following example, the login authentication method list name is deveng:

```
5300# configure terminal
5300(config)# aaa authentication login deveng
```

Specify the Authentication Method

After you identify a list name, you must specify an authentication method. An authentication method identifies how users are authenticated. For example, will users be authenticated by a local security database resident on the access server (local method)? Will they be authenticated by a remote security database, such as by a TACACS+ or RADIUS daemon? Will guest access to an AppleTalk network be permitted?

Authentication methods are defined with optional keywords in the **aaa authentication** command. See Tables 4-5 and 4-6.

Table 4-5 Authentication Methods for PPP

Method	Description
if-needed	Authenticates only if not already authenticated. No duplicate authentication.
krb5	Specifies Kerberos 5 authentication.
local	Uses the local username database in the access server. This is defined with the **username** global configuration command.
none	No authentication is required. Do not prompt for a username or password.
radius	Use RADIUS authentication as defined on a RADIUS security server.
tacacs+	Use TACACS+ authentication as defined on a TACACS+ security server.

Timesaver If you are not sure whether you should use TACACS+ or RADIUS, here are some comparisons: TACACS+ encrypts the entire payload of packets passed across the network, whereas RADIUS only encrypts the password when it crosses the network. TACACS+ can query the security server multiple times, whereas a RADIUS server gives one response only and is therefore not as flexible regarding per-user authentication and authorization attempts. Moreover, RADIUS does not support authentication of ARA.

Table 4-6 Authentication Methods for ARA

Method	Description
auth-guest	Allows guests to log in only if they have already been authenticated at the EXEC.
guest	Allows guests to log in.
line	Uses the line (login) password for authentication.
local	Uses the local username database in the access server for authentication. This database is defined with the **username** global configuration command.
tacacs+	Use TACACS+ authentication as defined on a TACACS+ security server.

Note RADIUS does not support ARA. To authenticate Macintosh users with RADIUS, you must configure AppleTalk to run over PPP, which is referred to as ATCP.

You can specify multiple authentication methods for each authentication list. The following example authentication method list for PPP first queries a TACACS+ server, then a RADIUS server, then the local security database. Multiple authentication methods can be useful if you have multiple types of security servers on the network and one or more types of security servers do not respond:

```
5300(config)# aaa authentication ppp testbed tacacs+ radius local
```

If you specify more than one authentication method and the first method (TACACS+ in the previous example) is not available, the Cisco IOS software attempts to authenticate using the next method (such as RADIUS). If in the previous example, the RADIUS server has no information about the user, or if no RADIUS server can be found, the user is authenticated using the local username database that was populated with the **username** command.

However, if authentication *fails* using the first method listed, the Cisco IOS software does *not* permit access. It does not attempt to authenticate using the subsequent security methods if the user entered the incorrect password.

Populate the Local Username Database if Necessary

If you specify **local** as the security method, you must specify username profiles for each user who might log in. An example of specifying local authentication is as follows:

```
5300(config)# aaa authentication login deveng local
```

This command specifies that any time a user attempts to log in to a line on an access server, the Cisco IOS software checks the username database. To create a local username database, define username profiles using the **username** global configuration command.

The following example shows how to use the **username** command for a user cpatino with password n1vriti:

```
5300(config)# username cpatino password n1vriti
```

The **show running-config** command shows the encrypted version of the password, as follows:

```
5300# show running-config
Building configuration...

Current configuration:
!
version 11.1
! most of config omitted
username cpatino password 7 0215055500070C294D
```

Note The Cisco IOS software adds the encryption type of 7 automatically for passwords. If you were to manually enter the number 7 to represent an encryption type, you must follow the 7 with the *encrypted* version of the password. If you specify the number 7, then enter a cleartext password, the user will not have access to the line, interface, or the network the user is trying to access, and you must reconfigure the user's authentication profile.

Authentication Method List Examples

This section shows some examples of authentication lists.

Authentication Method List Examples for Users Logging in to the Access Server

The following example creates a local authentication list for users logging in to any line on the access server:

```
5300(config)# aaa authentication login default local
```

The following example specifies login authentication using RADIUS (the RADIUS daemon is polled for authentication profiles):

```
5300(config)# aaa authentication login default radius
```

The following example specifies login authentication using TACACS+ (the TACACS+ daemon is polled for authentication profiles):

```
5300(config)# aaa authentication login default tacacs+
```

Authentication List Examples for Dial-In Users Using ARA to Access Network Resources

The following example creates a local authentication list for Macintosh users dialing in to an AppleTalk network through the access server:

```
5300(config)# aaa authentication arap default local
```

The following example specifies that Macintosh users dialing in to an AppleTalk network through the access server be authenticated by a TACACS+ daemon:

```
5300(config)# aaa authentication arap default tacacs+
```

The following example creates an authentication method list that:

- Enables guest access if the guest has been authenticated at the EXEC facility
- Queries a TACACS+ daemon for authentication
- Polls the line (login) authentication password if the TACACS+ server has no information about the user or if no TACACS+ server on the network responds
- Uses the local security database if there is no line password

```
5300(config)# aaa authentication arap default auth-guest tacacs+ line local
```

Authentication Method List Examples for Users Dialing In Using PPP

The following example creates a TACACS+ authentication list for users connecting to interfaces configured for dial-in using PPP. The name of the list is marketing. This example specifies that a remote TACACS+ daemon be used as the security database. If this security database is not available, the Cisco IOS software then polls the RADIUS daemon. Users are not authenticated if they are already authenticated on a tty line.

```
5300(config)# aaa authentication ppp marketing if-needed tacacs+ radius
```

In this example, **default** can be substituted for **marketing** if the administrator wants this list to be the default list.

Applying Authentication Method Lists

As described in the “Defining Authentication Method Lists” section earlier in this chapter, the **aaa authentication** global configuration command creates authentication method lists or profiles. You apply these authentication method lists to lines or interfaces by issuing the **login authentication**, **arap authentication**, or **ppp authentication** command, as described in Table 4-7.

Table 4-7 Applying Authentication Method Lists

Interface and Line Command	Action	Port to which List is Applied	Corresponding Global Configuration Command
login authentication	Logs directly in to the access server	Console port or vty lines	aaa authentication login
arap authentication	Uses ARA to access AppleTalk network resources	tty line	aaa authentication arap
ppp authentication [1]	Uses PPP to access IP or IPX network resources	Interface	aaa authentication ppp

[1] If you entered the **ppp authentication** command, you must specify either CHAP or PAP authentication. PAP is enabled by default, but Cisco recommends that you use CHAP because CHAP is more secure. For more information, refer to the *Security Configuration Guide*.

You can create more than one authentication list or profile for login and protocol authentication and apply them to different lines or interfaces. The following examples show the line or interface authentication commands that correspond to the **aaa authentication** global configuration command.

Login Authentication Examples

The following example shows the default login authentication list applied to the console port and the default virtual terminal (vty) lines on the access server:

```
5300(config)# aaa authentication login default local
5300(config)# line console 0
5300(config-line)# login authentication default
5300(config-line)# line vty 0 4
5300(config-line)# login authentication default
```

In the following example, the login authentication list named rtp2-office, which uses RADIUS authentication, is created. It is applied to all 54 lines on a Cisco AS5300 access server configured with a dual T1 PRI card, including the console (CON) port, the 48 physical asynchronous (tty) lines, the auxiliary (AUX) port, and 5 virtual terminal (vty) lines:

```
5300(config)# aaa authentication login rtp2-office radius
5300(config)# line 0 54
5300(config-line)# login authentication rtp2-office
```

The following sample output shows lines and their status on the access server:

```
5300# sho line
Tty Typ     Tx/Rx     A Modem  Roty AccO AccI  Uses    Noise   Overruns
*  0 CTY               -    -      -    -    -     0        0        0/0
I  1 TTY  57600/57600  - inout     -    -    -     0        0        0/0
I  2 TTY  57600/57600  - inout     -    -    -     0        0        0/0
...
I 48 TTY  57600/57600  - inout     -    -    -     0        0        0/0
  49 AUX   9600/9600   -    -      -    -    -     0        0        0/0
  50 VTY               -    -      -    -    -     0        0        0/0
  51 VTY               -    -      -    -    -     0        0        0/0
  52 VTY               -    -      -    -    -     0        0        0/0
  53 VTY               -    -      -    -    -     0        0        0/0
  54 VTY               -    -      -    -    -     0        0        0/0
```

ARA Authentication Examples

In the following example, the ARA authentication list bldg-d-list is created, then applied to lines 1 through 48 (the physical asynchronous lines) on an access server:

```
5300(config)# aaa authentication arap bldg-d-list auth-guest tacacs+
5300(config)# line 1 48
5300(config-line)# arap authentication bldg-d-list
```

PPP Authentication Examples

The following example creates the PPP authentication list called marketing, which uses TACACS+, then RADIUS authentication. The marketing list requires authentication only if the user has not already been authenticated on another line. It is then applied to asynchronous lines 1 through 48 on an access server and uses CHAP authentication, instead of the default of PAP:

```
5300(config)# aaa authentication ppp marketing if-needed tacacs+ radius
5300(config)# line 1 48
5300(config-line)# ppp authentication chap marketing
Configuring Authorization
```

You can configure the access server to restrict user access to the network so that users can only perform certain functions after successful authentication. As with authentication, authorization can be used with either a local or remote security database. This guide describes only remote security server authorization.

A typical configuration probably uses the EXEC facility and network authorization. EXEC authorization restricts access to EXEC mode, and network authorization restricts access to network services, including PPP and ARA.

Authorization must be configured on both the access server and the security daemon. The default authorization is different on the access server and the security server:

- By default, the access server *permits* access for every user until you configure the access server to make authorization requests to the daemon.
- By default, the daemon *denies* authorization of anything that is not explicitly permitted. Therefore, you have to explicitly allow all per-user attributes on the security server.

Timesaver If authentication has not been set up for a user, per-user authorization attributes are not enabled for that user. That is, if you want a user to obtain authorization before gaining access to network resources, you must first require that the user provide authentication. For example, if you want to specify the **aaa authorization network tacacs+** (or **radius**) command, you must first specify the **aaa authentication** {**ppp** | **arap**} **default if-needed tacacs+** (or **radius**) command.

Configuring Authorization

You typically have three methods for configuring default authorization on the security server:

1. To override the default denial or authorization from a non-existent user, specify authorization at the top level of the configuration file:

   ```
   default authorization = permit
   ```

2. At the user level, inside the braces of the user declaration, the default for a user who does not have a service or command explicitly authorized is to deny that service or command. To permit it:

   ```
   default service = permit
   ```

3. At the service authorization level, arguments are processed according to the following algorithm; for each attribute-value (AV) pair sent from the access server, the following process occurs:

   (a) If the AV pair from the access server is mandatory, look for an exact match in the daemon's mandatory list. If found, add the AV pair to the output

   (b) If an exact match does not exist, look in the daemon's optional list for the first attribute match. If found, add the access server AV pair to the output

   (c) If no attribute match exists, deny the command if the default is to deny, or if the default is permit, add the access server AV pair to the output

   (d) If the AV pair from the access server is optional, look for an exact AV match in the mandatory list. If found, add the daemon's AV pair to the output

   (e) If not found, look for the first attribute match in the mandatory list. If found, add the daemon's AV pair to the output

   (f) If no mandatory match exists, look for an exact AV pair match among the daemon's optional AV pairs. If found, add the daemon's matching AV pair to the output.

   (g) If no exact match exists, locate the first attribute match among the daemon's optional AV pairs. If found, add the daemon's matching AV pair to the output.

   (h) If no match is found, delete the AV pair if the default is to deny, or if the default is permit, add the access server AV pair to the output.

   (i) If there is no attribute match already in the output list after all AV pairs have been processed for each mandatory daemon AV pair, add the AV pair (add only one AV pair for each mandatory attribute).

Configuring Authorization on the Access Server

To specify network authorization (preventing unauthorized users from accessing network resources) enter the **aaa authorization network** command. To restrict users from logging into the EXEC facility, enter the **aaa authorization exec** command. For example:

```
5300(config)# aaa authorization network
5300(config)# aaa authorization exec
```

Note You can also require authorization before a user can enter specific commands by using the **aaa authorization** command. For more information, refer to the *Security Configuration Guide*, available online at
http://www.cisco.com/univercd/cc/td/doc/product/software/ios113ed/113ed_cr/secur_c/

Specifying the Authorization Method

Authorization methods are defined as optional keywords in the **aaa authorization** command. You can specify any of the authorization methods listed in Table 4-8 for both network and EXEC authorization.

Table 4-8 AAA Authorization Method

Method	Description
if-authenticated	User is authorized if already authenticated.
none	Authorization always succeeds.
local	Uses the local database for authorization. The local database is created using the **username privilege** command to assign users to a privilege level from 0 to 15 and the **privilege level** command to assign commands to these different levels.
radius	Uses RADIUS authorization as defined on a RADIUS server.
tacacs+	Uses TACACS+ authorization as defined on a TACACS+ server.

Specifying Authorization Parameters on a TACACS+ Server

When you configure authorization, you must ensure that the parameters established on the access server correspond with those set on the TACACS+ server.

Authorization Examples

The following example uses a TACACS+ server to authorize the use of network services, including PPP and ARA. If the TACACS+ server is not available or has no information about a user, no authorization is performed and the user can use all network services:

```
5300(config)# aaa authorization network tacacs+ none
```

The following example permits the user to run the EXEC process if the user is already authenticated. If the user is not already authenticated, the Cisco IOS software defers to a RADIUS server for authorization information:

```
5300(config)# aaa authorization exec if-authenticated radius
```

The following example configures network authorization. If the TACACS+ server does not respond or has no information about the username being authorized, the RADIUS server is polled for authorization information for the user. If the RADIUS server does not respond, the user still can access all network resources without authorization requirements.

```
5300(config)# aaa authorization network tacacs+ radius none
```

Security Examples

This series of examples shows complete security configuration components of a configuration file on an access server. Each of these examples shows authentication and authorization.

Simple Local Security Example

This sample configuration uses AAA to configure default authentication using a local security database on an access server. All lines and interfaces have the default authentication lists applied. Users aaaa, bbbb, and cccc have been assigned privilege level 7, which prevents them from issuing the **ppp, arap**, and **slip** commands, because these commands have been assigned to privilege level 8.

```
aaa new-model
aaa authentication login default local
aaa authentication arap default local
aaa authentication ppp default local
aaa authorization exec local
aaa authorization network local
aaa authorization
!
username aaaa privilege exec level 7 privilege network level 8 password 7 095E470B1110
username bbbb privilege network level 7 password 7 0215055500070C294D
username cccc privilege network level 7 password 7 095E4F10140A1916
!
privilege exec level 8 ppp
privilege exec level 8 arap
privilege exec level 8 slip

line console 0
 login authentication default
!
line 1 48
 arap authentication default
!
interface Group-Async1
 ppp authentication chap default
 group-range 1 48
```

With this configuration, the sign-on dialog from a remote PC appears as follows:

```
atdt5551234
CONNECT 14400/ARQ/V32/LAPM/V42BIS
User Access Verification
Username: aaaa
Password: <password>
5300> enable
Password: <password>
5300#
```

TACACS+ Security Example for Login, PPP, and ARA

The following example shows how to create and apply authentication lists:

- A TACACS+ server named maui is polled for authentication information (so you do not need to define a local username database). The shared key between the access server and the TACACS+ security server is shepard4.
- A login authentication list named rtp2-office is created, then applied to the console port.

- A PPP authentication list named marketing is created, then applied to group async interface 0, which includes asynchronous interfaces 1 to 48.
- An ARA list named kona-coast-office is created and applied to lines 1 to 48.

Note The authentication method lists used in this example use names other than default. However, you generally specify **default** as the list name for most lines and interfaces, and apply different named lists on an exception basis. These names are used only for illustrative purposes.

```
hostname 5300
!
tacacs-server host maui
tacacs-server key shepard4
!
aaa authentication login rtp2-office tacacs+
aaa authentication ppp marketing if-needed tacacs+
aaa authentication arap kona-coast-office tacacs+
!
line console0
 login authentication rtp2-office
!
interface group-async0
 ppp authentication chap marketing
 group-range 1 48
!
line 1 48
 arap authentication kona-coast-office RADIUS Example for Login and PPP
```

The following example shows how to create authentication lists:

- A RADIUS server named server219 is polled for authentication information (so you do not need to define a local username database). The shared key between the access server and the RADIUS security server is BaBe218.
- A login authentication list named fly is created, then applied to all lines that users can log in to, except the console port. In this example, the console port is physically secure and does not need password protection. The access server is locked in a closet and secured behind a deadbolt lock.
- A PPP authentication list named maaaa is created, then applied to group async interface 658, which includes asynchronous interfaces 1 to 48. CHAP authentication is used because it is more secure than PAP.

```
radius-server host server219
radius-server key BaBe218
!
privilege exec level 14 configure
privilege exec level 14 reload
privilege exec level 8 arap
privilege exec level 8 ppp
!
aaa authentication login fly radius
aaa authentication ppp maaaa if-needed radius
aaa authorization network radius
aaa authorization exec radius
!
line 1 54
 login authentication fly
!
interface group-async658
 ppp authentication chap maaaa
 group-range 1 48
```

Managing Modems

The Cisco AS5300 universal access servers support MICA or Microcom modem carrier cards. For details on the carrier cards, refer to the *Cisco AS5300 Universal Access Server Chassis Installation Guide* and *Cisco AS5300 Universal Access Server Module Installation Guide*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/hw_inst/index.htm

You can manage your modems using monitoring, polling, and troubleshooting commands. For both Microcom and MICA modems, most of the modem management functions are identical. This appendix discusses procedures and commands common to both types of modems and procedures and commands that apply to only one type of modem. Sections or commands that apply to only one type of modem are clearly indicated.

This appendix includes the following sections:

- Monitoring Modems
- Managing Modems
- Polling Modems
- Troubleshooting Modems
- Upgrading Modem Code

Monitoring Modems

This section describes how to send AT commands to MICA and Microcom modems.

For a list and description of AT commands, refer to the following:

- *AT Command Set and Register Summary for MICA Six-Port Modules* or *AT Command Set*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/sw_conf/sw_ports/at_set/index.htm
- *Register Summary for V.34 and 56K 12-Port Modules* publications, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/sw_conf/sw_ports/at_set/atcmnds1.htm

Configuring Microcom Modems for Monitoring

To monitor Microcom (V.34 and 56K) modems you must perform two main configuration tasks:

- Configure a modem to permit a direct-connect session
- Establish the session

Table A-1 describes all the steps necessary to enter AT command mode on the access server.

Table A-1 Entering AT Command Mode for Microcom Modems

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode (also called privileged EXEC mode).
		Enter the password.
		You have entered enable mode when the `5300#` prompt appears.

2	`5300#` **`configure terminal`**
	`Enter configuration commands, one per line. End with CNTL/Z.`
	`5300(config)#`
		Enter global configuration mode.You have entered global configuration mode when the `5300(config)#` prompt appears.

3	`5300(config)#` **`line 1`**
	`5300(config-line)#`
		Enter line configuration mode. In this example, line 1 is specified. You have entered line configuration mode when the `5300(config-line)#` prompt appears.

4	`5300(config-line)#` **`modem at-mode-permit`**	Configure a Microcom modem to permit a direct-connect session.

5	`5300(config-if)#` **`end`**
	`5300#`
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to enable mode.
		This message is normal and does not indicate an error.

Table A-1 Entering AT Command Mode for Microcom Modems (Continued)

Step	Command	Purpose
6	5300# **modem at-mode 1/1** You are now entering AT command mode on modem (slot 1 / port 1). Please type CTRL-C to exit AT command mode.	Enter a direct-connect session with a TA[1]. In this example, a direct connect session is established with the TA in slot 1, port 1. Enter the TA slot number first, followed by the TA port number. Now you are in AT command mode and can enter the AT commands described in this document.
7	**Ctrl-C** 5300#	When done entering AT commands, press **Ctrl-C** to return to enable mode.

[1] TA = Terminal Adapter.

Configuring MICA Modems for Monitoring

To send AT commands to a MICA modem involves a reverse Telnet procedure. Table A-2 shows how to enter AT command mode from enable mode (also called privileged EXEC) using reverse Telnet.

Note MICA modems do not support the **modem at-mode** commands available in Cisco IOS line configuration mode.

Table A-2 Entering AT Command Mode for MICA Modems

Step	Command	Purpose
1	5300> **telnet ip-address line#**	Open a reverse Telnet connection to the modem. In the command shown here, **ip-address** is the IP address of the access server and **line#** is the two-digit line number of the modem, prefixed by 20. (For example, enter **telnet 172.0.0.1 2001** if the IP address is 172.0.0.1 and the modem line number is 1.) If you do not know which line number to use, enter the **show line** command and check the resulting display for tty numbers that have `inout` in the Modem column.
	Trying 172.0.0.1, 2001 ... Open	The Telnet connection is open when the word **Open** appears.
2	at OK	There is no command prompt in AT command mode. To confirm that you are able to enter AT commands, type **at** and press **Return**. If you are in AT command mode, the modem returns `OK`.

Table A-2 Entering AT Command Mode for MICA Modems (Continued)

Step	Command	Purpose
3	`Ctrl-Shift-6 X`	To exit AT command mode and return to enable mode, enter **Ctrl-Sh-6 X** (hold down the **Control** and **Shift** keys and press **6**, then release everything and press **X**).
	`5300# disconnect`	Enter **disconnect** to end the Telnet connection.

Modem Performance Statistics Commands

You can view modem statistics and configure modem events using the Cisco IOS software with the Cisco AS5300 access server. To view performance statistics for the Microcom and MICA modems, enter one or more of the following commands in enable mode (the prompt is displayed as `5300#`):

- **show modem** [*slot/modem* | **group** *number*]—Show various performance statistics for a modem or group of modems.
- **show modem at-mode**—Display all directly connected AT sessions active on the access server. This command applies to Microcom modems only.
- **show modem call-stats**—Display the calling statistics for all the modems in the system.
- **show modem mapping**—List all Cisco IOS software and modem code files (bundled and unbundled) and their versions in the system Flash memory. This will help you decide if you need to update your modem code files.
- **show modem configuration** [*slot/modem-port* | **group** *number*]—Display the modem configuration for a single or group of modems. This command applies to MICA modems only.
- **show modem connect-speeds**—Display the connection speeds for all the modems in the system.
- **show modem csm** [*slot/modem-port* | **group** *number*]—Show the call-switching module status for a single or group of modems.
- **show modem group**—Display group information for the modems.
- **show modem log** [*slot/modem-port* | **group** *number*]—Show the event log status for a modem or group of modems. This command applies to Microcom modems only.
- **show modem operational-status** [*slot/modem* | **group** *number*]—Display the operational status for all the modems in the system. This command applies to MICA modems only.
- **show modem summary**—Display the cumulative system statistics for all installed modems.
- **show modem test**—Display the modem test log, which is the result of the modem configuration command.
- **show modem version**—Display version information for all the modems in the system.

To view additional performance statistics for MICA modems only, enter one or more of the following commands in EXEC mode:

- **show modem mica slot**—Show information for all installed MICA boards.
- **show modem mica slot** *number*—Show information about a specific MICA board.
- **show modem mica** [*slot/modem-port*]—Show information for a specific modem on a specific slot.

- **show modem mica all**—Show information for all installed modems including the pseudo channels.

Note The first three channels displayed for each board are the DC session (#60), status polling (#61), and the control (#62) channel.

Managing Modems

This section describes how to manage modems by checking the type of modem connected to the access server, removing inoperable modems from service, and disabling a modem from dial-up service. For details on disabling a modem from dial-up services, see the section, "Troubleshooting Modems," later in this appendix.

Check Modem Type

To check the type of modem connected to the access server and to configure the modem automatically, enter the following command in global configuration mode [the prompt is displayed as `5300(config)#`]:

- **modem autoconfigure discovery**—Check the modem type and configure the modem automatically.

The modem is identified each time the line is reset. If a modem cannot be detected, the line continues retrying for 10 seconds. When the modem type is determined, this information remains stored until the modem is recycled or disconnected. Discovery mode is much slower than configuring a line directly.

Each time the modem is reset (every time a chat reset script is executed), a string of commands is sent to the modem, the first one being "return to factory-defaults."

Set Modem Event Buffer

This section applies to Microcom modems only. To configure the size of the history event queue buffer for manageable modems in the access server, enter the following command in global configuration mode [the prompt is displayed as `5300(config)#`]:

- **modem buffer-size** *number*—Define the number of modem events that each modem is able to store. The default is 100 events per modem.

Note Use the **show modem log** command to view modem events.

Remove Inoperable Modems from Service

To remove modems from service and indicate them as suspected or proven to be inoperable, enter the following command in line configuration mode [the prompt is displayed as `5300(config-line)#`]:

- **modem bad**—Specify a modem as inoperable.

If you mark a *single* modem as inoperable using this command, it appears as *Bad*—without the asterisk (*)—in the *Status* column of the **show modem** command's output for that particular modem. A modem marked inoperable by the **modem startup-test** command appears as *Bad** in the **show modem** command output for that particular modem. Use the **no modem bad** command to unmark a modem as *Bad** or *Bad* and restore it for dial-up connection services.

Polling Modems

This section describes polling modems for statistics, including setting the time interval between polls and the maximum number of polling attempts.

Set Polling Attempts

To set the maximum number of polling attempts used to retrieve a local modem's status or statistics, enter the following command in global configuration mode [the prompt is displayed as `5300(config)#`]:

- **modem poll retry** *number*—Set maximum number of polling attempts. The default is three polling attempts. The configuration range is from 0 to 10 attempts.

If the number of attempts to retrieve modem status or statistics exceeds the *number* you define, the out-of-band port is removed from operation. In this case, you must reset the modem hardware using the **clear modem** command.

Set Time Interval between Polls

To set the time interval between the polls that are sent to the local modems for reporting modem status and statistics, enter the following command in global configuration mode [the prompt is displayed as `5300(config)#`]:

- **modem poll time** *seconds*—Specify the number of seconds between polls. The default is 12 seconds. The configuration range is from 2 to 120 seconds.

Poll for Modem Statistics

To poll for a modem's status and statistics through its out-of-band port, enter the following command in line configuration mode [the prompt is displayed as `5300(config-line)#`]:

- **modem status-poll**—Poll for a modem's status and statistics.

The **no modem status-poll** command disables status polling through the out-of-band port for a specified modem.

Troubleshooting Modems

This section describes how to perform diagnostic testing on installed modems, test two modems back-to-back, disable modems from service, reset a modem, and debug a modem.

Perform a Modem Startup Test

To perform diagnostic testing on all the installed modems during the system's initial startup or rebooting process, enter the following command in global configuration mode [the prompt is displayed as `5300(config)#`]:

- **modem startup-test**—Perform diagnostic testing for all modems.

The results of the modem startup test are displayed in the *Status* column of the **show modem** command's output. Modems that pass the diagnostic test are marked as *Idle*, *Busy*, *Downloading*, and *Reset*. Modems that fail the diagnostic test are marked as *Bad**. These modems cannot be used for call connections. Depending on how many modems are installed, this diagnostic test may take from 5 to 15 minutes to complete. Perform additional testing on an inoperative modem by executing the **test modem back-to-back** command. The **no modem startup-test** command disables startup testing.

Test Two Modems Back-to-Back

Perform additional testing on a modem suspected of being inoperable by conducting a series of internal back-to-back connections and data transfers between two modems. All modem test connections occur inside the access server. For example, if mobile users cannot dial into modem 2/5 (which is the sixth modem port on the modem board in the second chassis slot), attempt a back-to-back test with modem 2/5 and a known-functioning modem such as modem 2/6.

Enter the following command in enable mode (the prompt is displayed as `5300#`) to perform internal back-to-back modem tests between two modems:

- **test modem back-to-back** *first-slot*/*modem-number second-slot*/*modem-number*—Perform internal back-to-back modem tests between two modems.

You might need to enable this command on several different combinations of modems to determine which one is not functioning properly. A pair of operable modems successfully connect and complete transmitting data in both directions. An operable modem and an inoperable modem do not successfully connect with each other.

Hold and Reset a Modem

This section applies to Microcom modems only. To reset and isolate the modem hardware for extensive troubleshooting, enter the following command in line configuration mode [the prompt is displayed as `5300(config-line)#`]:

- **modem hold-reset**—Reset and isolate the modem hardware.

Use this command if you are experiencing extreme modem behavior (for example, if the modem is uncontrollably dialing into the network). This command prevents the modem from establishing software relationships such as those created by the **test back-to-back modem** command and the **modem startup-test** command. The modem is unusable while the **modem hold-reset** command is configured.

This command is also used to reset a modem that is frozen in a suspended state. Disable the suspended modem with the **modem hold-reset** command, and then restart hardware initialization with the **no modem hold-reset** command. A modem decommissioned by the **modem hold-reset** command does not accept modem firmware upgrades using the **copy modem** command.

Disable a Modem from Dial-Up Services

To disable modems from dialing or answering calls, enter one of the following commands in line configuration mode [the prompt is displayed as `5300(config-line)#`]:

- **modem busyout**—Gracefully disable a modem from dial-up services.
- **modem shutdown**—Abruptly shut down a modem from dial-up services.

The **modem busyout** command is not executed until the active modem is idle. No active connections are interrupted when you use this command. In contrast, the **modem shutdown** command immediately terminates all active connections on the specified modem. The resulting modem status for both these commands is the same. Enable the **no** form of these commands to restore a modem for dial-up services.

You can still configure the following commands on a disabled modem:

- **test modem back-to-back**
- **clear modem**
- **modem bad**
- **copy modem**

Debug a Modem

To debug a modem or group of modems, enter the following commands in enable mode (the prompt is displayed as `5300#`):

- **debug modem oob** [*slot/modem-port* | **group** *group-number*]—Debug a modem’s out-of-band port, which is used to poll modem events.
- **debug modem csm** [*slot/modem-port* | **group** *group-number*]—Debug a call-switching module, which is used to connect calls.
- **debug modem trace** [**normal** | **abnormal** | **all**] [*slot/modem-port* | **group** *group-number*]—Debug the call trace, which determines why calls are terminated. Use this keyword only with manageable modems. Upload the call trace on **normal**, **abnormal**, or **all** call terminations.

Upgrading Modem Code

Modem code is a generic term applied to a modem code file, which is also called modem code for MICA modems and firmware for Microcom modems.

With new systems, Cisco loads a Cisco IOS software-compatible version of modem code and copies the version to the installed modem modules. A map of the version(s) of modem code copied to the modem RAM for each modem module is stored in nonvolatile random-access memory (NVRAM) so that it is retained over power cycles.

Note You do not have to take any action to use the pre-installed version of modem code with new systems.

You can acquire new modem code in several ways:

- Cisco periodically releases new modem code versions (with bug fixes or new modem features) that improve your system's overall modem performance.
- Cisco also might ship modem code on diskette with spare boards or offer modem code for purchase with spare boards.
- Modem code is also available on the Cisco Software Center.

This section describes how to upgrade modem code on your access server modems by:

1. Understanding the modem code scenarios possible for your access server.
2. Choosing an upgrade strategy.
3. Finding out the modem code version installed on your access server.
4. Upgrading the modem code.

Caution Cisco ships the access server with the latest version of modem code installed in the system Flash memory and mapped to the modems. If you choose to use the modem code bundled with your installed Cisco IOS software, you could be reverting to a previous version of modem code. Also note that once you map the bundled modem code (using the **copy system:/ucode/***filename* **modem** command or, for Cisco IOS releases earlier than 11.3A or 12.0, the **copy ios-bundled modem** command) to your modems, each time you upgrade the Cisco IOS software, the new bundled modem code is automatically mapped to your modems. See "Displaying Modem Code Versions," later in this appendix, for details on displaying modem code versions mapped to modems, installed in system Flash memory, and bundled with the Cisco IOS software on your access server.

How to Obtain Modem Code

You can obtain modem code in one of two ways:

- **Bundled** in regular Cisco IOS releases. See "Using the Modem Code Bundled with Cisco IOS Software" for details.
- **Unbundled** from Cisco Connection Online (CCO) or supplied on diskette. This can be either a more up-to-date version of modem code released before the next Cisco IOS release (when the modem code will be bundled with the Cisco IOS release), or a special version of modem code shipped with a new board. See "Upgrading Modem Code from the Cisco CCO TFTP Server" and "Upgrading Modem Code from Diskettes" for details.

Note You must be a registered Cisco user to log into Cisco Connection Online (CCO).

Important Modem Upgrade Commands

There are several commands you use to upgrade modem code. For examples on using the commands, see "Upgrading Modem Code from the Cisco CCO TFTP Server," "Upgrading Modem Code from Diskettes," and "Using the Modem Code Bundled with Cisco IOS Software," later in this appendix for details.

- Use the **copy tftp flash** *filename* command to copy any version of modem code (no matter how it is obtained) into system Flash memory. You can store several versions of the modem code in system Flash memory under different filenames.
- Use the **copy flash modem** command to transfer a specified version (*filename*) of modem code from system Flash memory to the modem RAM and map that version to the modem modules (slots/ports) specified in response to the modem range query.
- Use the **copy system:/ucode/***filename* **modem** command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command) to transfer the version of modem code bundled with the Cisco IOS software release to the modem RAM and map that version to the modem modules (slots/ports) specified in response to the modem range query. To view a list of microcode filenames, use the command **dir system:/ucode**.

Choosing an Update Strategy

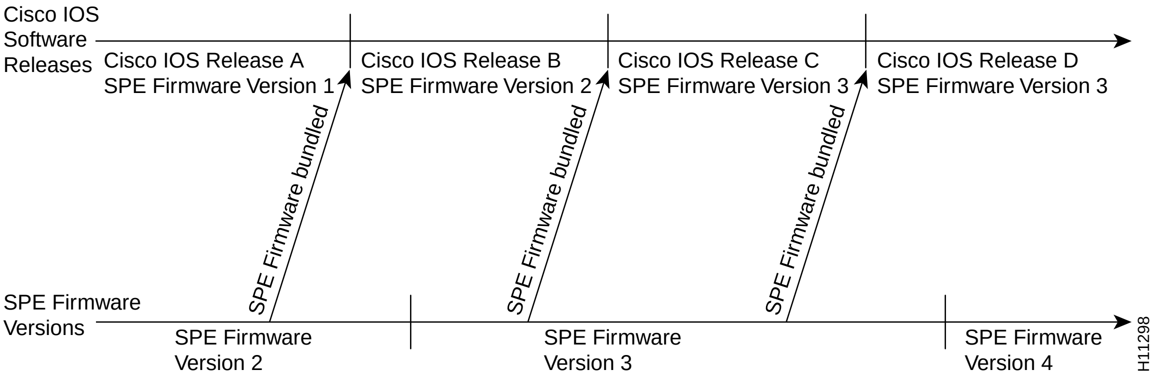
Because of multiple versions of modem code and the way Cisco IOS software processes these versions, Cisco suggests that you choose one of the following two strategies:

- Always allow Cisco IOS software to select the version of modem code.
- Always control the version of modem code used by the modules, independent of Cisco IOS software selections.

Caution Cisco ships the access server with the latest version of modem code installed in the system Flash memory and mapped to the modems. If you choose to use the modem code bundled with your installed Cisco IOS software, you could be reverting to a previous version of modem code. Also note that once you map the bundled modem code (using the **copy system:/ucode** command or, for releases earlier than Cisco IOS release 11.3AA or 12.0, the **copy ios-bundled modem** command) to your modems, each time you upgrade the Cisco IOS software, the new bundled modem code is automatically mapped to your modems. See "Displaying Modem Code Versions," later in this appendix, for details on displaying modem code versions mapped to modems, installed in system Flash memory, and bundled with the Cisco IOS software on your access server.

To help with the decision, Figure A-1 shows a hypothetical release process. Using the modem code bundled with Cisco IOS software is the easier strategy and enables you to take advantage of new modem code whenever you upgrade your Cisco IOS software. You can control the modem code by using the **copy** command as discussed later.

Figure A-1 Release Timeline for Cisco IOS Software and Modem Code


Cisco IOS Software Releases
Cisco IOS Release A SPE Firmware Version 1
Cisco IOS Release B SPE Firmware Version 2
Cisco IOS Release C SPE Firmware Version 3
Cisco IOS Release D SPE Firmware Version 3
SPE Firmware bundled
SPE Firmware bundled
SPE Firmware bundled
SPE Firmware Versions
SPE Firmware Version 2
SPE Firmware Version 3
SPE Firmware Version 4
H11298

Modem Code Scenarios

Table A-3 provides scenarios that can occur when you upgrade Cisco IOS software or modem code.

Table A-3 Modem Code Scenarios—Cisco IOS Software or Modem Code Upgrades

No.	Scenario	Update Process
1	You receive a new access server from the Cisco factory.	• No action needed. The factory loads and maps a compatible version of modem code.[1]
2	You update Cisco IOS software, and you decide to use the version of modem code selected by Cisco IOS software.	• Update Cisco IOS software. • No further action needed—Cisco IOS software automatically downloads either its bundled version or a mapped version from system Flash memory.[2]
3	You update Cisco IOS software, and you decide *not* to use the modem code selected by Cisco IOS software.	• Update Cisco IOS software. • Copy the desired version of modem code file to system Flash memory, then copy that file to the integrated modems on the 6-port module. See "Copy the Modem Code from Your PC to the Modems," later in this appendix, for details.
4	The modems are running a version of modem code from system Flash memory that is different than the version bundled with Cisco IOS software. You decide to revert to the bundled version.	• Use the Cisco IOS command **copy system:/ucode/***filename* **modem**. (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command). Note that once you map the bundled modem code to your modems, each time you upgrade the Cisco IOS software, the new bundled modem code is automatically mapped to your modems. See "Using the Modem Code Bundled with Cisco IOS Software," later in this appendix, for details.
5	Cisco releases new modem code, which is a later version than the version currently running on the modems. You decide to use Cisco's newest modem code.[3]	• Copy the desired version of modem code file to system Flash memory, then copy that file to the integrated modems. See "Copy the Modem Code File from Local TFTP Server to Modems," later in this appendix, for details.

[1] To find out the version of modem in your system, use the **show modem mapping** command. This command displays the versions bundled with Cisco IOS software (copied into Flash memory) and running on the modems.

[2] In part, Cisco IOS software bases this decision on the last **copy** command issued. For more details about *mapping*, see Table A-5.

[3] Cisco might ship this modem code on a diskette packed with the spare carrier card.

Figure A-2 shows a location on the release timeline where updates might take place, and Table A-4 explains the resulting versions of Cisco IOS software and modem code.

Figure A-2 Release Timeline for Cisco IOS Software and Modem Code

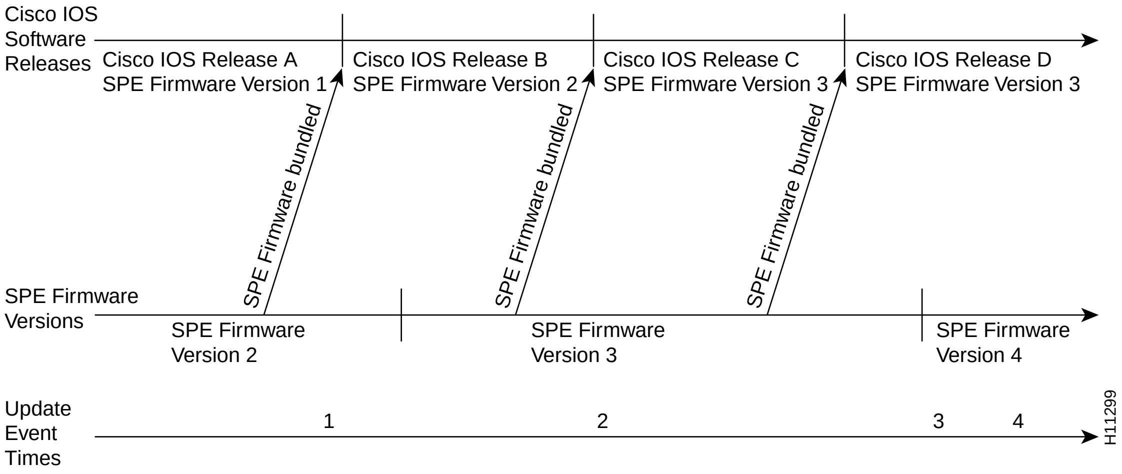


Table A-4 Resulting Versions of Cisco IOS Software and Modem Code

Update Event Time	Update Event	Resulting Version of Cisco IOS Software and Modem Code
1	You upgrade Cisco IOS software to Release B.	
	• If there is no previous **copy** command (Cisco IOS software uses the bundled version).	• Cisco IOS Release B Modem Code Version 2
	• If invalid mapping (Cisco IOS software uses the bundled version).	• Cisco IOS Release B Modem Code Version 2
	• If last copy command was **copy system:/ucode/***filename* **modem** or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command (Cisco IOS software uses the bundled version).	• Cisco IOS Release B Modem Code Version 2
	• If last copy command was **copy flash modem** and Modem Code Version 1 was specified.	• Cisco IOS Release B Modem Code Version 1
2	You upgrade Cisco IOS software to Release C. (Cisco IOS software uses mapping from last **copy** command at Time 1).[1]	Cisco IOS Release C Modem Code Version 1
	You enter the **copy system:/ucode/***filename* **modem** command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command).	Cisco IOS Release C Modem Code Version 3
3	New Modem Code Version 4 is released, you copy the file to system Flash memory, enter **copy flash modem,** and specify Modem Code Version 4.	Cisco IOS Release C Modem Code Version 4
4	You upgrade Cisco IOS software to Release D.	Cisco IOS Release D Modem Code Version 4
	You enter the **copy system:/ucode/***filename* **modem** command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command).	Cisco IOS Release D Modem Code Version 3

[1] This example assumes the last copy command was **copy flash modem**, and Modem Code Version 1 was specified.

Table A-5 provides a list of terms and commands and a description of how they are used in the modem code update process.

Table A-5 Modem Code Terminology

Terms	Description
Modem code	Modem code on the MICA modems resides in and runs out of modem RAM. Cisco IOS software transfers a version of modem code to modem RAM on each reboot and reload. System Flash memory can contain several versions of modem code: a version bundled with Cisco IOS software and multiple versions that resulted from previous **copy tftp flash** commands.
copy system:/ucode/*filename* command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command)	This command transfers the version of modem code bundled with Cisco IOS software to the modem RAM and maps that version to the modem modules specified by the modem range. To view a list of microcode filenames, use the command **dir system:/ucode**. This command does not affect any existing versions of modem code that reside in system Flash memory. After one **copy system:/ucode/***filename* **modem** command, future Cisco IOS upgrades will potentially result in the downloading of new Cisco IOS bundled firmware to the modems. (If the new Cisco IOS image contains the same modem code as the old one, no new code will be downloaded to the modems.)
copy tftp flash *filename* command	Places a copy of the modem code in system Flash memory.
copy flash modem command	This command transfers the version of modem code in system Flash memory to the modem RAM and maps that version to the modem modules specified by the modem range.
Mapping commands	The copy commands map a specific version of modem code to a group of modem slots/ports. The **copy system:/ucode/***filename* **modem** command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command) maps the slots/ports to the bundled version, and the **copy flash modem** command maps the slots/ports to the system Flash version. Cisco IOS software uses the mapping to determine which version of modem code should be downloaded to the modems. If Cisco IOS software finds no mapping or invalid mapping, it downloads the bundled version. Although modem ranges are specified on as slot/port, the modem code is downloaded on a per module basis. The **show modem mapping** command lists all versions of modem code running on the modem modules, residing in system Flash, and bundled with Cisco IOS software. This will help you decide if you need to update your modem code files.[1]

[1] This command is supported in Cisco IOS Releases 11.2(11)P, 11.3(2)T, and later.

Displaying Modem Code Versions

Use the **show modem mapping** command to list the versions of modem code running on the modem modules, residing in system Flash memory, and bundled with Cisco IOS software. This will help you decide if you need to change the version running on the modems.

```
5300# show modem mapping

Slot 1 has Mica Carrier card.


        Modem      Firmware   Firmware
Module  Numbers    Rev        Filename
  0   1/0  - 1/5   2.2.3.0    flash:mica-modem-portware.2.2.3.0.bin
  1   1/6  - 1/11  2.2.3.0    mica-modem-portware.2.2.3.0.bin
  2   1/12 - 1/17  2.2.3.0    mica-modem-portware.2.2.3.0.bin
  3   1/18 - 1/23  2.2.3.0    mica-modem-portware.2.2.3.0.bin
  4   1/24 - 1/29  2.2.3.0    mica-modem-portware.2.2.3.0.bin

Slot 2 has Mica Carrier card.


        Modem      Firmware   Firmware
Module  Numbers    Rev        Filename
  0   2/0  - 2/5   2.2.3.0    flash:1:mica-modem-portware.2.2.3.0.bin
  1   2/6  - 2/11  2.2.3.0    mica-modem-portware.2.2.3.0.bin
  2   2/12 - 2/17  2.2.3.0    mica-modem-portware.2.2.3.0.bin
  4   2/24 - 2/29  2.2.3.0    mica-modem-portware.2.2.3.0.bin

IOS Bundled Firmware Information:

Mica Boardware Version : 1.0.0.0
Mica Portware Version : 2.0.1.7
Microcom Firmware Version : 3.1.30
Microcom DSP Software Version : 1.01


Firmware files on System Flash:

Firmware-file                              Version  Firmware-Type
=============                              =======  =============
flash:1:mica-modem-portware.2.2.3.0.bin    2.3.0    Mica Portware
flash:2:mcom-modem-firmware.3.1.30.bin     3.1.30   Microcom Firmware
```

Upgrading Modem Code from the Cisco CCO TFTP Server

Upgrading modem code from the Cisco CCO TFTP server is a two-step process:

- Downloading the modem code from Cisco CCO TFTP server to a local TFTP server
- Copying the modem code file to the access server and modems

Note Cisco IOS software contains bundled modem code, which might differ from the version of modem code you download. For more information about how Cisco IOS software processes multiple modem code versions, refer to the earlier sections “Choosing an Update Strategy” and “Modem Code Scenarios.”

Download Modem Code from the Cisco CCO TFTP Server to a Local TFTP Server

Note You must be a registered Cisco user to log in to Cisco’s Software Center.

You can download software from the Cisco Systems CCO TFTP server using an Internet browser or using an FTP application. Both procedures are described.

Note To download modem code from CCO to a PC and then upgrade the modem code to an access server connected to your PC via an Ethernet hub, you need to set up a TFTP application on your PC, establish a HyperTerminal session, and make sure your PC and access server are correctly connected and talking before downloading the modem code from CCO. All these procedures are described in "Upgrading Modem Code from Diskettes," later in this appendix.

Using an Internet Browser

Step 1 Launch an Internet browser.

Step 2 Bring up Cisco's Software Center home page at following URL (this is subject to change without notice):

http://www.cisco.com/kobayashi/sw-center/

Step 3 Click **Access Products** (under **Cisco Software Products**) to open the **Access Products** window.

Step 4 Click **Cisco AS5300 Series Software**.

Step 5 Click the modem code you want and download it to your workstation or PC. For example, to download modem code for the Microcom modems, click **Download Microcom V.34 Modem Firmware** or **Download Microcom 56K Modem Firmware** under the respective sections. To download modem code for MICA modems, click **Download Modem Portware Images**.

Step 6 Click the modem code file you want to download, and then follow the remaining download instructions. If you are downloading the modem code file to a PC, make sure you download it to the c:\tftpboot directory; otherwise, the download process will not work.

Step 7 When the modem code is downloaded to your workstation, transfer the file to a TFTP server in your LAN using a terminal emulation software application.

Step 8 When the modem code is downloaded to your workstation, transfer the file to a TFTP server somewhere in your LAN using a terminal emulation software application.

Using an FTP Application

Note The directory path leading to the modem code files on cco.cisco.com is subject to change without notice. If you cannot access the files using an FTP application, try the Cisco Systems URL http://www.cisco.com/kobayashi/sw-center/.

Step 1 Log in to the Cisco CCO FTP server, called cco.cisco.com:

```
terminal> ftp cco.cisco.com
Connected to cio-sys.cisco.com.
220-
220-  Cisco Connection Online       |        |      Cisco Systems, Inc.
220-  Email: cco-team@cisco.com   |||      |||  170 West Tasman Drive
220-  Phone: +1.800.553.2447  .:|||||:..:|||||:.  San Jose, CA 95134
220-
220- NOTE: As of February 1,1997 ftp.cisco.com will now point to this
220- service. Please be advised. To use the former ftp.cisco.com after
220-  February 1, connect to ftpeng.cisco.com
220-
```

```
220-  You may login with:
220- + Your CCO username and password, or
220- + A special access code followed by your e-mail address, or
220- + "anonymous" followed by your e-mail address for guest access.
220-
220 cio-sys FTP server (CIOESD #103 Sun Dec 15 14:43:43 PST 1996) ready.
```

Step 2 Enter your CCO registered username and password (for example, **harry** and **letmein**):

```
Name (cco.cisco.com:harry): harry
331 Password required for harry.
Password: letmein
230-#############################################################
230-#  Welcome to the Cisco Systems CCO FTP server.
230-#  This server has a number of restrictions.  If you are not familiar
230-#  with these, please first get and read the /README or /README.TXT file.
230-#  http://www.cisco.com/acs/info/cioesd.html for more info.
230-#############################################################
230-
230-  *****  NOTE: As of February 1, 1997, "cco.cisco.com",   *****
230-  *****  "www.cisco.com" and "ftp.cisco.com" are now all  *****
230- *****  logical names for the same machine.              *****
230- *****                                                   *****
230- *****  The old "ftp.cisco.com" is an entirely           *****
230- *****  different machine, which is now known as        *****
230- *****  "ftpeng.cisco.com" or "ftp-eng.cisco.com".    *****
230- *****                                                   *****
230- *****  In general, "ftpeng.cisco.com" is used only for ****
230-  *****  distribution of Cisco Engineering-controlled  *****
230-  *****  projects, such as beta programs, early field   *****
230-  *****  trials, developing standards documents, etc.  *****
230-  *****                                                   *****
230-  *****  Be sure to confirm you have connected to         *****
230-  *****  the machine you need to interact with.           *****
230-
230-  If you have any odd problems, try logging in with a minus sign (-) as
230-  the first character of your password.  This will turn off a feature
230- that may be confusing your ftp client program.
230-  Please send any questions, comments, or problem reports about this
230-  server to cco-team@cisco.com.
230-
230-  NOTE:
230-  o To download files from CCO, you must be running a *passive-mode*
230-    capable FTP client.
230-  o To drop files on this system, you must cd to the /drop directory.
230-  o Mirrors of this server can be found at
230-
230-     + ftp://www-europe.cisco.com European (Amsterdam)
230-     + ftp://www-fr.cisco.com     France     (Paris)
230-     + ftp://www-au.cisco.com     Australia  (Sydney)
230-     + ftp://www-jp.cisco.com     Japan      (Tokyo)
230-     + ftp://www-kr.cisco.com     Korea      (Seoul)
230-
230-Please read the file README
230-  it was last modified on Sat Feb  1 12:49:31 1997 - 163 days ago
230 User harry logged in.  Access restrictions apply.
Remote system type is UNIX.
Using binary mode to transfer files.
```

Step 3 Specify the directory path that holds the modem firmware you want to download. For example, the directory path for the Cisco AS5300 modem code is /cisco/access/5300:

```
ftp> cd /cisco/access/5300
250-Please read the file README
250-  it was last modified on Tue May 27 10:07:38 1997 - 48 days ago
250-Please read the file README.txt
250-  it was last modified on Tue May 27 10:07:38 1997 - 48 days ago
250 CWD command successful.
```

Step 4 View the contents of the directory with the **ls** command:

```
     ftp> ls
     227 Entering Passive Mode (192,31,7,130,218,128)
     150 Opening ASCII mode data connection for /bin/ls.
     total 2688
     drwxr-s--T   2 ftpadmin ftpcio    512 Jun 30 18:11 .
     drwxr-sr-t  19 ftpadmin ftpcio    512 Jun 23 10:26 ..
     lrwxrwxrwx  1  root     3          10 Aug   6 1996     README ->README.txt
     -rw-rw-r--   1 root     ftpcio   2304 May 27 10:07 README.txt
     -r--r--r-- 1 ftpadmin ftpint 377112 Jul 10 18:08 mcom-modem-code.x.x.x.bin
     -r--r--r-- 1 ftpadmin ftpint 635 Jul 10 18:08 mcom-modem-code.3.1.30.readme
226 Transfer complete.
```

Step 5 Specify a binary image transfer:

```
ftp> binary
200 Type set to I.
```

Step 6 Copy the modem firmware files from the access server to your local environment with the **get** command.

The following example downloads a Microcom modem firmware file:

```
ftp> get mcom-modem-code.x.x.x.bin
PORT command successful.
Opening BINARY mode data connection for mcom-modem-code.x.x.x.bin (280208 bytes).
Transfer complete.
local: mcom-modem-code.x.x.x.bin
remote: mcom-modem-code.x.x.x.bin
385503 bytes received in 3.6 seconds (1e+02 Kbytes/s)
```

Step 7 Quit your terminal session:

```
ftp> quit
Goodbye.
```

Step 8 Verify you successfully transferred the files to your local directory:

```
server% ls -al
total 596
-r--r--r-- 1 280208 Jul 10 18:08 mcom-modem-code.x.x.x.bin
server% pwd
/auto/tftpboot
```

Step 9 Transfer these files to a local TFTP or RCP server that your access server or router can access.

Copy the Modem Code File from Local TFTP Server to Modems

The procedure for copying the modem code file from your local TFTP server to the modems is a two-step process. First, transfer the modem code to the access server's Flash memory. Then, transfer the modem code to the modems.

These two steps are performed only once. After you copy the modem code file into Flash memory for the first time, you should not have to perform these steps again. Because the modem code runs from the modems themselves, the Cisco IOS software automatically copies the modem code to each modem each time the access server power cycles.

Depending on the type of modems that you have installed in your system, the download instructions will vary. Refer to the instructions that best describe your scenario:

- Upgrading MICA Modem Code
- Upgrading Microcom Modem Code

Upgrading MICA Modem Code

Downloading modem code to MICA modems is a six-step process:

Step 1 Establish an xterm session to the access server if using a UNIX workstation, or a HyperTerminal session to the access server if using a PC. For details on establishing a HyperTerminal session, see "Upgrading Modem Code from Diskettes," later in this appendix for details.

Step 2 Enter the access server enable mode (the prompt is displayed as `5300#`):

```
5300> enable
Password: <password>
5300#
```

Step 3 Check the files in the access server system Flash memory:

```
5300# show flash
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mx
 [498776 bytes used, 16278440 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 4 Download the modem code file from TFTP server into the access server Flash memory using the **copy tftp flash** command. After you enter the command, you are prompted for the download destination and the remote host name as requested by the system software.

```
5300# copy tftp flash
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mx
[498776 bytes used, 16278440 available, 16777216 total]
Address or name of remote host [255.255.255.255]?
Source file name? mica-modem-portware.x.x.x.x.bin
Destination file name [mica-modem-portware.x.x.x.x.bin]?
Accessing file 'mica-modem-portware.x.x.x.x.bin' on 255.255.255.255...
Loading mica-modem-portware.x.x.x.x.bin from 2.2.0.1 (via Ethernet0): ! [OK]
Erase flash device before writing? [confirm] no
Copy 'mica-modem-portware.x.x.x.x.bin' from server
  as 'mica-modem-portware.x.x.x.x.bin' into Flash WITHOUT erase? [yes/no]y
Loading mica-modem-portware.x.x.x.x.bin from 2.2.0.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 249108/16278440 bytes]
Verifying checksum...  OK (0xE009)
Flash device copy took 00:00:02 [hh:mm:ss]
```

Step 5 Verify the file has been copied into the access server system Flash memory:

```
5300# show flash
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mz
  2   210104   mica-modem-portware.x.x.x.x.bin
  [747948 bytes used, 16029268 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 6 Copy the modem code file from the access server system Flash memory to the modems by entering the **copy flash modem** command:

```
5300# copy flash modem
Modem Numbers (<slot>/<port> | group <number> | all)? all
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mz
  2   210104   mica-modem-portware.x.x.x.x.bin
[747948 bytes used, 16029268 available, 16777216 total]
Name of file to copy? mica-modem-portware.x.x.x.x.bin
Type of service [busyout/reboot] busyout
Copy 'flash:mica-modem-portware.x.x.x.x.bin' from Flash to modems? [yes/no] yes

*Nov 30 21:17:43.574: %MODEM-5-DL_START: Modem (2/0) started firmware download
*Nov 30 21:17:43.578: %MODEM-5-DL_START: Modem (2/1) started firmware download
*Nov 30 21:17:43.578: %MODEM-5-DL_START: Modem (2/2) started firmware download
*Nov 30 21:17:43.578: %MODEM-5-DL_START: Modem (2/3) started firmware download
.
.
.
*Nov 30 21:17:53.170: %MODEM-5-DL_GOOD: Modem (2/11) completed firmware download:
*Nov 30 21:17:53.598: %MODEM-5-DL_GOOD: Modem (2/12) completed firmware download:
*Nov 30 21:17:53.598: %MODEM-5-DL_GOOD: Modem (2/13) completed firmware download:
 *Nov 30 21:17:53.598: %MODEM-5-DL_GOOD: Modem (2/14) completed firmware download:
```

Note The modem code is downloaded to the module, not the individual slots/ports as implied by the screen display.

For additional information about downloading modem code to modems, refer to the following publications:

- *Installing 56K 12-Port Modem Modules in Cisco AS5300 Universal Access Servers*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/hw_inst/spares/index.htm
- *Installing 6-Port Modem Modules and Carrier Cards in Cisco AS5300 Universal Access Servers*, available online at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/hw_inst/spares/index.htm

Upgrading Microcom Modem Code

Downloading modem code to 56K Microcom modems is a five-step process:

Step 1 Enter the access server enable mode (the prompt is displayed as `5300#`):

```
5300> enable
Password: <password>
5300#
```

Step 2 Check the image in the access server system Flash memory:

```
5300# show flash
System flash directory:
File  Length   Name/status
  1   5826036 c5300-js-mz
[5826100 bytes used, 10951116 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)

5300#
```

Step 3 Download the modem code file from the TFTP server into the access server system Flash memory using the **copy tftp flash** command. After you enter the command, you are prompted for the download destination and the remote host name as requested by the system software.

```
5300# copy tftp flash

System flash directory:
File  Length   Name/status
  1   5826036 c5300-js-mz
[5826100 bytes used, 10951116 available, 16777216 total]
Address or name of remote host [jurai]? jurai
Source file name? mcom-modem-code-3.1.30.bin
Destination file name [mcom-modem-code-3.1.30.bin]? mcom-modem-code-3.1.30.bin
Accessing file 'mcom-modem-code-3.1.30.bin' on tftp_server...
Loading mcom-modem-code-3.1.30.bin from 223.255.254.254 (via Ethernet0): ! [OK]

Erase flash device before writing? [confirm] no
%Warning: File not a valid executable for this system
Copy file? [confirm]

Copy 'mcom-modem-code-3.1.30.bin' from server
  as 'mcom-modem-code-3.1.30.bin' into Flash WITHOUT erase? [yes/no] yes
Loading mcom-modem-code-3.1.30.bin from 223.255.254.254 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 377112/10951116 bytes]

Verifying checksum...  OK (0xB163)
Flash device copy took 00:00:10 [hh:mm:ss]
```

Step 4 Verify the file has been copied into the access server Flash memory:

```
5300# show flash

System flash directory:
File  Length   Name/status
  1   5826036 c5300-js-mz
  2   377112   mcom-modem-code-3.1.30.bin
[6203276 bytes used, 10573940 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 5 Copy the modem code file from the access server system Flash memory to the modems by entering the **copy flash modem** command.

```
5300# copy flash modem
Modem Numbers (<slot>/<port> | group <number> | all)? all

System flash directory:
File  Length   Name/status
  1   5826036 c5300-js-mz
  2   377112   mcom-modem-code-3.1.30.bin
[6203276 bytes used, 10573940 available, 16777216 total]
Name of file to copy? mcom-modem-code-3.1.30.bin
Copy 'mcom-modem-code-3.1.30.bin' from Flash to modems? [yes/no] yes
[OK - 377112/278528 bytes]

5300#
*Mar  3 03:51:17.147: %MODEM-5-DL_START: Modem (1/15) started firmware download
*Mar  3 03:52:47.519: %MODEM-5-DL_GOOD: Modem (1/15) completed firmware download:
MNPClass10K56flexModemRev3.1.30/85
```

Upgrading Modem Code from Diskettes

This section describes how to copy modem code from diskettes to your hard disk in a PC environment, and then upload the modem code to the modems. The steps are similar if you are using a Macintosh or UNIX workstation.

Note If you loaded Cisco IOS software from a feature pack CD-ROM using Router Software Loader (RSL), note that the CD contains a TFTP server program for PCs using Microsoft Windows 95. Run the TFTP server program from the directory where you installed the RSL program. Remember to set the root directory to the directory where the Cisco AS5300 modem code is located. The RSL and the TFTP applications are also available on CCO in the software library in the Access Products section.

Copy the Modem Code to Your PC Hard Disk

This section describes how to copy the modem code file to your hard disk in a PC environment. The steps are similar if you are using a Macintosh or a UNIX workstation.

Step 1 Insert the modem code diskette into the diskette drive.

Step 2 Use Microsoft Windows 95 Explorer to create a folder named tftpboot at your hard disk root **c:**.

Step 3 Use the Microsoft Windows 95 Explorer to copy the modem code file into the c:/tftpboot folder.

Copy the Modem Code from Your PC to the Modems

If you are using a PC running Microsoft Windows 95, upgrading modem code from a hard drive onto a Cisco AS5300 involves installing a TFTP application on your PC, connecting your PC and the access server, establishing a HyperTerminal session on your PC, pinging the PC and access server to make sure they are talking to each other, and finally, copying the modem code from the PC to the access server. See the following sections for details.

Note The steps are similar if you are using a Macintosh or a UNIX workstation.

Set Up a TFTP Application on the PC

Step 1 Install the TFTP application on the PC.

Note You can use any TFTP or rcp application available from independent software vendors. A number of TFTP programs are also available as shareware from public sources on the World Wide Web. If you are using Microsoft Windows 95, you can also download a TFTP application (as zipped files) from the Cisco web site at http://www.cisco.com/public/sw-center/sw-other.shtml.

Step 2 Launch the TFTP application. You commonly do this by double-clicking the application icon or its filename.

Step 3 Set your TFTP server root directory:

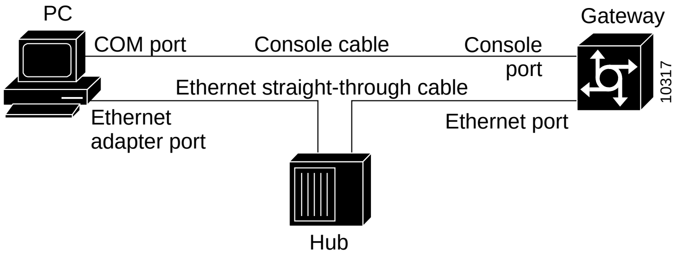
- Choose **Server Root Directory** from the Options menu.
- Choose **c:\tftpboot** from the **Drives** and **[...]** list boxes.
- Click **OK.**

Caution If you do not select the c:\tftpboot directory as your TFTP server directory, you will not be able to perform the copy procedure. This also applies if you are using RCP on your system.

Connect your PC and the Access Server

Step 1 Use straight-through cables to connect the PC and access server via a 10BaseT hub, as shown in Figure A-3. Also note that both Ethernet ports must have the same baseband.

Figure A-3 Connecting a PC and an Access Server



Note You can also connect your PC Ethernet port to the Cisco AS5300 Ethernet port using the 10BaseT crossover cable provided.

Step 2 Connect your PC COM port to the Cisco AS5300 console port, as shown in Figure A-3.

Step 3 Make sure your PC and access server are powered ON.

Establish a HyperTerminal Session

Use the steps in this section to establish a HyperTerminal session from your local PC to the Cisco AS5300. You will use the HyperTerminal session to talk to the access server.

Step 1 In Microsoft Windows 95 on your PC, choose **Start/Programs/Accessories/HyperTerminal**.

Step 2 Double-click **Hypertrm.exe** to display the Connection Description dialog box.

Step 3 Enter a name for your connection, for example, **Console** and then click **OK**. HyperTerminal displays the Phone number dialog box.

Step 4 Choose the COM port connecting the PC and the access server in the Connect Using list box. You have options to connect directly to one of four COM ports.

Step 5 Click **OK**. HyperTerminal displays the COM Properties dialog box.

Step 6 Choose these options in the COM Properties dialog box:

- Bits per second: **9600**
- Data bits: **8**
- Parity: **None**
- Stop bits: **1**
- Flow control: **None**

Step 7 Click **OK**. The HyperTerminal dialog box appears.

Step 8 Press **Enter** to display the `5300#` prompt.

Note If the access server prompt does not appear, you might have selected the wrong COM port, the cable connections could be incorrect or bad, or the access server might not be powered on.

Ping the PC and Access Server

Ping the access server and the PC to make sure they are talking to each other and there are no configuration problems on your access server.

Step 1 Choose the correct Ethernet adapter connecting to the access server and note the PC’s IP address:

(a) Choose **Start/Run** to display the Run dialog.

(b) Enter **winipcfg** and click **OK** to display the IP Configuration dialog box.

(c) Choose the PC Ethernet adapter connector used for the connection to the access server if you have more than one Ethernet adapter connector installed on your PC.

(d) Make a note of the PC IP address, and then click **OK**.

Note Enter the **show running config** command at the 5300# prompt to verify the access server has an IP address assigned. If the access server does not have an IP address, assign an IP address before continuing.

Step 2 In the HyperTerminal dialog box (see the previous section "Establish a HyperTerminal Session," for details), enter the access server enable mode (the prompt is displayed as `5300#`):

```
5300> enable
Password: <password>
5300#
```

Step 3 Enter the **ping** command with your PC's IP address.

```
5300# ping 172.16.1.1
```

The access server displays five exclamation points (!) if everything is working and it displays five dots (.) if there is a problem. In the latter case, check the cabling between the router and the PC and check the access server configuration.

Upload Modem Code to the Access Server

The procedure for copying the modem code file from your PC set up as a local TFTP server to the access server system Flash memory is a two-step process:

- Transfer the modem code to the access server.
- Transfer the modem code to the modems.

Perform these two steps only once. After you copy the modem code file into system Flash memory for the first time, you should not have to perform these steps again. Because the code runs from modem RAM, the Cisco IOS software must automatically copy the modem code to each modem each time the access server power cycles.

The following code examples show a download to MICA modems. Use the same steps to download to Microcom modems.

Step 1 Check the image in the access server Flash memory:

```
5300# show flash
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mx
 [498776 bytes used, 16278440 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 2 Enter the **copy tftp flash** command to download the code file from the TFTP server into the access server Flash memory. You are prompted for the download destination and the remote host name.

```
5300# copy tftp flash
System flash directory:
File  Length   Name/status
  1   4530624   images/c5300-js-mx
[498776 bytes used, 16278440 available, 16777216 total]
Address or name of remote host [255.255.255.255]? jurai
Source file name? mica-modem-portware.x.x.x.x.bin
Destination file name [mica-modem-portware.x.x.x.x.bin]?
Accessing file 'mica-modem-portware.x.x.x.x.bin' on 255.255.255.255...
Loading mica-modem-portware.x.x.x.x.bin from 2.2.0.1 (via Ethernet0): ! [OK]
Erase flash device before writing? [confirm] no
Copy 'mica-modem-portware.x.x.x.x.bin' from server
  as 'mica-modem-portware.x.x.x.x.bin' into Flash WITHOUT erase? [yes/no] yes
Loading images/mica-modem-portware.x.x.x.x.bin from 2.2.0.1 (via Ethernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 249108/16278440 bytes]
Verifying checksum...  OK (0xE009)
Flash device copy took 00:00:02 [hh:mm:ss]
```

Step 3 Verify the file has been copied into the access server Flash memory:

```
5300# show flash
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mz
  2   210104   mica-modem-portware.x.x.x.x.bin
  [747948 bytes used, 16029268 available, 16777216 total]
16384K bytes of processor board System flash (Read/Write)
```

Step 4 Copy the modem code file from the access server Flash memory to the modems by entering the **copy flash modem** command:

```
5300# copy flash modem
Modem Numbers (<slot>/<port> | group <number> | all)? all
System flash directory:
File  Length   Name/status
  1   4530624  c5300-js-mz
  2   210104   mica-modem-portware.x.x.x.x.bin
[747948 bytes used, 16029268 available, 16777216 total]
Name of file to copy? mica-modem-portware.x.x.x.x.bin
Type of service [busyout/reboot] busyout
Copy 'flash:mica-modem-portware.x.x.x.x.bin' from Flash to modems? [yes/no] yes

*Feb 27 21:17:43.574: %MODEM-5-DL_START: Modem (2/0) started portware download
.
.
.
*Feb 27 21:17:43.598: %MODEM-5-DL_START: Modem (2/13) started portware download
*Feb 27 21:17:53.598: %MODEM-5-DL_GOOD: Modem (2/14) completed portware download:
```

Note The code is downloaded to the module, not the individual slots as shown.

Using the Modem Code Bundled with Cisco IOS Software

Use this procedure to update modem code on the modems in your access server if you decide to use the version of modem code bundled with Cisco IOS software instead of the version already mapped to your modems.

Caution Cisco ships the access server with the latest version of modem code installed in the system Flash memory and mapped to the modems. If you choose to use the modem code bundled with your installed Cisco IOS software, you could be reverting to a previous version of modem code. Also note that once you map the bundled modem code (using the **copy system:/ucode/***filename* **modem** command—or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command) to your modems, each time you upgrade the Cisco IOS software, the new bundled modem code is automatically mapped to your modems. See “Displaying Modem Code Versions,” later in this appendix, for details on displaying modem code versions mapped to modems, installed in system Flash memory, and bundled with the Cisco IOS software on your access server.

To set the modem code mapping to the modem code version bundled with Cisco IOS software, enter the following command:

Step 1 Enter the access server enable mode (the prompt is displayed as `5300#`):

```
5300> enable
Password: <password>
5300#
```

Step 2 Enter the **copy system:/ucode/***filename* **modem** command (or, for Cisco IOS releases earlier than 11.3AA or 12.0, the **copy ios-bundled modem** command):

```
5300# copy system:/ucode/microcom_firmware modem
 Modem Numbers (<slot>/<port> | group <number> | all)? 0/0
 Copy "system:/ucode/microcom_firmware" to modems? [yes/no]yes
5300#
 Mar 11 22:55:38.734: %MODEM-5-DL_START: Modem (0/0) started firmware download
 Mar 11 22:57:08.699: %MODEM-5-DL_GOOD: Modem (0/0) completed firmware download:
 MNPClass10V.90ModemRev5.0.40/85
```

This command does not affect any existing modem code that resides in system Flash memory in case you later want to revert to it. If you decide to delete the code from system Flash memory, remember that *all* files in system Flash memory will be deleted, therefore save and restore any important files (for example, the Cisco IOS software image).

Note If the new Cisco IOS image contains the same modem code as the old one, no new code will be downloaded to the modems.

APPENDIX B

ROM Monitor

This appendix describes the Cisco AS5300 ROM monitor, the first software to run when the access server is powered-up or reset. The ROM Monitor can help you isolate or rule out hardware problems encountered when installing your access server.

This appendix describes:

- Entering the ROM Monitor Program
- ROM Monitor Command Conventions
- Command Aliasing
- ROM Monitor Commands

Entering the ROM Monitor Program

The ROM monitor diagnostics help initialize the processor hardware and boot the main operating system software. If you set the software configuration register (bits 3, 2, 1, and 0) to zero, you can start the access server in the standalone ROM monitor. An example of the ROM monitor prompt follows:

```
rommon 1 >
```

To enable the Break key, and to default to booting at the ROM monitor while running the system software, reset the configuration register to 0x0 by entering configuration mode, and enter the following configuration command:

```
config-reg 0x0
```

The new configuration register value, 0x0, takes effect after the access server is rebooted with the **reload** command. If you set the configuration to 0x0, you will have to manually boot the system from the console each time you reload the access server.

Timesaver Break (system interrupt) is always enabled for 60 seconds after rebooting the system, regardless of whether break is configured to be off by setting the configuration register. During the 60-second window, you can break to the ROM monitor prompt.

ROM Monitor Command Conventions

Following are ROM monitor command conventions:

- Brackets [ ] denote an optional field. If a minus option is followed by a colon (for example: [-s:]), you must provide an argument for the option.

- A word in italics means that you must fill in the appropriate information.
- All address and size arguments to the memory-related commands are assumed to be hexadecimal (no “0x” prefix or ‘h’ suffix needed).
- The options [-bwl] for the memory-related commands provide for byte, word, and longword operations. The default is word.
- You can invoke the memory-related commands by entering the command with no arguments. This causes the utility to prompt you for parameters. This option is available for the commands marked as prompting.
- All the built-in commands can be aborted (user interrupt signal) by pressing the **Break** key at the console.
- You can place more than one command (except the repeat command) on a line by using the ‘;’ delimiter.

Command Aliasing

The ROM monitor supports command aliasing modeled on the aliasing function built into the Korn shell. The alias command is used to set and view aliased names. This allows the user to alias command names to a letter or word. Aliasing is often used to shorten command names or automatically invoke command options.

Aliases are stored in NVRAM and remain intact across periods of no power. These are some of the set aliases:

```
b=boot
h=history
i=reset
r=repeat
k=stack
?=help
```

ROM Monitor Commands

At the ROM monitor prompt, enter **?** or ***help*** at the *rommon n* > prompt to display a list of available commands and options, as follows:

```
rommon 12 > help
alias               set up and display alias
boot                boot up an external process
confreg             configuration register utility
cont                continue executing a downloaded image
context             display the context of a loaded image
dev                 list the device table
dir                 list files in file system
dnld                serial download a program module
frame               print out a selected stack frame
help                monitor builtin command help
history             monitor command history
meminfo             main memory information
repeat              repeat a monitor command
reset               system reset
set                 display the monitor variables
stack               produce a stack trace
sync                write monitor environment to NVRAM
```

```
sysret              print out info from last system return
unalias             unset an alias
unset               unset a monitor variable
xmodem              x/y modem download
```

Note You can display additional details for a command by entering the command name with a *-?* option, which prints the command usage message.

The commands are listed and described in alphabetical order. Note that the ROM monitor commands are case sensitive.

- **alias** [name=value]—Aliases a name to a value. If the value contains white space or other special (shell) characters, it must be quoted. If the value has a space as the last character the next command-line word is also checked for an alias (normally only the first word on the command line is checked). Without an argument, this command prints a list of all aliased names with their values.

  For example:

  ```
  rommon 1 > alias
  r=repeat
  h=history
  ?=help
  b=boot
  ls=dir
  ```

- **boot** or **b**—Boots an image. The **boot** command with no arguments boots the first image in boot Flash memory. You can include an argument, *filename*, to specify a file to be booted over the network using the Trivial File Transfer Protocol (TFTP). The local device (see the description of **b** *device* following) can be specified by entering the device specifier (*devid*). If the specified device name is not recognized by the ROM monitor, the system will attempt to boot the image (*imagename*) from a network TFTP server. Do not insert a space between *devid* and *imagename*. Options to the boot command are -x, load image but do not execute, and -v, verbose. The form of the **boot** command follows:

  boot [-xv] [*devid*] [*imagename*]

  b—Boots the default system software from ROM.

  b *filename [host]*—Boots using a network TFTP server. When a host is specified, either by name or IP address, the *boot* command will boot from that source.

  b flash:—Boots the first file in Flash memory.

  b *device:*—Boots the first file found in the Flash memory device. The Flash memory device specified can be either *flash*:, to boot the Cisco IOS software, or *bootflash*:, to boot the boot image in Flash memory.

  b *device:name*—An extension of the above command, allows you to specify a particular filename in the Flash memory bank.

- **confreg** [*hexnum*]—Executing the **confreg** command with the argument *hexnum* changes the virtual configuration register to match the hex number specified. Without the argument, **confreg** dumps the contents of the virtual configuration register in English and allows the user to alter the contents. You are prompted to change or keep the information held in each bit of the virtual configuration register. In either case, the new virtual configuration register value is written into NVRAM and does not take effect until you reset or power cycle the access server.

The configuration register resides in NVRAM. The configuration register is identical in operation to other Cisco access servers. Enter **confreg** for the menu-driven system, or enter the new value of the register in hexadecimal.

Note The value is always interpreted as hex. The **confreg** utility will print a before and after view of the configuration register when used in menu-driven mode.

For example:

```
rommon 7 > confreg

     Configuration Summary
enabled are:
console baud: 9600
boot: the ROM Monitor
 es
do you wish to change the configuration? y/n  [n]:  yes
enable  “diagnostic mode”? y/n  [n]:  yes
enable  “use net in IP bcast address”? y/n  [n]:
enable  “load rom after netboot fails”? y/n  [n]:
enable  “use all zero broadcast”? y/n  [n]:
enable  “break/abort has effect”? y/n  [n]:
enable  “ignore system config info”? y/n  [n]:
change console baud rate? y/n  [n]:  yes
enter rate: 0 = 9600, 1 = 4800, 2 = 1200, 3 = 2400  [0]:  0
change the boot characteristics? y/n  [n]:  yes
enter to boot:
 0 = ROM Monitor
 1 = the boot helper image
 2-15 = boot system
    [0]:  0

     Configuration Summary
enabled are:
diagnostic mode
console baud: 9600
boot: the ROM Monitor

do you wish to change the configuration? y/n  [n]:

You must reset or power cycle for new config to take effect.
```

- **cont** [*-b*]**—**Continues a loaded image that has stopped. The -b option sets the requested break points before continuing.

  For example:

  ```
  reboot >
  monitor: command “launch” aborted due to user interrupt
  diagmon 7 > cont

  reboot>
  ```

- **context—**Displays the CPU context at the time of the fault. The context from the kernel mode and process mode of a booted image is displayed, if available.

For example:

```
rommon 6 > context
CPU Context:
d0 - 0x00000028      a0 - 0x0ff00420
d1 - 0x00000007      a1 - 0x0ff00000
d2 - 0x00000007      a2 - 0x02004088
d3 - 0x00000000      a3 - 0x020039e6
d4 - 0x00000000      a4 - 0x02002a70
d5 - 0x02003e8a      a5 - 0x02003f17
d6 - 0x00000000      a6 - 0x02003938
d7 - 0x00000001      a7 - 0x0200392c
pc - 0x02004adc     vbr - 0x02000000
```

- **cookie**—Displays the contents of the cookie PROM in hexadecimal format.

  For example:

```
rommon 1 > cookie
cookie:
01 01 00 00 0c 07 af 80 07 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

- **dev**—Lists boot device identifications on the access server.

  For example:

```
rommon 10 > dev
Devices in device table:
        id  name
    eprom:  eprom
    flash:  PCMCIA slot 1
```

- **dir** *devid***—**Lists the files on the named device.

  For example:

```
rommon 11 > dir flash:
        File size                Checksum      File name
            65 bytes (0x41)       0xb49d       clev/oddfiles65
       2229799 bytes (0x220627)   0x469e       C5300-k.z
```

- **dlnd** [-*xv:*] [*args*]—Downloads in binary format through the console and executes. The -x option downloads but does not execute. The -v option allows you to specify the verbose level. The optional arguments are passed to the downloaded program via the argc/argv mechanism (only when -x is not used). The exit value is the return value from the downloaded routine or the status of the download operation (success or failure) if the -x option is used.
- **frame** [*number*]—Displays an entire individual stack frame. Enter a number to indicate which frame to display. You can also specify a number to indicate which stack frame to display. Note that the default is 0 (zero), which is the youngest frame.

For example:

```
rommon 6 > frame 2
Frame 02: FP = 0x02003960    RA = 0x020050ee
at 0x02003968 (fp + 0x08) = 0x02004f8d
at 0x0200396c (fp + 0x0c) = 0x0200f390
at 0x02003970 (fp + 0x10) = 0x02006afc
at 0x02003974 (fp + 0x14) = 0xc0a82983
at 0x02003978 (fp + 0x18) = 0x02003a7e
at 0x0200397c (fp + 0x1c) = 0x02002630
at 0x02003980 (fp + 0x20) = 0x00000000
at 0x02003984 (fp + 0x24) = 0x02000000
at 0x02003988 (fp + 0x28) = 0x0200c4a4
at 0x0200398c (fp + 0x2c) = 0x0200f448
```

- **help**—The **help** command prints a summary of the ROM monitor commands to the console screen. This is the same output as entering **?**.

  For example:

```
rommon 11 > help
alias               set up and display alias
boot                boot up an external process
confreg             configuration register utility
cont                continue executing a downloaded image
context             display the context of a loaded image
dev                 list the device table
dir                 list files in file system
dnld                serial download a program module
frame               print out a selected stack frame
help                monitor builtin command help
history             monitor command history
meminfo             main memory information
repeat              repeat a monitor command
reset               system reset
set                 display the monitor variables
stack               produce a stack trace
sync                write monitor environment to NVRAM
sysret              print out info from last system return
unalias             unset an alias
unset               unset a monitor variable
xmodem              x/y modem download
```

- **history** or **h**—Displays the command history, that is, the last 16 commands executed in the monitor environment.
- **meminfo**—Displays the size (in bytes) the starting address, the available range of the main memory, the starting point and size of packet memory, and the size of nonvolatile memory (NVRAM).

  For example:

```
rommon 9 > meminfo

Main memory size: 8 MB. Packet memory size: 4 MB
Available main memory starts at 0xa000e001, size 0x7f1fff
Packet memory starts at 0xa8000000
NVRAM size: 0x20000
```

- **repeat** [*number or string*] [*count*] or r—Repeats the specified command. Without an argument, repeats the last command. The optional command number (from the history list) or match string specifies which command to repeat. In the case of the match string, the most recent command to begin with the specified string will be re-executed. If the string includes spaces, you must define it using quotes. The *count* option allows you to repeat the command more than once.

- **reset** or **i**—Resets and initializes the system, similar to power-on.
- **set**—Displays all the monitor variables and their values.
- **stack** [*num*]**—**Produces a stack trace of the num frames. The default is 5. The command dumps from the kernel stack and the process stack (if one is available) of a booted image.

  For example:

  ```
  rommon 5 > stack 8
  Stack trace:
  PC = 0x02004adc
  Frame 00: FP = 0x02003938    RA = 0x02005f2a
  Frame 01: FP = 0x02003948    RA = 0x02005df0
  Frame 02: FP = 0x02003960    RA = 0x020050ee
  Frame 03: FP = 0x02003994    RA = 0x02004034
  Frame 04: FP = 0x02003b00    RA = 0x00012ca6
  ```

- **sync**—Writes the working in-core copy of the environment variables and aliases to NVRAM so that they are read on the next reset.
- **sysret**—Displays the return information from the last booted system image. This includes the reason for terminating the image, a stack dump of up to eight frames, and if an exception is involved, the address where the exception occurred.

  For example:

  ```
  rommon 8 > sysret
  System Return Info:
  count: 19,  reason: user break
  pc:0x60043754,  error address: 0x0
  Stack Trace:
  FP: 0x80007e78, PC: 0x60043754
  FP: 0x80007ed8, PC: 0x6001540c
  FP: 0x80007ef8, PC: 0x600087f0
  FP: 0x80007f18, PC: 0x80008734
  ```

- **unalias** ***name***—Removes *name* and its associated value from the alias list.
- **unset** ***varname***—Removes the variable name from the variable list.
- **xmodem** [- *yc*] *destination_file_name*—Downloads a system image to the boot Flash memory over the console port. The -y option performs the download. The -c option performs the download using 16-bit CRC error checking. The xmodem transfer protocol supports a 128-byte block size and the transfer begins with a block number starting at 1, which contains file data. This is the default transfer protocol.

Using Setup on Cisco IOS Releases 11.2 or 11.3(2)T

This appendix contains instructions for running the setup script for systems containing Cisco IOS Release 11.2 or 11.3 software.

Getting Started

Before you turn on the access server and begin to use the setup script in the System Configuration dialog, make sure you have:

- Already connected the cables to the access server
- Configured your PC terminal emulation program for 9600 baud, 8 data bits, no parity, and 2 stop bits

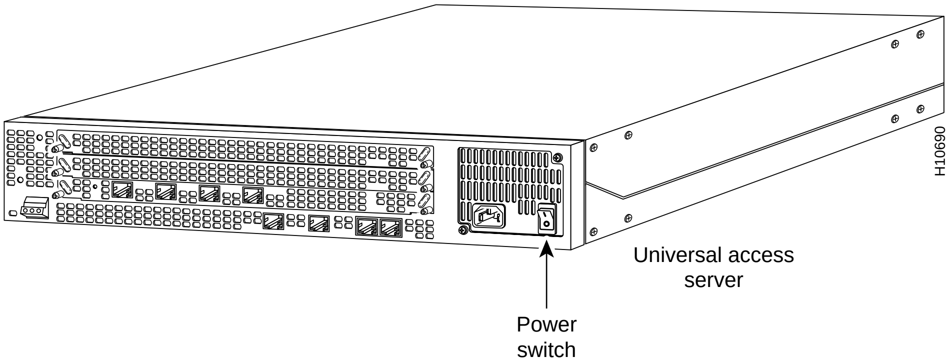
All configuration will be performed from your PC terminal emulation program window.

Complete these steps:

Note If you make a mistake, you can exit and run the System Configuration dialog again. Press **Ctrl-c**, and type **setup** at the enable mode prompt (`5300#`).

Step 1 Power ON the access server. The power switch is on the rear panel of the access server, at the lower right corner, near the power cord.

Figure C-1 Power Switch Location



Step 2 Continue with one of the following sections:

- "Running Setup for Cisco IOS Release 11.2"
- "Running Setup for Cisco IOS Release 11.3(2)T"

Running Setup for Cisco IOS Release 11.2

The messages look similar to the following:

Note The messages vary, depending on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and might not exactly reflect the messages on your console.

```
System Bootstrap, Version 11.X(X)P, RELEASED SOFTWARE
Copyright (c) 1994-1998 by cisco Systems, Inc.
AS5300 processor with 32768 Kbytes of main memory

rommon 1 b f
program load complete, entry point: 0x80008000, size: 0xef4e0
Self decompressing the image : ###############################################
[OK]

Notice: NVRAM invalid, possibly due to write erase.
program load complete, entry point: 0x80008000, size: 0x415b20
Self decompressing the image :
#################################################################################
#################################################################################
#################################################################################
#############################################[OK]

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Software clause at DFARS sec. 252.227-7013.

           Cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco Internetwork Operating System Software
IOS (tm) 5300 Software (C5300-JS-M), Released Version 11.2(19970619:020846)
[ppalleti-DVT_08 102]
Copyright (c) 1986-1997 by cisco Systems, Inc.
Compiled Wed 18-Jun-97 22:25 by ppalleti
Image text-base: 0x600088A0, data-base: 0x60738000

cisco AS5300 (R4K) processor (revision A) with 32768K/8192K bytes of memory.
Processor board ID 04614954
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Bridging software.
SuperLAT software copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
```

```
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.0.
Backplane revision 1
Manufacture Cookie is not programmed.
1 Ethernet/IEEE 802.3 interface(s)
1 FastEthernet/IEEE 802.3 interface(s)
48 terminal line(s)
4 Channelized T1/PRI port(s)
128K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash (Read/Write)
4096K bytes of processor board Boot flash (Read/Write)

Notice: NVRAM invalid, possibly due to write erase.
          --- 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 3 When the following message appears, press **Enter** to accept the default entry (yes) in square brackets:

```
Would you like to enter the initial configuration dialog? [yes]:
```

Step 4 When the following message appears, press **Enter** to see the current interface summary:

```
First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid configuration

Interface       IP-Address OK? Method Status        Protocol
Ethernet0      unassigned  NO  unset  up             up
FastEthernet0  unassigned  NO  unset  up             down
```

Step 5 Enter a host name for the access server (this example uses 5300):

```
Configuring global parameters:

  Enter host name [Router]: 5300

The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.
```

Step 6 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when viewing the configuration:

```
   Enter enable secret: lab

The enable password is used when there is no enable secret
and when using older software and some boot images.
```

Step 7 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:

```
   Enter enable password: guessme
```

Step 8 Enter the virtual terminal password, which prevents unauthenticated access to the router through ports other than the console port:

```
  Enter virtual terminal password: guessagain
```

Step 9 Respond to the following prompts as appropriate for your network:

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

```
  Configure LAT? [no]:
  Configure AppleTalk? [no]: yes
    Multizone networks? [no]: yes
  Configure DECnet? [no]:
  Configure IP? [yes]:
    Configure IGRP routing? [yes]:
      Your IGRP autonomous system number [1]: 15
```

Note If you answer no to IGRP, you will be prompted to configure RIP.

```
  Configure CLNS? [no]:
  Configure IPX? [no]: yes
Configure Vines? [no]:
   Configure XNS? [no]:
   Configure Apollo? [no]:
   Configure bridging? [no]:
```

Step 10 Configure the asynchronous serial lines for the integrated modems on the modules installed in the access server. (If you want to allow users to dial in through the integrated modems, you must configure the async lines.)

```
Async lines accept incoming modems calls. If you will have
users dialing in via modems, configure these lines.

Configure Async lines? [yes]:
    Async line speed [115200]:
```

Note We recommend that you do not change this speed.

```
Will you be using the modems for inbound dialing? [yes]:
```

Note If your asynchronous interfaces will be using the same basic configuration parameters, we recommend answering yes to the next prompt. That way you group the modems so that they can be configured as a group. Otherwise, you will need to configure each interface separately.

```
      Would you like to configure group async interface? [yes]:
```

Note Dynamic IP addresses permit dial-in users to choose a static IP address when they dial in. If you do not allow dynamic IP addresses, the access server will provide IP addresses from an IP address pool that you set up later in the next prompt.

```
Configure for Dynamic IP addresses? [no]:
Configure for TCP header compression? [yes]:
Configure for routing updates on async links? [no]:
Enter the starting address of IP local pool? [X.X.X.X]: 172.20.30.40
```

Note Make sure the starting and ending addresses of the IP pool are in the same subnet.

```
Enter the ending address of IP local pool? [X.X.X.X]: 172.20.30.88
What is the username of the test user? [user]:
      What is the password of the test user? [passwd]:
    Will you be using the modems for outbound dialing? [no]:
    Configure for Async IPX? [yes]: no
    Configure for Appletalk Remote Access (ARA)? [no]: yes
      AppleTalk Network for ARAP clients [1]:
      Zone name for ARAP clients [ARA Dialins]:
      Allow ARAP "Guest" logins? [yes/no]: yes
```

Step 11 Configure the Ethernet 0 LAN interface:

```
Configuring interface Ethernet0:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
    IP address for this interface: 172.21.40.10
```

The next prompts ask about the number of bits in the **host** portion of the subnet mask.

```
    Number of bits in subnet field [0]:
    Class B network is 172.21.0.0, 0 subnet bits; mask is /16
  Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [no]:
    AppleTalk network number [0]: 10
    AppleTalk zone name [myzone]: etherzone
  Configure IPX on this interface? [no]: yes
    IPX network number [1]:
```

Step 12 Configure the Fast Ethernet 0 interface:

```
  Is this interface in use? [yes]:
```

Note Full duplex mode enables simultaneous data transfer between a sending and a receiving station.

```
  Operate in full-duplex mode? [no]: yes
  Operate at 100 Mbps speed? [yes]: yes
  Configure IP on this interface? [yes]: yes
    IP address for this interface: 172.22.50.10
```

The next prompts ask about the number of bits in the **host** portion of the subnet mask.

```
    Number of bits in subnet field [0]:
    Class B network is 172.22.0.0, 0 subnet bits; mask is /16
  Configure AppleTalk on this interface? [no]: yes
    Extended AppleTalk network? [no]: y
    AppleTalk starting cable range [0]:
  Configure IPX on this interface? [no]: yes
    IPX network number [2]:
```

Step 13 Configure the ISDN switch type:

```
 Do you want to configure ISDN switch type? [yes]:
  The following ISDN switch types are available:
                [a] primary-4ess
                [b] primary-5ess
                [c] primary-dms100
                [d] primary-net5
                [e] primary-ntt
                [f] primary-ts014
  Enter the switch type [b]:
```

Step 14 If you want users to be able to dial in via ISDN or analog modems, configure the controllers:

Note All incoming calls to the access server are handled by the controllers, which route calls to the appropriate place inside the access server for processing.

```
These controllers enable users to dial in via ISDN or analog modems.

Do you intend to allow users to dial in? [yes]:

There are 4 controllers on this access server. If you want to use the full
capacity of the access server configure all controllers.

Controller T1 0,1,..etc  in software corresponds to Port 0,1,..etc
on the back of the access server.

Configuring controller T1 0:
  Is this controller in use? [yes]:
  Will you be using PRI on this controller? [yes]:
  Would you like to enable multilink PPP? [yes]:
```

Note If you want to configure the access server for channelized T1, enter **no** to the above prompt.

```
Configuring controller T1 1:
  Is this controller in use? [yes]:
  Will you be using PRI on this controller? [yes]:
  Would you like to enable multilink PPP? [yes]:

Configuring controller T1 2:
  Is this controller in use? [yes]:
  Will you be using PRI on this controller? [yes]:
  Would you like to enable multilink PPP? [yes]:

Configuring controller T1 3:
  Is this controller in use? [yes]:
  Will you be using PRI on this controller? [yes]:
  Would you like to enable multilink PPP? [yes]:
```

When you have completed the initial configuration script, messages similar to the following appear:

```
The following configuration command script was created:

hostname 5300
enable secret 5 $1$zxxT$YZMzUP1/wQvyLn5cWeyPu.
enable password guessme
line vty 0 4
password guessagain
snmp-server community public
```

```
!
appletalk routing
no decnet routing
ip routing
no clns routing
ipx routing
no vines routing
no xns routing
no apollo routing
no bridge 1
!
line 1 48
speed 115200
 flowcontrol hardware
login local
autoselect during-login
autoselect ppp
modem dialin
ip local pool setup_pool 172.20.30.40 172.20.30.88
!
username user password passwd
!
arap network 1 ARA Dialins
line 1 48
arap enable
autoselect arap
!
! Turn off IPX to prevent network conflicts.
interface Ethernet0
no ipx network
interface FastEthernet0
no ipx network
!
interface Ethernet0
ip address 172.21.40.10 255.255.0.0
appletalk address 10.0
appletalk zone etherzone
ipx network 1
no mop enabled
!
interface FastEthernet0
duplex full
speed 100
ip address 172.22.50.10 255.255.0.0
appletalk cable-range 0-0 0.0
appletalk discovery
ipx network 2
no mop enabled
!

Interface Group-Async1
group-range 1 48
ip unnumbered Ethernet0
encapsulation ppp
ppp authentication chap pap
peer default ip address pool setup_pool
ip tcp header-compression passive
async mode interactive
!
isdn switch-type primary-5ess
!
controller T1 0
framing esf
clock source line primary
linecode b8zs
```

```
pri-group timeslots 1-24
description PRI from Teleos: 555-1400
!
interface serial0:23
isdn incoming-voice modem
ip unnumbered Ethernet0
encapsulation ppp
ppp authentication chap pap
ppp multilink
peer default ip address pool setup_pool
dialer-group 1
access-list 101 permit ip any any
dialer-list 1 list 101
!

controller T1 1
pri-group timeslots 1-24
clock source line secondary
linecode b8zs
!
interface serial1:23
isdn incoming-voice modem
ip unnumbered Ethernet0
encapsulation ppp
ppp authentication chap pap
ppp multilink
peer default ip address pool setup_pool
dialer-group 1
access-list 101 permit ip any any
dialer-list 1 list 101
!
controller T1 2
pri-group timeslots 1-24
framing esf
clock source internal
linecode b8zs
!
interface serial2:23
isdn incoming-voice modem
ip unnumbered Ethernet0
encapsulation ppp
ppp authentication chap pap
ppp multilink
peer default ip address pool setup_pool
dialer-group 1
access-list 101 permit ip any any
dialer-list 1 list 101
!

controller T1 3
pri-group timeslots 1-24
framing esf
clock source internal
cas-group 0 timeslots 1-20 type e&m-fgb
linecode b8zs
!
interface serial3:23
isdn incoming-voice modem
ip unnumbered Ethernet0
encapsulation ppp
ppp authentication chap pap
ppp multilink
peer default ip address pool setup_pool
dialer-group 1
access-list 101 permit ip any any
```

```
dialer-list 1 list 101
!
router igrp 15
redistribute connected
network 172.21.0.0
network 172.22.0.0
!
end
```

Step 15 The next prompt asks if you want to save this configuration. If you answer no, nothing you entered is saved, and you are taken out of the System Configuration dialog to the enable prompt (`5300#`). (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 (`5300>`).

```
Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.


Press RETURN to get started!

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0, changed state to up

<Additional messages omitted.>
```

Step 16 When the messages stop displaying on your screen, press **Enter** to get the prompt:

```
5300>
```

Note If you see the next message, it means that no other AppleTalk routers were found on the network attached to the port.

```
%AT-6-ONLYROUTER: Ethernet0: AppleTalk port enabled; no neighbors found
```

Step 17 Continue the configuration. The `5300>` prompt indicates that you are now at the command-line interface (CLI) and you have just completed a basic access server configuration. However, this is *not* a complete configuration. At this point you have two choices:

- Run the setup script in the System Configuration dialog again and create another configuration. Enter the following:

```
5300> enable
Password: <password>
5300# setup
```

- Modify the existing configuration or configure additional features with the CLI as described in the chapter "Basic Configuration."

Running Setup for Cisco IOS Release 11.3(2)T

Note Cisco IOS Release 11.3(2)T includes CAS options and includes the capability of configuring controllers by group for the Integrated Services (ISDN) Primary Rate Interface (PRI).

The messages look similar to the following:

Note The displayed messages depend on the Cisco IOS software release and feature set you selected. The screen displays in this section are for reference only and might not exactly reflect the messages on your console.

```
System Bootstrap, Version 11.3(2)T, RELEASED SOFTWARE
Copyright (c) 1994-1998 by cisco Systems, Inc.
AS5300 processor with 32768 Kbytes of main memory

rommon 1 b f
program load complete, entry point: 0x80008000, size: 0xef4e0
Self decompressing the image : ###############################################
[OK]

Notice: NVRAM invalid, possibly due to write erase.
program load complete, entry point: 0x80008000, size: 0x415b20
Self decompressing the image :
##########################################################################
##########################################################################
######################################################################[OK]

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Cisco Systems, Inc.
170 West Tasman Drive
San Jose, California 95134-1706

Cisco Internetwork Operating System Software
IOS (tm) 5300 Software (C5300-JS-M), Version 11.3(2)T RELEASE SOFTWARE (fc1)
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Wed 11-Feb-98 22:25 by ppalleti
Image text-base: 0x600088A0, data-base: 0x60738000

cisco AS5300 (R4K) processor (revision A) with 32768K/8192K bytes of memory.

Processor board ID 04614954
R4700 processor, Implementation 33, Revision 1.0 (Level 2 Cache)
Bridging software.
SuperLAT software copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software.
Primary Rate ISDN software, Version 1.0.
Backplane revision 1
```

```
Manufacture Cookie is not programmed.
1 Ethernet/IEEE 802.3 interface(s)
1 FastEthernet/IEEE 802.3 interface(s)
48 terminal line(s)
4 Channelized T1/PRI port(s)
128K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash (Read/Write)
4096K bytes of processor board Boot flash (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 18 When the following message appears, press **Enter** to accept the default entry [**yes**] in square brackets:

```
Would you like to enter the initial configuration dialog? [yes]:
```

Step 19 When the following message appears, press **Enter** to see the current interface summary:

```
First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid configuration

    Interface       IP-Address      OK? Method Status           Protocol
    Ethernet0       unassigned      NO  unset  up               up
FastEthernet0   unassigned      NO  unset  up
```

Step 20 Enter a host name for the access server:

```
Configuring global parameters:

  Enter host name [Router]: 5300

The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.
```

Step 21 Enter an enable secret password. This password is encrypted (more secure) and cannot be seen when viewing the configuration:

```
  Enter enable secret: lab

The enable password is used when there is no enable secret
and when using older software and some boot images.
```

Step 22 Enter an enable password. This password is *not* encrypted (less secure) and can be seen when viewing the configuration:

```
  Enter enable password: guessme
```

Step 23 Enter the virtual terminal password, which is used for remote console access:

```
  Enter virtual terminal password: guessagain
```

Step 24 Respond to the following prompts as appropriate for your network:

```
Configure SNMP Network Management? [yes]:
  Community string [public]:
Configure LAT? [no]:
Configure AppleTalk? [no]: yes
  Multizone networks? [no]: yes
Configure DECnet? [no]:
Configure IP? [yes]:
  Configure IGRP routing? [yes]:
    Your IGRP autonomous system number [1]: 15
```

Note If you answer no to IGRP, you will be prompted to configure RIP.

```
Configure CLNS? [no]:
Configure IPX? [no]: yes
Configure Vines? [no]:
Configure XNS? [no]:
Configure Apollo? [no]:
Configure bridging? [no]:
```

Step 25 Configure the asynchronous serial lines for the integrated modems on the modules installed in the access server. (If you want to allow users to dial in through the integrated modems, you must configure the async lines.)

```
Async lines accept incoming modems calls. If you will have users dialing in via
    modems, configure these lines.

Configure Async lines? [yes]:
  Async line speed [115200]:
```

Note We recommend that you do not change this speed for modems. However, for V.110 terminal adapters, we recommend that the speed not go above 19200.

```
Will you be using the modems for inbound dialing? [yes]:
```

Note If your asynchronous interfaces will be using the same basic configuration parameters, we recommend that you group them so that they can be configured as a group. Otherwise, you will need to configure each interface separately.

```
Would you like to configure group async interface? [yes]:
```

Note Dynamic IP addresses permit dial-in users to choose a static IP address when they dial in. If you do not allow dynamic IP addresses, the access server will provide IP addresses from an IP address pool that you set up later in the next prompt.

```
Configure for Dynamic IP addresses? [no]:
Configure for TCP header compression? [yes]:
Configure for routing updates on async links? [no]:
```

Note Make sure the starting and ending addresses of the IP pool are in the same subnet.

```
Enter the starting address of IP local pool? [X.X.X.X]: 172.20.30.40
Enter the ending address of IP local pool? [X.X.X.X]: 172.20.30.88
What is the username of the test user? [user]:
What is the password of the test user? [passwd]:
Will you be using the modems for outbound dialing? [no]:
Configure for Async IPX? [yes]: no
Configure for Appletalk Remote Access (ARA)? [no]: yes
  AppleTalk Network for ARAP clients [1]:
  Zone name for ARAP clients [ARA Dialins]:
  Allow ARAP "Guest" logins? [yes/no]: yes
```

Step 26 Configure the Ethernet 0 LAN interface:

```
Configuring interface Ethernet0:
  Is this interface in use? [yes]:
Configure IP on this interface? [yes]:
  IP address for this interface: 172.21.40.10
```

The next prompts ask about the number of bits in the **host** portion of the subnet mask.

```
Number of bits in subnet field [0]:
  Class B network is 172.21.0.0, 0 subnet bits; mask is /16
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]:
  AppleTalk network number [0]: 10
  AppleTalk zone name [myzone]: etherzone
Configure IPX on this interface? [no]: yes
  IPX network number [1]:
```

Step 27 Configure the Fast Ethernet 0 interface:

```
Configuring interface FastEthernet0:
Is this interface in use? [yes]:
```

Note Full duplex mode enables simultaneous data transfer between a sending and a receiving station.

```
Operate in full-duplex mode? [no]: yes
Operate at 100 Mbps speed? [yes]: yes
Configure IP on this interface? [yes]:
  IP address for this interface: 172.22.50.10
```

The next prompts ask about the number of bits in the **host** portion of the subnet mask.

```
Number of bits in subnet field [0]:
  Class B network is 172.22.0.0, 0 subnet bits; mask is /16
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]:
Configure IPX on this interface? [no]: yes
  IPX network number [2]:
```

Note If your access server is using a T1/PRI card, continue with the section “Continuing the Setup Script for T1/PRI Cards” and if your access server is using a E1/PRI card, continue with the section “Continuing the Setup Script for E1/PRI Cards.”

Continuing the Setup Script for T1/PRI Cards

This section continues the setup script for T1/PRI cards.

Step 1 Enter the letter corresponding to the ISDN switch type that matches your telco switch type:

```
Do you want to configure ISDN switch type? [yes]:
  The following ISDN switch types are available:
   [a] primary-4ess
   [b] primary-5ess
   [c] primary-dms100
   [d] primary-net5
   [e] primary-ntt
   [f] primary-ts014
  Enter the switch type [b]:
```

Step 2 Press **Enter** to allow users to dial in via ISDN or analog modems:

```
Next, you will be prompted to configure controllers.
These controllers enable users to dial in via ISDN or analog modems.

Do you intend to allow users to dial in? [yes]:

There are 4 controllers on this access server. If you want to use
the full capacity of the access server configure all controllers.

Controller T1 0,1,..etc  in software corresponds to Port 0,1,..etc
on the back of the access server.

PRI configuration can be configured to controllers all at once
based on your PRI controllers selection. Where as CAS configuration
will be configured individually for each controller.
```

Step 3 Enter the number of controllers you will be using for the PRI configuration:

```
Enter # of controllers, you will be using for PRI configuration [4]:

  Configuring controller parameters:

  Configuring controller T1 0:
  Configuring PRI on this controller.
  Configuring controller T1 1:
  Configuring PRI on this controller.
```

Step 4 Set the CAS configuration options for the first controller you are configuring. First, enter **yes** to set robbed-bit signaling on the controller:

```
Configuring controller T1 2:
  Will you be using CT1 (robbed bit signaling) on this controller? [yes]:
```

Step 5 Enter your telco framing type:

```
The following framing types are available: esf | sf
  Enter the framing type [esf]:
```

Step 6 Enter your telco line code type:

```
The following linecode types are available: ami | b8zs
  Enter the line code type [b8zs]:
```

Step 7 Enter the letter corresponding to the signaling type to support modem pooling over the T1 lines:

```
The following line signaling types are available:
    [a] e&m-fgb
    [b] e&m-fgd
    [c] e&m-immediate-start
    [d] fxs-ground-start
    [e] fxs-loop-start
    [f] sas-ground-start
    [g] sas-loop-start
  Enter the line signaling type [a]:
```

Step 8 Enter the tone signaling type:

```
The following tone signaling types are available: dtmf | mf
  Enter the tone signal type [dtmf]:
```

Step 9 Press **Enter** to configure digital number identification service (DNIS) over T1 lines:

```
Do you want to provision DNIS address information? [yes]:
```

Step 10 Set the CAS configuration options for the next controller you are configuring.

```
Configuring controller T1 3:
  Will you be using CT1 (robbed bit signaling) on this controller? [yes]:

The following framing types are available: esf | sf
  Enter the framing type [esf]:

The following linecode types are available: ami | b8zs
  Enter the line code type [b8zs]:

The following line signaling types are available:
    [a] e&m-fgb
    [b] e&m-fgd
    [c] e&m-immediate-start
    [d] fxs-ground-start
    [e] fxs-loop-start
    [f] sas-ground-start
    [g] sas-loop-start
  Enter the line signaling type [a]: b
```

After you complete the configuration script, messages similar to the following appear:

```
Current configuration:
version 11.3
no service password-encryption
!
hostname Router
!
enable secret 5 $1$BzCj$3WnJoC.GO0SmB2U7Bd.Kb1
enable password b
!
no ip routing
isdn switch-type primary-5ess
!
!
controller T1 0
  framing esf
  clock source line primary
  linecode b8zs
  pri-group timeslots 1-24
!
controller T1 1
  framing esf
  clock source line secondary
  linecode b8zs
  pri-group timeslots 1-24
!
controller T1 2
  framing esf
  clock source internal
  linecode b8zs
  cas-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
!
controller T1 3
  framing esf
  clock source internal
  linecode b8zs
  cas-group 0 timeslots 1-24 type e&m-fgd
!
interface Ethernet0
  no ip address
  no ip route-cache
  shutdown
!
interface Serial0:23
  ip unnumbered Ethernet0
  encapsulation ppp
  no ip mroute-cache
  dialer-group 1
  isdn incoming-voice modem
  peer default ip address pool setup_pool
  ppp authentication chap pap
  ppp multilink
!
interface Serial1:23
  ip unnumbered Ethernet0
  encapsulation ppp
  no ip mroute-cache
  dialer-group 1
  isdn incoming-voice modem
  peer default ip address pool setup_pool
  ppp authentication chap pap
  ppp multilink
!
interface FastEthernet0
  no ip address
  no ip route-cache
  shutdown
!
ip classless
access-list 101 permit ip any any
dialer-list 1 protocol ip list 101
!
line con 0
  logging synchronous
line 1 48
line aux 0
line vty 0 4
  password b
  login
!
scheduler interval 1000
end
```

Step 11 Enter **yes** to save the configuration, or enter **no** to erase it:

```
Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.


Press RETURN to get started!


%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to down
%LINK-3-UPDOWN: Interface Serial1, changed state to down

<Additional messages omitted.>
```

Step 12 When the messages stop displaying on your screen, press **Enter** to get the following prompt:

```
5300>
%AT-6-ONLYROUTER: Ethernet0: AppleTalk port enabled; no neighbors found
```

Note If you see this message, it means that no other AppleTalk routers were found on the network attached to the port.

The `5300>` prompt indicates that you are now at the command-line interface (CLI) and you have just completed the basic access server configuration. However, this is not a complete configuration. At this point you have two options:

- Run the setup script in the System Configuration dialog again and create another configuration. Enter the following commands to repeat the setup script:

  ```
  5300> enable
  Password: <password>
  5300# setup
  ```

- Modify the existing configuration or configure additional features with the CLI as described in the earlier chapters in this guide, the *Dial Solutions Configuration Guide*, the *Dial Solutions Command Reference Guide*, the Cisco IOS software configuration guide, and the command reference publications.

Continuing the Setup Script for E1/PRI Cards

This section continues the setup script for E1/PRI cards.

Step 1 Enter the letter corresponding to the ISDN switch type that matches your telco switch type:

```
Do you want to configure ISDN switch type? [yes]:
  The following ISDN switch types are available:
    [a] primary-4ess
    [b] primary-5ess
    [c] primary-dms100
    [d] primary-net5
    [e] primary-ntt
    [f] primary-ts014
  Enter the switch type [d]:
```

Step 2 Press **Enter** to allow users to dial in via ISDN or analog modems:

```
Next, you will be prompted to configure controllers.
These controllers enable users to dial in via ISDN or analog modems.

Do you intend to allow users to dial in? [yes]:

There are 4 controllers on this access server. If you want to use
the full capacity of the access server configure all controllers.

Controller E1 0,1,..etc  in software corresponds to Port 0,1,..etc
on the back of the access server.

PRI configuration can be configured to controllers all at once
based on your PRI controllers selection. Where as CAS configuration
will be configured individually for each controller.
```

Step 3 Enter the number of controllers you will be using for the PRI configuration:

```
Enter # of controllers, you will be using for PRI configuration [4]: 1

Configuring controller parameters:

Configuring controller E1 0:
Configuring PRI on this controller.
```

Step 4 Set the CAS configuration options for the first controller you are configuring. First, enter **yes** to set channel-associated signaling on the controller:

```
Configuring controller E1 1:
Will you be using CE1 (channel associated signaling) on this controller? [yes]:
```

Step 5 Enter your telco’s framing type.

```
The following framing types are available: no-crc4 | crc4
  Enter the framing type [crc4]:
```

Step 6 Enter your telco line code type:

```
The following linecode types are available: ami | hdb3
  Enter the line code type [hdb3]:
```

Step 7 Enter the letter corresponding to the signaling type to support modem pooling over the E1 lines:

```
The following line signaling types are available:
  [a] e&m-fgb
  [b] e&m-fgd
  [c] e&m-immediate-start
  [d] fxs-ground-start
  [e] fxs-loop-start
  [f] sas-ground-start
  [g] sas-loop-start
  [h] r2-analog
  [i] r2-digital
  [j] r2-pulse
  [k] p7
Enter the line signaling type [i]:
```

Step 8 Enter the letter corresponding to the tone signaling type:

```
The following tone signaling types are available:
  [a] dtmf
  [b] r2-compelled
  [c] r2-non-compelled
  [d] r2-semi-compelled
Enter the tone signaling type [b]:
```

Step 9 Press **Enter** to provision ANI address information over E1 lines:

```
Do you want to provision ANI address information? [yes]:
```

Step 10 Enter the number corresponding to the country for which you are configuring R2 signaling:

```
R2 signaling is available for the following countries:
  [0] itu
  [1] argentina
  [2] australia
  [3] brazil
  [4] china
  [5] columbia
  [6] costarica
  [7] easteurope
  [8] ecuador itu
  [9] ecuador lme
  [10] greece
  [11] guatemala
  [12] hongkong-china
  [13] indonesia
  [14] israel
  [15] korea
  [16] malaysia
  [17] newzealand
  [18] paraguay
  [19] peru
  [20] philippines
  [21] singapore
  [22] saudiarabia
  [23] southafrica-panaftel
  [24] telmex
  [25] telnor
  [26] thailand
  [27] uruguay
  [28] venezuela
  [29] vietnam
  Enter the country name [0]:
```

Step 11 Set the CAS configuration options for the next controller you are configuring. Repeat Step 4 to Step 10 to configure the options:

```
Configuring controller E1 2:
Will you be using CE1 (channel associated signaling) on this controller? [yes]:

The following framing types are available: no-crc4 | crc4
  Enter the framing type [crc4]:

The following linecode types are available: ami | hdb3
  Enter the line code type [hdb3]:

The following line signaling types are available:
  [a] e&m-fgb
  [b] e&m-fgd
  [c] e&m-immediate-start
  [d] fxs-ground-start
  [e] fxs-loop-start
  [f] sas-ground-start
  [g] sas-loop-start
  [h] r2-analog
  [i] r2-digital
  [j] r2-pulse
  [k] p7
  Enter the line signaling type [i]: h

The following tone signaling types are available:
  [a] dtmf
  [b] r2-compelled
  [c] r2-non-compelled
  [d] r2-semi-compelled
  Enter the tone signaling type [b]: c

Do you want to provision ANI address information? [yes]: no

R2 signaling is available for the following countries:
  [0] itu
  [1] argentina
  [2] australia
  [3] brazil
  [4] china
  [5] columbia
  [6] costarica
  [7] easteurope
  [8] ecuador itu
  [9] ecuador lme
  [10] greece
  [11] guatemala
  [12] hongkong-china
  [13] indonesia
  [14] israel
  [15] korea
  [16] malaysia
  [17] newzealand
  [18] paraguay
  [19] peru
  [20] philippines
  [21] singapore
  [22] saudiarabia
  [23] southafrica-panaftel
  [24] telmex
  [25] telnor
  [26] thailand
  [27] uruguay
  [28] venezuela
  [29] vietnam

  Enter the country name [0]: 15

Configuring controller E1 3:
Will you be using CE1 (channel associated signaling) on this controller? [yes]:

The following framing types are available: no-crc4 | crc4
  Enter the framing type [crc4]:

The following linecode types are available: ami | hdb3
  Enter the line code type [hdb3]:

The following line signaling types are available:
  [a] e&m-fgb
  [b] e&m-fgd
  [c] e&m-immediate-start
  [d] fxs-ground-start
  [e] fxs-loop-start
  [f] sas-ground-start
  [g] sas-loop-start
  [h] r2-analog
  [i] r2-digital
  [j] r2-pulse
  [k] p7
  Enter the line signaling type [i]: j

The following tone signaling types are available:
  [a] dtmf
  [b] r2-compelled
  [c] r2-non-compelled
  [d] r2-semi-compelled
  Enter the tone signaling type [b]: d

Do you want to provision ANI address information? [yes]:

R2 signaling is available for the following countries:
  [0] itu
  [1] argentina
  [2] australia
  [3] brazil
  [4] china
  [5] columbia
  [6] costarica
  [7] easteurope
  [8] ecuador itu
  [9] ecuador lme
  [10] greece
  [11] guatemala
  [12] hongkong-china
  [13] indonesia
  [14] israel
  [15] korea
  [16] malaysia
  [17] newzealand
  [18] paraguay
  [19] peru
  [20] philippines
  [21] singapore
  [22] saudiarabia
  [23] southafrica-panaftel
  [24] telmex
  [25] telnor
  [26] thailand
  [27] uruguay
  [28] venezuela
  [29] vietnam
  Enter the country name [0]: 16
```

After you complete the configuration script, messages similar to the following appear.

```
5300# wr t
Building configuration...

Current configuration:
!
version 11.3
no service password-encryption
!
hostname Router
!
```

```
enable secret 5 $1$R20d$Yh/u1cqh63haVfbmHI0r.0
enable password b
!
no ip routing
isdn switch-type primary-net5
!
controller E1 0
clock source line primary
pri-group timeslots 1-31
!
controller E1 1
clock source line secondary
cas-group 0 timeslots 1-15,17-31 type r2-digital r2-compelled ani
cas-custom 0
!
controller E1 2
clock source internal
cas-group 0 timeslots 1-15,17-31 type r2-analog r2-non-compelled
cas-custom 0
country telmex use-defaults
category 2
answer-signal group-b 1
!
controller E1 3
clock source internal
cas-group 0 timeslots 1-15,17-31 type r2-pulse r2-semi-compelled ani
cas-custom 0
country telnor use-defaults
category 2
answer-signal group-b 1
!
interface Ethernet0
no ip address
no ip route-cache
shutdown
!
interface Serial0:15
ip unnumbered Ethernet0
encapsulation ppp
no ip mroute-cache
dialer-group 1
isdn incoming-voice modem
peer default ip address pool setup_pool
ppp authentication chap pap
ppp multilink
!
interface FastEthernet0
no ip address
no ip route-cache
shutdown
!
ip classless
access-list 101 permit ip any any
dialer-list 1 protocol ip list 101
!
line con 0
logging synchronous
line 1 96
line aux 0
line vty 0 4
password b
login
!
scheduler interval 1000
end
```

Step 12 Enter **yes** to save the configuration, or enter **no** to erase it:

```
Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!

%LINK-3-UPDOWN: Interface Ethernet0, changed state to up
%LINK-3-UPDOWN: Interface Serial0, changed state to down
%LINK-3-UPDOWN: Interface Serial1, changed state to down

<Additional messages omitted.>
```

Step 13 When the messages stop displaying on your screen, press **Enter** to get the following prompt:

```
5300>
%AT-6-ONLYROUTER: Ethernet0: AppleTalk port enabled; no neighbors found
```

Note If you see this message, it means that no other AppleTalk routers were found on the network attached to the port.

Step 14 The `5300>` prompt indicates that you are now at the command-line interface (CLI) and you have just completed the basic access server configuration. However, this is not a complete configuration. At this point you have two options:

- Run the setup script in the System Configuration dialog again and create another configuration. Enter the following commands to repeat the setup script:

  ```
  5300> enable
  Password: <password>
  5300# setup
  ```

- Modify the existing configuration or configure additional features with the CLI as described in the chapter "Basic Configuration," *Dial Solutions Guide*, Cisco IOS software configuration guide and command reference publications.

Where to Go Next

At this point you can proceed to:

- The chapter "Using Cisco IOS Software" to learn how to use the CLI to configure additional features.
- The chapter "Access Service Security" to configure security on the access server.
- The *Dial Solutions Guide*, 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 access server, on the World Wide Web from Cisco's home page, or you can order printed copies.

Upgrade VoIP Software

As Cisco revises its Voice feature card software, you can download these upgrades from Cisco. Use the steps in this section to upgrade your Voice feature card software.

Before downloading a new version of VCware, be sure to verify that the version of VCware is compatible with the specific release of Cisco IOS software already running on the access server. A compatibility matrix is posted on CCO's Software Center.

Note In certain countries, use of these products or provision of voice telephony over the Internet may be prohibited and/or subject to laws, regulations or licenses, including requirements applicable to the use of the products under telecommunications and other laws and regulations; customer must comply with all such applicable laws in the country(ies) where customer intends to use the product.

This chapter includes the following sections:

- Upgrading VoIP Feature Card Firmware
- New Hardware Features

Upgrading VoIP Feature Card Firmware

To download software to your VFC, you need to:

- Determine the number of VFC cards in the system.
- Check to see that the version of VFC ROM Monitor software is compatible with your installed Cisco IOS image. VFC ROM version 1.2 requires Cisco IOS image 0.14.1 (1.6 NA1) or later. VFC ROM Monitor version 1.2 can be made to work with Cisco IOS image 0.13 (or later) by appending the suffix ".VCW" to the VCWare image stored in VFC Flash memory.
- Determine whether the VFC is in VCWare mode or ROM Monitor mode. This determines how you download software to the VFC.
- Download the software using the appropriate procedure.

Determine the number of VFC cards

To determine the number of VFC in the system and what slot they are on, perform the following task in privileged EXEC (enable) mode:

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode.
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`show vfc 0 board`**
	`show vfc 1 board`
	`show vfc 1 board`
	`5300#`
		Use the procedures in this section to upgrade the software for each card in the system that needs to be updated.

Identify the VFC ROM Monitor Version

To identify the VFC ROM Monitor software version, perform the following task in privileged EXEC (enable) mode:

Step	Command	Purpose

1	`5300>` **`enable`**
	`Password: <`*`password`*`>`
	`5300#`
		Enter enable mode.
		Enter the password.
		You have entered enable mode when the prompt changes to `5300#`.

2	`5300#` **`show vfc`** *`slot_number`*
	`version vcware`
	`5300#`
		Show the VFC ROM Monitor version your selected voice card is running.

Identify the VFC/ROM Monitor Mode

To identify the VFC/ROM Monitor software version, perform the following task in privileged EXEC (enable) mode:

Step	Command	Purpose
1	5300> **enable** Password: *<password>* 5300#	Enter enable mode. Enter the password. You have entered enable mode when the prompt changes to 5300#.
3	5300# **show vfc** *slot_number* [VCWARE running | ROMMON] **board** 5300#	Shows whether your selected voice card is running in VCWare mode or in ROM Monitor mode.

After you have determined in which mode your voice card is running, go to one of the following procedures:

- "Download Software in VCWare Mode", if your voice card is running in VCWare mode.
- "Download Software in ROM Monitor Mode", if your voice card is running in ROM Monitor mode.

Download Software in VCWare Mode

Use the steps in the following table to download new voice software if your voice card is running in VCWare mode from a floppy diskette. To do so, first copy the software *from* the floppy diskette *to* a TFTP server. After the software is on the TFTP server, begin the steps in the following Configure section.

Configure

Step	Command	Purpose
1	5300# **erase vfc** *slot_number* This will erase the contents of VFC Flash. Continue ?[y/n]:**yes** This will take some time. Please, wait...vfc	Erase the contents of the VFC Flash in the selected voice card.
2	5300# **show vfc** *slot_number* **directory**	Verify that the VFC Flash memory is empty.
3	5300# **copy tftp: vfc:** Voice card slot number <slot ? 1> Address or name of remote host [UNKNOWN]? 223.255.212.244 Source file name? vcware.vcw Destination file name [vcware.vcw]? **vcware.vcw** ! note, the destination filename is *IMPORTANT* Accessing file 'vcware.VCW' on 223.255.212.244... Loading vcware.vcw from 223.255.212.244 (via Ethernet0):	Use TFTP to download the new images to VFC flash memory. **Note** If the VFC ROM version is 1.1 the image name must *end* with the extension ".VCW" (all uppercase). If the VFC ROM is version 1.2, the image name must *begin* with "vcw-" (all lowercase) and no other character can be in front of the "vcw-", so no directory path should be prepended to the image name.
4	5300> **clear vfc** *slot_number*	Reboot the voice feature card so you can add the new VCWare image into the voice card.

Step	Command	Purpose
5	5300> **enable** Password: <*password*> 5300#	Re-enter enable mode. Enter the password. You have entered enable mode when the prompt changes to 5300#.
6	5300# **show vfc** *slot_number* **board** 5300#	Check to see if the VFC is back up in VCWare mode.
7	5300# **show vfc** *slot_number* **directory** 5300#	Verify that VCWare is in the VFC Flash.
8	5300# **unbundle vfc** *slot_number*	Unbundle the DSPWare from the VCWare and configure the default file list and the capability list.
9	5300# **show vfc** *slot_number* **directory** 5300#	Verify that the DSPWare has been unbundled.
10	5300# **show vfc** *slot_number* **default-list** 5300#	Verify that the default file list has been populated.
11	5300# **show vfc** *slot_number* **cap-list** 5300#	Verify that the capability list has been populated.

After you have completed the preceding tasks, reboot the Cisco AS5300 for these changes to take effect.

Verify

To check that you have successfully downloaded the software:

- Run the **show vfc** *slot_number* **directory** command to verify that the VCWare is in the Flash memory. Only one filename should appear. If this command times out, start over with "Determine the number of VFC cards".

```
5300# show vfc 1 dir

Files in slot 1 VFC flash:
    File Name               Size (Bytes)
1.  vcware.VCW              291292
```

- Run the **show vfc** *slot_number* **default-list** and **show vfc** *slot_number* **cap-list** commands to verify that the DSPWare has been unbundled and the default-list and cap-list have been initialized.

```
5300# show vfc 1 default-list
% Invalid input detected at '^' marker.


5300# show vfc 1 cap-list

Capability List for VFC in slot 1:

1. fax-vfc-l.0.13.0.bin
2. bas-vfc-l.0.13.0.bin
3. cdc-g729-l.0.13.0.bin
4. cdc-g711-l.0.13.0.bin

5300#
```

Tips

If you are having trouble downloading the voice feature card software in VCWare mode, try the following:

- Run the **show vfc** *slot_number* **board** command to verify that the voice feature card is back up in VCWare mode.

```
5300# show vfc 1 board
VFC board state is UP, vfc status VCWARE running(0x4)
VFC board in slot 1 with 18 dsps
5300#
```

- Determine if the VFC ROM version you are running is 1.1 or version1.2.

After you have completed the preceding tasks, reboot the Cisco AS5300 for these changes to take effect.

Download Software in ROM Monitor Mode

Use the steps in the following table to download new voice software if your voice card is running in ROM Monitor mode from a floppy diskette. To do so, first copy the software *from* the floppy diskette *to* a TFTP server. After the software is on the TFTP server, begin the steps in the following Configure section.

Configure

Step	Command	Purpose
1	5300# **clear vfc** *slot_number* **purge** clear vfc <slot# cons flash erase	Erase the contents of the VFC Flash in the selected voice card. This may take awhile.
2	5300# **copy tftp: vfc:** Voice card slot number <slot ? 1> Address or name of remote host [UNKNOWN]? 223.255.212.244 Source file name? vcware.vcw Destination file name [vcware.vcw]? **vcware.vcw** ! note, the destination filename is *IMPORTANT* Accessing file 'vcware.vcw' on 223.255.212.244... Loading vcware.vcw from 223.255.212.244 (via Ethernet0): !!! [OK - 291292/291328 bytes] [OK - 291292/291292 bytes]	Use TFTP to download the new images to VFC Flash memory. **Note** If the VFC ROM version is 1.1 the image name must *end* with the extension ".VCW" (all uppercase). If the VFC ROM is version 1.2, the image name must *begin* with "vcw-" (all lowercase) and no other character can be in front of the "vcw-", so no directory path should be prepended to the image name.
3	5300> **clear vfc** *slot_number*	Reboot the voice feature card so you can add the new VCWare image into the voice card.
4	5300> **enable** Password: <*password*> 5300#	Re-enter enable mode. Enter the password. You have entered enable mode when the prompt changes to 5300#.
5	5300# **show vfc** *slot_number* **board** 5300#	Check to see if the VFC is back up in ROM monitor mode.
6	5300# **show vfc** *slot_number* **directory** 5300#	Verify that VCWare is in the VFC Flash.

Step	Command	Purpose
7	`5300#` **`unbundle vfc`** *`slot_number`*	Unbundle the DSPWare from the VCWare and configure the default file list and the capability list.

8	`5300#` **`show vfc`** *`slot_number`* **`directory`**
	`5300#`
		Verify that the DSPWare has been unbundled.

9	`5300#` **`show vfc`** *`slot_number`* **`default-list`**
	`5300#`
		Verify that the default file list has been populated.

10	`5300#` **`show vfc`** *`slot_number`* **`cap-list`**
	`5300#`
		Verify that the capability list has been populated.

After you have completed the preceding tasks, reboot the Cisco AS5300 for these changes to take effect.

Verify

To check that you have successfully downloaded the software:

- Run the **show vfc** *slot_number* **directory** command to verify that the VCWare is in the Flash memory. Only one filename should appear. If this command times out, start over with “Determine the number of VFC cards”.

```
5300# show vfc 1 dir

Files in slot 1 VFC flash:
    File Name               Size (Bytes)
1.  vcware.vcw              291292
```

- Run the **show vfc** *slot_number* **default-list** and **show vfc** *slot_number* **cap-list** commands to verify that the DSPWare has been unbundled and the default-list and cap-list have been initialized.

```
5300# show vfc 1 default-list
% Invalid input detected at '^' marker.


5300# show vfc 1 cap-list

Capability List for VFC in slot 1:

1. fax-vfc-l.0.13.0.bin
2. bas-vfc-l.0.13.0.bin
3. cdc-g729-l.0.13.0.bin
4. cdc-g711-l.0.13.0.bin

5300#
```

Tips

If you are having trouble downloading the voice feature card software in ROM Monitor mode, try the following:

- Run the **show vfc** *slot_number* **board** command to verify that the voice feature card is back up in VCWare mode.

```
5300# show vfc 1 board
VFC board state is UP, vfc status VCWARE running(0x4)
VFC board in slot 1 with 18 dsps
5300#
```

- Determine if the VFC ROM version you are running is 1.1 or version1.2.

New Hardware Features

Hardware features available after the release of this document can be found at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/5300/5300cfg/index.htm

INDEX