

# Configuring Dial-on-Demand Routing

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This chapter describes how to configure your communication server for dial-on-demand routing (DDR) and dial backup. For a complete description of the commands mentioned in this chapter, refer to the “Dial-on-Demand Routing Commands” chapter in the *Access and Communication Servers Command Reference* publication. For historical background and a technical overview of DDR, see the *Internetworking Technology Overview* publication.

## Cisco’s Implementation of Dial Backup and DDR

Dial backup provides protection against WAN downtime by allowing you to configure a backup serial line circuit-switched connection. Dial backup software keeps the secondary line inactive (data terminal ready [DTR] inactive) until one of the following conditions is met:

- The primary line goes down.
- The transmitted traffic load on the primary line exceeds a defined limit.

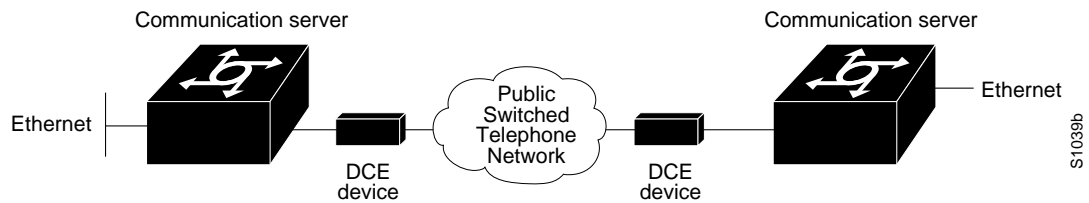
The secondary line and these conditions are defined using the **backup interface**, **backup load**, and **backup delay** interface configuration commands.

When the software detects a lost Carrier Detect signal from the primary line device or finds that the line protocol is down, it activates DTR on the secondary line. At that time, the data communications equipment (DCE) must be set to dial the remote site. When the connection is made, the routing protocol defined for the serial line will take over the task of transmitting traffic over the dialup line.

DDR provides network connections across the Public Switched Telephone Network (PSTN). Traditionally, networks have been interconnected using dedicated lines for wide-area network (WAN) connections. With DDR, you can use modems, Integrated Service Data Network (ISDN) terminal adapters (TAs), or integrated ISDN capabilities to establish low-volume, periodic network connections over public circuit-switched networks. You can also establish dial-up connections over X.25 or Frame Relay packet-switched networks by using LAPB, X.25, or Frame Relay encapsulations.

Figure 7-1 illustrates a typical DDR interconnection configuration.

Figure 7-1 Dial-on-Demand Routing Interconnection



## Placing Calls Using DDR

On the communication server, DDR places calls using the following two methods:

- Chat scripts for asynchronous interfaces
- V.25bis for synchronous interfaces

### Chat Scripts on Asynchronous Interfaces

On asynchronous lines, our communication servers support chat scripts used to send commands for modem dialing and logging on to remote systems. To dial a call on an asynchronous line, a chat script must be defined. If multiple chat scripts are defined, regular expressions are used for powerful pattern matching to select between many scripts. Refer to the appendix “Regular Expressions” in the *Access and Communication Servers Command Reference* publication for information about regular expressions.

A *chat script* is a string of text that defines the login “conversation” that occurs between two systems. It consists of expect-send pairs, which define the string the local system expects to receive from the remote system and what the local system should send as a reply.

### V.25bis over Synchronous Interfaces

Our communication servers support connections from the synchronous serial interface to any DCE device that supports V.25bis. V.25bis is an ITU-T recommendation for initiating calls using in-band signaling. Depending on the type of modem or CSU/DSU you are using, ITU-T V.25bis options might be supported.

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**Note** The ITU-T carries out the functions of the former Consultative Committee for International Telegraph and Telephone (CCITT).

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The V.25bis specification describes two modes of establishing or receiving calls: the *direct call mode* and the *addressed call mode*. Communication servers support connections using the addressed call mode and synchronous, bit-oriented operation. The addressed call mode allows control signals and commands to be sent over the DCE data interface to establish and terminate calls. These commands are packaged in High-Level Data Link Control (HDLC) synchronous data frames.

Devices used by the communication server for dialing out must support certain hardware signals in addition to V.25bis. When the communication server drops DTR, the device must disconnect any calls that are currently connected. When the device connects to the remote end, Data Carrier Detect (DCD) must be automatically asserted.

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**Note** For many V.25bis devices, raised DCD requires a special cable to crossover DCD and Data Set Ready (DSR) signals, because the V.25bis specification requires DSR to be raised when a connection is established.

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Table 7-1 lists V.25bis options. The V.25bis options are supported in the dial string (telephone number) only if you have enabled DDR using the **dialer in-band** command. The functions of these options are nation-specific, and they might have different implementations in your country. Refer to your modem manual for a list of supported options.

**Table 7-1** ITU-T V.25bis Options

Option	Description
:	Wait tone.
<	Pause. Usage and duration of this parameter vary by country.
=	Separator 3. For national use.
>	Separator 4. For national use.
<b>P</b>	Dialing to be continued in pulse mode. Optionally accepted parameter.
<b>T</b>	Tone. (Dialing to be continued in Dual Tone Multifrequency, DTMF mode.) Optionally accepted parameter.
<b>&amp;</b>	Flash. (The flash duration varies by country.) Optionally accepted parameter.

Our communication servers support connections over serial lines connected by non-V.25bis modems, using EIA signaling (DTR) only.

## Controlling Access for DDR

DDR supports a variety of security and access control methods including the following:

- Dialer access lists and dialer access groups—Based on the access lists configured, access groups control access for dial-on-demand routing.

Packets that are permitted entry according to the access list are identified as “interesting” or “packets of interest.” Packets that are not permitted entry or are denied entry by an access list are deemed “uninteresting.”

A communication server activates the dial-on-demand feature when it receives an interesting packet destined for a location that can be reached over a dialed connection through a PSTN. After the communication server dials the destination phone number and establishes a connection, packets can be transmitted. When the transmission is complete, after a configured period of line time during which there is no interesting traffic on the line, the line is automatically disconnected.

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**Note** TCP/IP routing protocols IS-IS, BGP, and OSPF are not recommended with DDR because they require an acknowledgment for routing updates. Because DDR lines are brought up as needed, DDR will not necessarily be active and available to send responses at the times the updates are sent.

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- Address mapping—Interfaces can be configured to map a next hop address to a phone number. This allows the communication server to forward packets to the correct destinations, and to determine if a connection is already established to that destination.
- CHAP—Access control using Challenge Handshake Authentication Protocol (CHAP) can be configured on serial interfaces that have PPP encapsulation enabled. CHAP reduces the risk of security violations on your communication server. CHAP also serves a method to identify incoming calls.

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**Note** Access lists must be defined before you can use DDR. If there are no access lists defined, access is implicitly denied. Refer to the IP chapter in this manual for information about the IP access lists with the **tcp** keyword specified and the IPX chapter for information about the IPX access lists.

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## Dial Backup Configuration Task List

You must first decide whether you want to backup when the primary line goes down, when traffic load on the primary line exceeds the defined threshold, or both. The tasks you perform depend on your decision. Perform one or more of the following tasks to configure dial backup:

- Select Backup Line
- Define the Traffic Load Threshold
- Define Backup Line Delays

### Select Backup Line

To configure dial backup, set a secondary serial interface as a backup to a primary serial interface. An external DCE device such as a modem, attached to a circuit-switched service, must be connected to the secondary serial interface. The external device must be capable of responding to a DTR signal (DTR active) by auto-dialing a connection to a preconfigured remote site.

To select a backup line, perform the following task in interface configuration mode:

Task	Command
Select a backup line.	<b>backup interface</b> <i>type number</i>

The interface specified in the **backup interface** command can only backup one interface. For an example of selecting a backup line, see “Dial Backup Example” at the end of this chapter.

### Define the Traffic Load Threshold

You can configure dial backup to activate the secondary line based on the traffic load on the primary line. The software monitors the traffic load and computes a five-minute moving average. If this average exceeds the value you set for the line, the secondary line is activated and, depending upon how the line is configured, some or all of the traffic will flow onto the secondary dialup line.

To define how much traffic should be handled at one time on an interface, perform the following task in interface configuration mode:

Task	Command
Define the traffic load threshold as a percentage of the primary line's available bandwidth.	<b>backup load</b> { <i>enable-threshold</i>   <b>never</b> } { <i>disable-load</i>   <b>never</b> }

## Define Backup Line Delays

You can configure a value that defines how much time should elapse before a secondary line status changes after a primary line status changed. This means you can define two delays:

- A delay that apply after the primary line goes down but before the secondary line is activated
- A delay that applies after the primary line goes up but before the secondary line is activated

To define these delays, perform the following task in interface configuration mode:

Task	Command
Define backup line delays.	<b>backup delay</b> { <i>enable-delay</i>   <b>never</b> } { <i>disable-delay</i>   <b>never</b> }

For an example of how to define backup line delays, see “Dial Backup Example” at the end of this chapter.

## DDR Configuration Task List

Before you configure the asynchronous interface to support DDR, configure the line as follows:

- Specify line speed
- Set flow control, if any
- Specify your modem type

Refer to the chapter “Configuring Terminal Lines and Modem Support” for more information about setting line speed, flow control, and modem type.

One of the following three tasks is required to configure your communication server for dial-on-demand routing:

- Configure an Interface to Place Calls
- Configure a Dialer Hold Queue
- Configure an Interface to Receive Calls
- Configure an Interface to Place and Receive Calls

The following are optional tasks to customize, enhance, and monitor DDR:

- Configure Snapshot Routing
- Configure Snapshot Routing
- Customize the DDR Network
- Configure DDR over Frame Relay
- Configure DDR over LAPB

- Configure DDR over X.25
- Configure DDR for Routed Protocols
- Configure DDR for IPX
- Monitor DDR Connections

The following sections describe these tasks. See the “DDR Configuration Examples” section later in this chapter for an idea of how to configure DDR on your network.

## Configure an Interface to Place Calls

The following tasks are required to configure a single interface, multiple interfaces, or dialer rotary groups to place calls:

- Step 1** Create chat scripts (for asynchronous interfaces only; refer to “Configure Chat Scripts for Asynchronous Lines” in the chapter “Configuring Terminal Lines and Modem Support”).
- Step 2** Specify a chat script for a line (asynchronous).
- Step 3** Configure to call a single site or multiple sites.

## Configure a Dialer Hold Queue

Sometimes packets destined for a remote communication server are discarded because no connection exists. Establishing a connection using an analog modem can take time, during which packets are discarded. However, creating a dialer hold queue will allow out-going packets to be queued and sent as soon as the modem connection is established.

A dialer hold queue can be configured on any type of dialer, including in-band synchronous, asynchronous, and DTR, dialers. Also, hunt group leaders can be configured with a dialer hold queue. If a hunt group leader (of a rotary dialing group) is configured with a hold queue, all members of the group will be configured with a dialer hold queue and no individual member’s hold queue can be altered.

To establish a dialer hold queue, perform the following task in interface configuration mode:

Task	Command
Create a dialer hold queue and specify the number of packets to be held in it.	<b>dialer hold-queue</b> <i>packets</i>

As many as 100 packets can be held in an out-going dialer hold queue.

## Create Chat Scripts for Asynchronous Interfaces

After a chat script has been defined as described in the “Configuring Terminal Lines and Modem Support” chapter of this publication, it must be applied to a line or an interface before it can be used. To specify a chat script for a line, perform the following task in line configuration mode:

Task	Command
Specify a modem script for a line.	<b>script dialer</b> <i>regexp</i>

A maximum of one **script dialer** command can be configured per line. The chat script naming convention described in the “Configuring Terminal Lines and Modem Support” chapter of this publication allows you to specify a chat script by the type of the modem attached to that line as follows:

**script dialer** *modem-type*\*

It is recommended that one chat script (a “dialer” chat script) be written for placing a call and another chat script (a “system” or “login” chat script) be written to log in to remote systems, where required.

UNIX-style regular expressions are used to match patterns and select between many scripts. This will be useful if you specify modem scripts on an interface that is used to dial multiple destinations. Dialing multiple destinations is described in the “Configuring Calls to Multiple Sites” section in this chapter. Regular expressions are described in the “Regular Expressions” appendix in the *Access and Communication Servers Command Reference* publication.

You can also assign chat scripts to asynchronous interfaces for purposes other than DDR. For more information, refer to the chapter “Configuring Terminal Lines and Modem Support” in this publication.

## Configuring Calls to a Single Site

The modem chat script becomes the default chat script for an interface. This means that it becomes the default chat script for the **dialer string** and **dialer map** commands presented in this section.

To configure an interface to call a single site, perform the following steps:

**Step 1** Enable DDR on the interface.

**Step 2** For synchronous interfaces, specify the dial string.  
For asynchronous interfaces, specify chat scripts and dial strings.

To enable DDR and specify either DTR dialing or in-band dialing, perform one of the following tasks in interface configuration mode:

Task	Command
Configure a serial interface to use DTR dialing.	<b>dialer dtr</b>
Configure a serial interface to use in-band dialing.	<b>dialer in-band [odd-parity   no-parity]</b>

To call a single site over serial lines connected by non-V.25bis modems using EIA signaling only (specifically, the Data Terminal Ready [DTR] signal), you enable DDR using the **dialer dtr** command. A serial interface configured for DTR dialing can place calls only; it cannot accept them. Dialer rotary group leaders cannot be configured for DTR dialing.

For information about configuring the router that will receive the DTR calls, see the “Configure to Receive Calls from a Single Site” section.

To call a single site over serial lines connected by asynchronous interfaces or by V.25bis modems on synchronous interfaces, you enable DDR using the **dialer in-band** command. If using V.25bis modems, you can optionally specify parity. The 1984 version of the V.25bis specification states that characters must have odd parity. However, the default is no parity.

For an example of configuring an interface to support DTR dialing, see the section “DTR Dialing Configuration Example” later in this chapter.

For ISDN interfaces, the **dialer in-band** command is not required. The software automatically configures these interfaces to be dialer type ISDN.

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**Note** For asynchronous interfaces that do not require a system script, a modem script must be defined for the associated line by using the **script dialer** line configuration command.

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To place a call to a single site on an asynchronous line for which a modem script has not been assigned or a system script must be specified, perform the following task in interface configuration mode:

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Task	Command
Specify chat scripts and a dial string.	<b>dialer map</b> <i>protocol next-hop-address</i> [ <b>modem-script</b> <i>modem-regexp</i> ] [ <b>system-script</b> <i>system-regexp</i> ] <i>dial-string</i> [ <i>isdn-subaddress</i> ]

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Use the **dialer map** command to specify a chat script if no modem script is specified for the line or an additional (system) chat script is required to log in to the remote system.

You do not need to specify a system script if one of the following is true:

- The modem script can be used to dial and log in to the remote system.
- You are calling a system that does not require a login script; that is, a system that answers and immediately goes into protocol mode.

If you want to call only one remote system per interface, the **dialer string** command is useful. You do not need to use the **dialer map** command for authentication. Dialers pass the string you have defined to the external DCE. ISDN devices call the number specified in the string.

To specify the string (telephone number) to be called on serial interfaces (asynchronous or synchronous), perform the following task in interface configuration mode:

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Task	Command
Specify a string of numbers to dial.	<b>dialer string</b> <i>dial-string</i>

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## Configuring Calls to Multiple Sites

You can configure your communication server to call multiple sites from a single line, from multiple lines, or from a dialer rotary group.

### Call on a Single Line or Multiple Lines

To configure your communication server to call multiple sites on a single line or on multiple lines, perform the following tasks:

**Step 1** Enable DDR on the interface.

**Step 2** Define multiple dialing destinations on the interface.

Or, specify a string of numbers to dial.

To enable DDR on an interface, perform the following task in interface configuration mode:

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Task	Command
Enable DDR on a serial interface. Set parity on synchronous serial interfaces only.	<b>dialer in-band</b> [ <b>no-parity</b>   <b>odd-parity</b> ]

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To define dialing destinations, perform one of the following tasks, as appropriate:

Task	Command
Define multiple dialing destinations on a synchronous interface.	<b>dialer map</b> <i>protocol next-hop-address dial-string</i>
Define multiple dialing destinations on an asynchronous interface.	<b>dialer map</b> <i>protocol next-hop-address</i> [ <b>modem-script</b> <i>modem-regexp</i> ] [ <b>system-script</b> <i>system-regexp</i> ] <i>dial-string</i>
Specify a string of numbers to dial (to configure one phone number on multiple lines only.)	<b>dialer string</b> <i>dial-string</i>

If you adhered to the chat script naming convention described earlier in this chapter, use the form [**modem-script** *\*modulation-type*] in the **dialer map** command, as in “.\*-v32bis.” This allows you to specify the modulation type that is best for the system you are calling, and allows the modem type for the line to be specified by the **modem chat-script** command.

The expression “.” is a wildcard that matches any character, and the expression “\*” indicates that the preceding character can be duplicated multiple times. For more information about regular expressions, refer to the appendix “Regular Expressions” in the *Access and Communication Servers Command Reference* publication.

If there is a **modem script** specified in the interface configuration command (**dialer map**) and a modem script specified in the line configuration command (**modem chat-script**), the first chat script that matches both will be used. If no script matches both, an error message is logged and the connection is not established. If there is no modem chat script specified for the line, the first chat script (**chat-script** global configuration command) that matches the modem script regular expression will be used. If there is a system script specified in the interface configuration command, the first chat script to match the regular expression will be used.

Configure a **dialer map** command for each remote destination for that interface.

## Call on a Dialer Rotary Group

To configure your communication server to place multiple calls using a dialer rotary group, perform the following tasks:

- Step 1** Define a rotary group.
- Step 2** Enable DDR on the rotary interface.
- Step 3** Define multiple dialing destinations for the rotary group.
- Step 4** Assign physical interfaces to the rotary group.

Dialer rotary groups allow you to apply a single interface configuration to a set of physical interfaces. Dialer rotary groups are useful in environments that have multiple callers and calling destinations. Configure a dialer interface unless you are only using a single line for dialing out or have a single line dedicated to each destination.

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**Note** The dialer rotary groups discussed in this chapter are on the communication server. The telephone company also has rotary groups that allow you to dial one rotary phone number and get connected to one of several different phone numbers. If you are using telephone company rotary groups, it is a good idea to configure dialer rotary groups on the communication server.

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A dialer rotary group is defined by specifying a “dialer interface.” The dialer interface is not a physical interface; it is an entity that allows you to propagate an interface configuration to multiple interfaces. After the dialer interface is defined by a number, interface parameters are configured for the dialer interface. Finally, physical interfaces are assigned to the dialer rotary group. Physical interfaces inherit the interface dialer configuration parameters.

After an interface configuration is propagated to a set of physical interfaces, those interfaces can be used to place calls using standard DDR criteria. When many destinations are configured, any of the physical interfaces in a rotary group can be used for outgoing calls. When traffic arrives, an interface from the rotary group is dialed. When more traffic for a different host arrives, another interface is dialed. Using the dialer interface allows you to specify one set of dialer maps that can apply to multiple physical lines.

You can define none to as many as nine dialer interfaces. Perform the tasks in this section for each dialer rotary group.

To define a rotary group, perform the following task in global configuration mode:

Task	Command
Define a rotary group.	<b>interface dialer</b> <i>number</i>

To enable DDR for the dialer rotary group, perform the following task in interface configuration mode:

Task	Command
Enable DDR on a serial interface. Set parity on synchronous serial interfaces only.	<b>dialer in-band</b> [ <b>no-parity</b>   <b>odd-parity</b> ]

To define multiple dialing destinations for the dialer rotary group, perform one of the following tasks in interface configuration mode, as appropriate:

Task	Command
Define multiple dialing destinations on a synchronous interface.	<b>dialer map</b> <i>protocol next-hop-address dial-string</i>
Define multiple dialing destinations on an asynchronous interface.	<b>dialer map</b> <i>protocol next-hop-address</i> [ <b>modem-script</b> <i>modem-regexp</i> ] [ <b>system-script</b> <i>system-regexp</i> ] <i>dial-string</i>

To assign a physical interface to a dialer rotary group, perform the following task in interface configuration mode:

Task	Command
Include the specified physical interface in a dialer rotary group in interface configuration mode.	<b>dialer rotary-group</b> <i>number</i>

Interfaces in a dialer rotary group do not have individual addresses; when the interface is being used for dialing, it inherits the parameters configured for the dialer interface. However, if the individual interface is configured with an address and it is subsequently used to establish a connection from the user EXEC level, the individual interface address again applies.

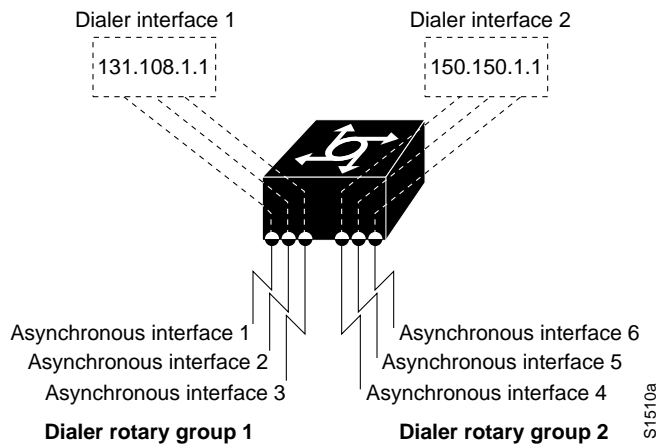
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**Note** When you look at your configuration file, commands will not appear in the order in which you entered them. You will also see interface configuration commands that you did not enter, because interfaces inherit the parameters of the dialer interface in the dialer rotary group to which each interface has been assigned.

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Figure 7-2 illustrates how dialer interfaces work. In this example configuration, serial interfaces 1, 2, and 3 are assigned to dialer rotary group 1. That means that these three interfaces take on the parameters configured for dialer interface 1. For example, when it is being used for dialing, the IP address of serial interface 2 is the same as the address of the dialer interface, 131.108.1.1.

**Figure 7-2 Sample Dialer Interface Configuration**



## Configure an Interface to Receive Calls

You can configure an interface or dialer rotary group to receive calls from a single site or from multiple sites. To configure a single line or multiple lines to receive calls from a single site or multiple sites, simply enable DDR. To receive calls from multiple sites on a dialer rotary group, configure the dialer rotary group to authenticate the caller.

Perform one of the following tasks to configure an interface to receive calls:

- Configure to Receive Calls from a Single Site
- Receive Calls from Multiple Sites

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**Note** CHAP is required for caller identification on dialer rotary groups receiving calls from multiple sites, and is described later in this section. CHAP can also be used for authentication only, in which case, an accompanying **dialer map** command is not required.

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### Configure to Receive Calls from a Single Site

To receive a call from a single site, you must enable DDR using the **dialer in-band** command. Dialers specified by this command use chat scripts for asynchronous interfaces and V.25bis on synchronous interfaces. Parity is not needed to enable DDR to receive calls only.

To receive calls from an interface that is using DTR dialing, an interface can be configured for in-band dialing or not configured for anything but encapsulation, depending on the desired behavior. If the receiving interface is expected to terminate a call when no traffic is received for some time, in-band dialing must be configured (along with access lists and a dummy dialer string). If the receiving interface is purely passive, no additional configuration is necessary.

To enable DDR, perform the following task in interface configuration mode:

Task	Command
Enable DDR on a serial interface.	<b>dialer in-band [no-parity   odd-parity]</b>

## Receive Calls from Multiple Sites

You can configure your communication server to receive calls from multiple sites on a single line, on multiple lines, or on a dialer rotary group.

### Receive Calls on a Single Line or Multiple Lines

No special configuration is required to receive calls on individual lines.

### Receive Calls on a Dialer Rotary Group

The following steps describe how to configure your communication server to receive calls on a dialer rotary group:

- Step 1** Assign a rotary group leader.
- Step 2** Enable DDR on the rotary interface.
- Step 3** Enable CHAP and configure CHAP authentication.
- Step 4** Assign physical interfaces to dialer rotary groups.

#### Assign a Rotary Group Leader

Dialer rotary groups allow you to apply a single interface configuration to a set of physical interfaces. Dialer rotary groups are useful in environments that have multiple callers and calling destinations. Configure a dialer interface unless you are only using a single line for dialing out.

A dialer rotary group is defined by specifying a dialer interface. The dialer interface is not a physical interface; it is an entity that allows you to propagate an interface configuration to multiple interfaces. After the dialer interface is defined by a number, interface parameters are configured for the dialer interface. Finally, physical interfaces are assigned to the dialer rotary group. Physical interfaces inherit the interface dialer configuration parameters.

After an interface configuration is propagated to a set of physical interfaces, those interfaces can be used to place calls using standard DDR criteria. When many destinations are configured, any of the physical interfaces in a rotary group can be used for outgoing calls. When traffic arrives, an interface from the rotary group is dialed. When more traffic for a different host arrives, another interface is dialed. Using the dialer interface allows you to specify one set of dialer maps that can apply to multiple physical lines.

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**Note** The dialer rotary groups discussed in this chapter are on the communication server. The telephone company also has rotary groups that allow you to dial one rotary phone number and get connected to one of several different phone numbers.

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You can define 0 to as many as 9 dialer interfaces. For each dialer rotary group, perform the following task in global configuration mode:

Task	Command
Define a rotary group.	<b>interface dialer</b> <i>number</i>

### Enable DDR

To receive a call from multiple sites, you must enable DDR using the **dialer in-band** command. Dialers specified by this command use chat scripts for asynchronous interfaces and V.25bis on synchronous interfaces. Parity is not needed to enable DDR to receive calls only.

To enable DDR, perform the following task in interface configuration mode:

Task	Command
Enable DDR on a serial interface.	<b>dialer in-band</b> [no parity   odd parity]

### Configure Challenge Handshake Authentication Protocol (CHAP)

Point-to-Point Protocol (PPP) with Challenge Handshake Authentication Protocol (CHAP) authentication is often used to inform the central site about which remote communication servers are connected to it.

With this authentication information, if another packet is received for a destination to which the communication server is already connected, an additional call will not be placed. However, if using rotaries, the packet will be sent out the correct port.

CHAP is specified in RFC 1333. CHAP is supported on synchronous and asynchronous serial interfaces. Using CHAP authentication, each communication server identifies itself by a *name*, which informs the other communication server what communication servers are currently connected to it. This identification process prevents a communication server from placing a call to another communication server if it is already connected to that communication server and prevents unauthorized access.

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**Note** To use CHAP, you must be running PPP encapsulation.

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When CHAP is enabled, a remote device (a PC, workstation, or communication server) attempting to connect to the local communication server is requested, or *challenged*, to respond. The challenge consists of a random number and the host name of the local communication server. This challenge is transmitted to the remote device. The required response is an encrypted version of a secret password, or *secret*, plus a random value and the name of the remote device.

The remote device finds the secret by looking up the host name that was received in the challenge. When the local communication server receives the challenge response, it verifies the response by looking up the name of the remote device given in the response. The secret passwords must be identical on the remote device and the local communication server. These names and secret passwords are configured using the **username** command.

By transmitting this response, the secret is never transmitted, preventing other devices from stealing it and gaining illegal access to the system. Without the proper response, the remote device cannot connect to the local communication server.

CHAP transactions occur only at the time a link is established. The local communication server does not issue a challenge during the rest of the call. (The local communication server can, however, respond to such requests from other devices during a call.)

To use CHAP, you must perform the following tasks:

- Enable PPP encapsulation.
- Enable CHAP on the interface.
- Configure host name authentication and the password for each remote system with which authentication is required.

To enable PPP encapsulation, perform the following task in interface configuration mode:

Task	Command
Enable PPP on an interface.	<b>encapsulation ppp</b>

To enable CHAP on an interface configured for PPP encapsulation, perform the following task in interface configuration mode:

Task	Command
Enable CHAP on an interface.	<b>ppp authentication chap [if-needed]</b> or <b>ppp authentication chap</b>

Use the optional **if-needed** argument with TACACS or XTACACS. After you enable CHAP, the local communication server requires authentication from remote devices that are calling in. If the remote device does not support CHAP, no traffic is passed to that device.

To specify the password to be used in CHAP caller identification, perform the following task in global configuration mode:

Task	Command
Configure host authentication.	<b>username name password password</b>

Add a **name** entry for each remote system from which the local communication server requires authentication.

To configure TACACS as an alternative to host authentication, perform the following task in interface configuration mode:

Task	Command
Configure TACACS.	<b>ppp use-tacacs [single-line]</b> or <b>aaa authentication ppp</b>

Use the **ppp use-tacacs** command with TACACS and XTACACS. Use the **aaa authentication ppp** command with AAA/TACACS+.

The host name of each site calling in to the local communication server needs to be mapped to its address. To map a next hop to a host name, perform the following task in interface configuration mode:

Task	Command
Configure a serial interface to map host names to next hop addresses. For rotary groups only.	<b>dialer map</b> <i>protocol next-hop-address name hostname</i>

### Enable PAP

Access control using Password Authentication protocol (PAP) is available on all serial interfaces that use PPP encapsulation. The authentication feature reduces the risk of security violations on your communication server.

To use PAP, perform the following task in interface configuration mode:

Task	Command
Enable PAP on the interface.	<b>ppp authentication pap [if-needed]</b> or <b>ppp authentication pap [list-name]</b> <sup>1</sup>

1. This command is documented in the “Interface Configuration Commands” chapter of the *Access and Communication Servers Command Reference* publication.

Use the optional **if-needed** argument with TACACS or XTACACS. Use the optional *list-name* keyword with AAA/TACACS+.

To specify the password to be used in PAP caller identification, perform the following task in global configuration mode:

Task	Command
Configure host authentication.	<b>username</b> <i>name password secret</i>

To configure TACACS as an alternative to host authentication, perform the following task in interface configuration mode:

Task	Command
Configure TACACS.	<b>ppp use-tacacs [single-line]</b> or <b>aaa authentication ppp</b>

Use the **ppp use-tacacs** command with TACACS and XTACACS. Use the **aaa authentication ppp** command with AAA/TACACS+.

### Assign an Interface to a Dialer Rotary Group

To assign a physical interface to a dialer rotary group, perform the following task in interface configuration mode:

Task	Command
Include the specified physical interface in a dialer rotary group in interface configuration mode.	<b>dialer rotary-group</b> <i>number</i>

Interfaces in a dialer rotary group do not have individual addresses; when the interface is being used for dialing, it inherits the parameters configured for the dialer interface. However, if the individual interface is configured with an address and it is subsequently used to establish a connection from the user EXEC level, the individual interface address again applies.

## Configure an Interface to Place and Receive Calls

You can configure an interface or dialer rotary group to both place and receive calls. If the interface is calling and being called by a single site, simply enable DDR and specify a dialer string. For calling and receiving calls from multiple sites, an interface or dialer rotary group must be configured to authenticate callers and to map next hop addresses to phone numbers, or dial strings.

Perform one of the following tasks to configure an interface to place and receive calls:

- Place and Receive Calls from a Single Site
- Place and Receive Calls from Multiple Sites

### Place and Receive Calls from a Single Site

To configure your communication server to place calls to, and receive calls from, a single site, perform the following tasks in interface configuration mode:

**Step 1** Enable DDR.

**Step 2** Specify the phone number to dial.

When a dialer string is configured on an interface, and CHAP is not, any incoming call is assumed to be from the configured dialer string.

To call and receive a call from a single site, you must enable DDR using the **dialer-in-band** command. Dialers specified by this command use chat scripts on asynchronous interfaces and V.25bis on synchronous interfaces. If using V.25bis, you can optionally specify parity. The 1984 version of the V.25bis specification states that characters must have odd parity. However, the default is no parity.

To enable DDR, perform the following task in interface configuration mode:

Task	Command
Enable DDR on a serial interface. Set parity on synchronous serial interfaces only.	<b>dialer in-band</b> [no-parity   odd-parity]



To specify a dial-string destination for an interface, perform the following task in interface configuration mode:

Task	Command
Specify a string of numbers to dial.	<b>dialer string</b> <i>dial-string</i>

**Note** Any incoming calls are assumed to be from the dialer string.

## Place and Receive Calls from Multiple Sites

To configure a single line, multiple lines, or a rotary group to place calls to and receive calls from multiple sites, perform the following tasks in interface configuration mode:

- Step 1** Enable DDR.
- Step 2** Specify a phone number to dial.
- Step 3** Configure PPP encapsulation and enable CHAP.
- Step 4** Map next hop to host name and phone number.

To call and receive calls from multiple sites, you must enable DDR using the **dialer in-band** command. Dialers specified by this command use chat scripts on asynchronous interfaces and V.25bis on synchronous interfaces. If using V.25bis, you can optionally specify parity. The 1984 version of the V.25bis specification states that characters must have odd parity. However, the default is no parity.

To enable DDR, perform the following task in interface configuration mode:

Task	Command
Enable DDR on a serial interface. Set parity on synchronous serial interfaces only.	<b>dialer in-band</b> [ <b>no-parity</b>   <b>odd-parity</b> ]

To specify one destination dial-string per interface, perform the following task in interface configuration mode:

Task	Command
Specify a string of numbers to dial (to configure one phone number on multiple lines only).	<b>dialer string</b> <i>dial-string</i>

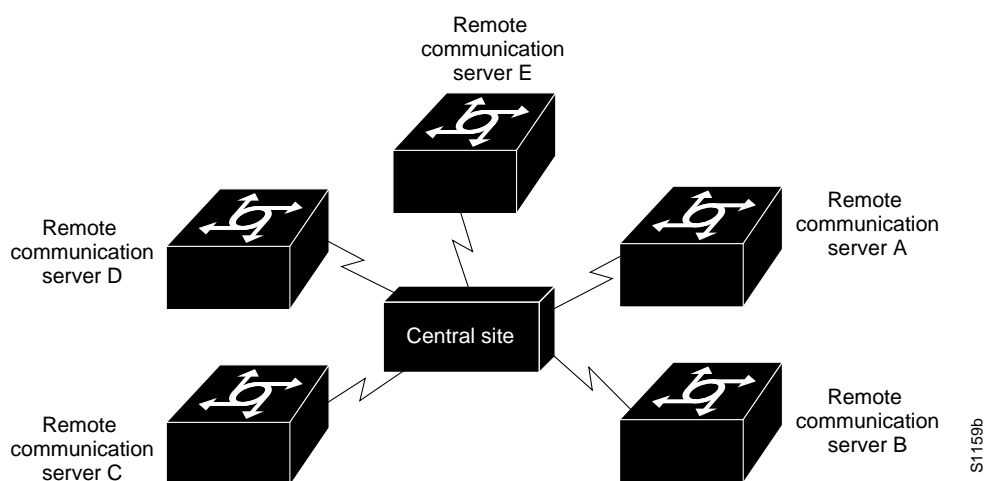
Calls from the multiple sites will need to be authenticated. Authentication can be done through CHAP. To enable CHAP on an interface and authenticate sites that are calling in, perform the following tasks in interface configuration mode:

Task	Command
Configure an interface for PPP encapsulation.	<b>encapsulation ppp</b>
Enable CHAP. <sup>1</sup>	<b>ppp authentication</b> { <b>chap</b>   <b>pap</b> } [if-needed]
Map the next hop address to the host name and phone number.	<b>dialer map</b> <i>protocol next-hop-address</i> [ <b>modem-script</b> <i>modem-regexp</i> ] [ <b>system-script</b> <i>system-regexp</i> ] <b>name</b> <i>hostname dial-string</i>

1. For more information about configuring CHAP, see the section “Configure Challenge Handshake Authentication Protocol (CHAP)” earlier in this chapter.

Figure 7-3 shows a configuration in which the central site is calling and receiving calls from multiple sites. In this configuration, multiple sites are calling in to a central site, and the central site is calling out to the remote sites.

**Figure 7-3 Sample Configuration Using Dial-on-Demand Routing**



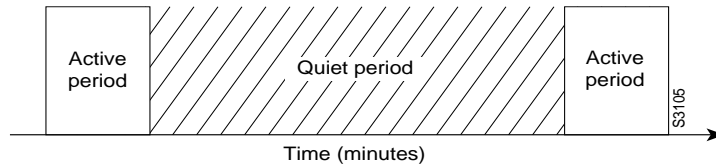
## Configure Snapshot Routing

Snapshot routing, which is available on serial lines, is a method of learning remote routes dynamically and then keeping the routes available for a period of time while regular routing updates are not being exchanged. This might be during periods when a remote site has not dialed into the local site or when a remote site has a dedicated connection to the local site but wishes to avoid the overhead of exchanging routing updates. Snapshot routing allows you to avoid configuring static routes when using dial-on-demand routing. It also eliminates the overhead required for sending periodic updates over dedicated serial lines.

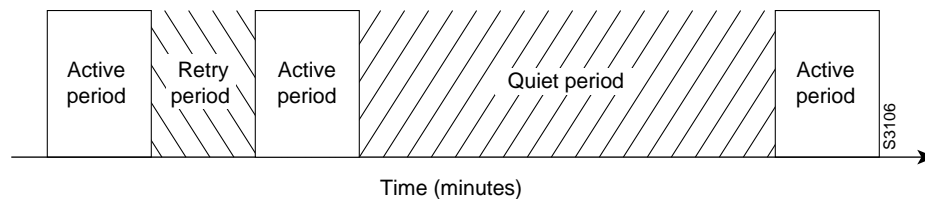
When configuring snapshot routing, you choose one router on the interface to be the client router and one or more other routers to be server routers. The client router determines the frequency at which routing information is exchanged between routers.

Routing information is exchanged during an active period. At the end of this period, the router takes a snapshot of the entries in the routing table. These entries remain frozen during a quiet period. At the end of the quiet period, another active period starts during which routing information is again exchanged.

At the end of the active period, the client router takes a snapshot of the entries in the routing table. These entries remain frozen during a quiet period. At the end of the quiet period, another active period starts during which routing information is again exchanged. See Figure 7-4.

**Figure 7-4 Active and Quiet Periods in Snapshot Routing**

When the router transitions from the quiet period to the active period, the line might not be available for a variety of reasons. For example, the line might be down or busy, or the PVC might be down. If this happens, the router has to wait through another entire quiet period before it can update its routing table entries. This might be a problem if the quiet period is very long, for example, around 12 hours. To avoid having to wait through the quiet period, you can configure a retry period. If the line is not available when the quiet period ends, the router waits for the amount of time specified by the retry period and then transitions to an active period. See Figure 7-5.

**Figure 7-5 Retry Period in Snapshot Routing**

Snapshot routing is useful in two command situations:

- Configuring static routes for DDR interfaces
- Reducing the overhead of periodic updates sent by routing protocols to remote branch offices over a dedicated serial line

The following routing protocols support snapshot routing. Note that these are all distance-vector protocols.

- AppleTalk—RTMP
- Banyan VINES—RTP
- IP—RIP, IGRP
- Novell IPX—RIP, SAP

To configure snapshot routing, perform the tasks described in the following sections. The tasks in the first two sections are required; those in the remaining section are optional:

- Configure the Client Router
- Configure the Server Router
- Monitor and Maintain Snapshot Routing

### Configure the Client Router

To configure snapshot routing on the client router that is connected to a dedicated serial line, perform the following steps starting in global configuration mode:

Task	Command
<b>Step 1</b> Specify a serial interface.	<b>interface serial</b> <i>number</i>
<b>Step 2</b> Configure the client router.	<b>snapshot client</b> <i>active-time quiet-time</i> [ <b>suppress-statechange-updates</b> ] [ <b>dialer</b> ]

To configure snapshot routing on the client router connected to an interface configured for DDR, perform the following steps starting in global configuration mode:

Task	Command
<b>Step 1</b> Specify a serial interface.	<b>interface serial</b> <i>number</i>
<b>Step 2</b> Configure a dialer rotary group.	<b>dialer rotary-group</b> <i>number</i>
<b>Step 3</b> Specify a dialer interface.	<b>interface dialer</b> <i>number</i>
<b>Step 4</b> Configure the client router.	<b>snapshot client</b> <i>active-time quiet-time</i> [ <b>suppress-statechange-updates</b> ] [ <b>dialer</b> ]
<b>Step 5</b> Define a dialer map.	<b>dialer map snapshot</b> <i>next-hop address dial-string</i>

Repeat Step 5 for each map you want to define.

### Configure the Server Router

To configure snapshot routing on the server router that is connected to a dedicated serial line, perform the following steps starting in global configuration mode:

Task	Command
<b>Step 1</b> Specify a serial interface.	<b>interface serial</b> <i>number</i>
<b>Step 2</b> Configure the server router.	<b>snapshot server</b> <i>active-time</i> [ <b>dialer</b> ]

The active period for the client router and its associated server routers should be the same.

For an example of configuring the snapshot client and server routers, see the “Snapshot Routing Examples” section later in this chapter.

### Monitor and Maintain Snapshot Routing

To monitor and maintain snapshot routing, perform one or both of the following tasks in EXEC mode:

Task	Command
Terminate the quiet period on the client router within two minutes.	<b>clear snapshot quiet-time</b> <i>interface</i>
Display information about snapshot routing parameters.	<b>show snapshot</b> <i>interface</i>

## Configure DDR Over an X.25 Interface

Cisco communication servers support PPP and HDLC serial encapsulations and X.25 encapsulation on synchronous serial interfaces. X.25 encapsulation is available for in-band and DTR dialers, but dialer group leaders cannot be configured for X.25 encapsulation.

To configure an interface for X.25 encapsulation, perform the following task in interface configuration mode:

Task	Command
Configure the interface to use X.25 encapsulation.	<b>encapsulation x25</b> [dte   dce] [ddn   bfe] [ietf]

For an example of configuring an interface for X.25 encapsulation, see the section “X.25 Encapsulation Example”

## Customize the DDR Network

Perform the following tasks, as necessary, to customize DDR in your network:

- Set Line Idle Time
- Set Idle Time for Busy Interfaces (sets the line idle time before a line disconnects when multiple calls are going out on an interface)
- Set Line Downtime
- Set Carrier Wait Time
- Controlling Access to a DDR Interface
- Set Dialer Interface Priority
- Set the Load Threshold for a Dialer Interface

### Set Line Idle Time

To specify the amount of time a line will stay idle before it is disconnected, perform the following task in interface configuration mode:

Task	Command
Set line idle time.	<b>dialer idle-timeout</b> <i>seconds</i>

### Set Idle Time for Busy Interfaces

The fast idle timer is activated if there is contention for a line. In other words, if a line is in use and a packet for a different next hop address is received, and the busy line is required to send the competing packet, the dialer fast idle timer is activated.

If the line has been idle for the configured amount of time, the current call is disconnected immediately and the new call is placed.

If the line has not yet been idle as long as the fast idle timer, the packet is dropped because there is no way to get through to the destination. (After the packet is dropped, the fast idle timer remains active and the current call is disconnected as soon as it has been idle for as long as the fast idle timeout.

If, in the meantime, there is another packet transmitted to the currently connected destination, and it is classified as interesting, the fast idle timer will be restarted.

Specify the amount of time a line for which there is contention will stay idle before the line is disconnected and the competing call is placed. Perform the following task in interface configuration mode:

Task	Command
Set idle time for high traffic lines.	<b>dialer fast-idle</b> <i>seconds</i>

This task applies to inbound and outbound calls.

### Set Line Downtime

To set the length of time an interface stays down before it is available to dial again after a line is disconnected or fails, perform the following task in interface configuration mode:

Task	Command
Set the interface downtime.	<b>dialer enable-timeout</b> <i>seconds</i>

This task applies to inbound and outbound calls.

### Set Carrier Wait Time

To set how long to wait for the telephone service (carrier), perform the following task in interface configuration mode:

Task	Command
Set how long to wait for the carrier to come up when a call is placed.	<b>dialer wait-for-carrier-time</b> <i>seconds</i>

For asynchronous interfaces, this task sets the total time to wait for a call to connect. This time is set to allow for running the chat script.

### Controlling Access to a DDR Interface

Access lists are central to the operation of DDR. In general, access lists are used as the screening criteria for determining when to initiate DDR calls. All packets are tested against the dialer access list. Packets that match a permit entry are deemed *interesting* or *packets of interest*. Packets that do not match a permit entry or that do match a deny entry are deemed *uninteresting*. When a packet is found to be interesting, either the idle timer is reset (if the line is active) or a connection is attempted (assuming the line is available but not active). If a tested packet is deemed *uninteresting*, it will be forwarded if it is intended for a destination known to be on a specific interface and the link is active. However, such a packet will not initiate a DDR call and will not reset the idle timer.

Before you perform the tasks outlined in this section, see the “Configuring IP” chapter in this publication for information about defining IP access lists, and see the “Configuring Novell IPX” chapter for information about defining IPX access lists. Define access lists if you want to control access on DDR interfaces by access lists rather than protocols.

**Step 1** Associate a protocol or access list with the dialer access group.

**Step 2** Set a dialer access group number.

You can permit or deny access to an entire protocol or you can specify an access list for more refined control. Perform one of the following tasks in global configuration mode:

Task	Command
Associate an IP access list number with the dialer access group,	<b>dialer-list</b> <i>dialer-group</i> <b>list</b> <i>access-list-number</i>
or	
Permit or deny a specific protocol for the dialer access group.	<b>dialer-list</b> <i>dialer-group</i> <b>protocol</b> <i>protocol-name</i> { <b>permit</b>   <b>deny</b> }

Acceptable access list numbers are IP standard and extended access list numbers, Novell IPX standard and extended access list numbers, Novell SAP access list numbers and bridge type codes. Packets matching permit conditions are deemed interesting. Packets matching deny conditions or not matching any dialer list statements are deemed uninteresting.

An interface can be associated only with a single dialer access group; multiple dialer access group assignments are not allowed. To specify the dialer access group to which you want to assign an access list, perform the following task in interface configuration mode:

Task	Command
Specify the number of the dialer access group to which the specific interface belongs.	<b>dialer-group</b> <i>group-number</i>

## Set Dialer Interface Priority

You can assign dialer priority to an interface. Priority indicates which interface in a dialer rotary group will get used first. Perform the following task in interface configuration mode.

Task	Command
Specify which dialer interfaces will be used first.	<b>dialer priority</b> <i>number</i>

For example, you might give one interface in a dialer rotary group higher priority than another if it is attached to a faster, more reliable modem. In this way, the higher-priority interface will be used as often as possible.

The range of values for *number* is 0 through 255. Zero is the default value and lowest priority; 255 is the highest priority. This command applies to outgoing calls only.

## Configure a Dialer Hold Queue

Sometimes packets destined for a remote router are discarded because no connection exists. Establishing a connection using an analog modem can take time, during which packets are discarded. However, configuring a dialer hold queue will allow “interesting” outgoing packets to be queued and sent as soon as the modem connection is established.

A dialer hold queue can be configured on any type of dialer, including in-band synchronous, asynchronous, DTR, and ISDN dialers. Also, rotary groups can be configured with a dialer hold queue. If a rotary group of a dialer interface is configured with a hold queue, all members of the group will be configured with a dialer hold queue and no individual member’s hold queue can be altered.

To establish a dialer hold queue, perform the following task in interface configuration mode:

Task	Command
Create a dialer hold queue and specify the number of packets to be held in it.	<b>dialer hold-queue</b> <i>packets</i>

As many as 100 packets can be held in an outgoing dialer hold queue.

### Set the Load Threshold for a Dialer Interface

You can configure a dialer rotary group to place additional calls to a single destination if the load for the interface exceeds a specified weighted value. Parallel communication server links are established based on traffic load. The number of parallel links that can be established to one location is not limited.

Task	Command
Configure the dialer rotary group to place additional calls to a single destination, as indicated by interface load.	<b>dialer load-threshold</b> <i>load</i>

## Configure DDR over Frame Relay

Access to Frame Relay networks is now available through dial-up connections as well as leased lines. Dial-up connectivity allows Frame Relay networks to be extended to sites that do not generate enough traffic to justify leased lines and also allows a Frame Relay network to back up another network or point-to-point line.

DDR over Frame Relay is supported for synchronous serial and for rotary groups, and is available for in-band, DTR.

Frame Relay supports multiple connections (PVCs) over the same serial interface, but only one *physical* interface can be used (dialed, connected, and active) in a rotary group.

### Configuration Restrictions

The following restrictions apply to DDR over Frame Relay:

- Frame Relay is not available for asynchronous dialers.
- Like HDLC, LAPB, and X.25, Frame Relay does not provide authentication.

---

**Note** Frame Relay subinterfaces work the same on dial-up connections as they do on leased lines.

---

### Configuration Overview

No new commands are required to support DDR over Frame Relay. In general, you configure Frame Relay and configure DDR. In general, complete the following steps to configure an interface for DDR over Frame Relay:

- Specify the interface.
- Specify the protocol identifiers for the interface.



For example, enter the IP address and mask, the IPX network number, and the AppleTalk cable range and zone.

- Configure Frame Relay, as described in the “Configuring Frame Relay” chapter.

As a minimum, you must enable Frame Relay encapsulation and decide whether you need to do static or dynamic address mapping. If you decide to do dynamic mapping, you do not need to enter a command because Inverse ARP is enabled by default. If you decide to do static mapping, you must enter Frame Relay mapping commands.

You can then configure various options as needed for your Frame Relay network topology.

- Configure DDR, as specified in this chapter.

At a minimum, you must decide and configure the interface for outgoing calls only, incoming calls only, or both outgoing and incoming calls.

You can also configure DDR for your routed protocols (as specified in the “Configure DDR for Routed Protocols” section of this chapter) and for snapshot routing (as specified in the “Configure Snapshot Routing” section of this chapter). You can also customize DDR on your access server (as described in this chapter).

For examples of configuring various interfaces for DDR over Frame Relay, see the “DDR over Frame Relay Examples” section later in this chapter.

## Configure DDR over LAPB

Dial-on-demand routing over serial lines supports LAPB encapsulation, in addition to PPP, HDLC, and X.25 encapsulations.

LAPB encapsulation is supported on synchronous serial, ISDN, and dialer rotary group interfaces, but not on asynchronous dialers.

Because the default encapsulation is HDLC, you must explicitly configure LAPB encapsulation. To configure an interface to support LAPB encapsulation, perform the following task in interface configuration mode and also complete the DDR configuration of the interface:

Task	Command
Specify LAPB encapsulation.	<b>encapsulation lapb</b> [ <b>dte</b>   <b>dce</b> ] [ <b>multi</b>   <i>protocol</i> ]

For more information about the serial connections on which LAPB encapsulation is appropriate, see the **encapsulation lapb** command in the “X.25 and LAPB Commands” chapter of the *Access and Communication Servers Command Reference* publication.

For an example of configuring an interface for DDR over LAPB, see the “AppleTalk Configuration Example” section later in this chapter.

## Configure DDR over X.25

X.25 interfaces can be configured to support DDR routing. Synchronous serial and ISDN interfaces on our routers can be configured for X.25 addresses, X.25 encapsulation, and mapping of protocol addresses to a remote host’s X.25 address.

In-band, DTR, and dialer rotary groups can be configured to support X.25 encapsulation. On dialer rotary groups configured for X.25 encapsulation, only one serial interface can be used.

To configure an interface to support X.25, perform the following X.25-specific tasks in interface configuration mode and also complete the DDR configuration of the interface:

Task	Command
<b>Step 1</b> Configure the interface to use X.25 encapsulation.	<b>encapsulation x25</b> [dte   dce] [ietf]
<b>Step 2</b> Assign an X.25 address to the interface.	<b>x25 address</b> <i>x.121-address</i>
<b>Step 3</b> Set up the LAN protocols-to-remote host address mapping.	<b>x25 map</b> <i>protocol address</i> [ <i>protocol2 address2</i> [... <i>[protocol9 address9]</i> ]] <i>x.121-address</i> [ <i>option</i> ]

The order of DDR and X.25 configuration tasks is not critical; you can configure DDR before or after X.25, and you can even mix the DDR and X.25 commands.

For an example of configuring an interface for X.25 encapsulation and then completing the DDR configuration, see the “X.25 Support Configuration Example” section later in this chapter.

## Configure DDR for Routed Protocols

DDR now supports AppleTalk.

To configure DDR for AppleTalk, perform the tasks in this section:

- Configure DDR for AppleTalk

### Configure DDR for AppleTalk

To configure DDR for AppleTalk, you specify AppleTalk access lists and then define DDR dialer lists. Use the **dialer-list protocol** command to define permit or deny conditions for the entire protocol; for a finer granularity, use the **dialer-list protocol** command with the **list** keyword.

## Configure DDR for IPX

On DDR links for IPX, the link might come up often even when all client sessions are idle due to watchdog/keepalive packets coming from the server to all the clients approximately every five minutes. A local communication server with the DDR link can be configured to idle out the link and still make the server believe the clients are active by responding to the watchdog packets on behalf of the clients. To do so, perform the following tasks in interface configuration mode:

**Step 1** Enable DDR.

**Step 2** Enable watchdog spoofing.

You must enable DDR using the **dialer in-band** command. Dialers specified by this command use chat scripts on asynchronous interfaces and V.25bis on synchronous interfaces. If using V.25bis, you can optionally specify parity. The 1984 version of the V.25bis specification states that characters must have odd parity. However, the default is no parity. To enable DDR, perform the following task in interface configuration mode:

Task	Command
Enable DDR.	<b>dialer in-band</b> [no parity   odd-parity]

After enabling DDR, you can enable watchdog spoofing. To do so, perform the following task in interface configuration mode:

Task	Command
Enable watchdog spoofing.	<b>ipx watch-dog spoof</b> <sup>1</sup>

1. This command is documented in the “IP Commands” chapter of the *Access and Communication Servers Command Reference* publication.

## Monitor DDR Connections

To monitor DDR connections and snapshot routing, perform the following tasks in privileged EXEC mode:

Task	Command
Display general diagnostics about the DDR interface.	<b>show dialer</b> [ <i>interface type number</i> ]
Display status about the IPX interface.	<b>show ipx interface</b> [ <i>type number</i> ]
Terminate the snapshot routing quiet period on the client router within two minutes.	<b>clear snapshot quiet-time</b> <i>interface</i>
Display information about snapshot routing parameters.	<b>show snapshot</b> <i>interface</i>
Display information about the IPX packets transmitted by the router, including watchdog counters.	<b>show ipx traffic</b>
Display information about the AppleTalk packets transmitted by the router.	<b>show appletalk traffic</b>
Clear the values of the general diagnostic statistics.	<b>clear dialer</b>

## DDR Configuration Examples

The examples provided in this section show various DDR configurations as follows:

- Dial Backup Example
- DTR Dialing Configuration Example
- Configuring DDR in an IP Environment Example
- Configuring DDR in an IPX Environment Example
- Configuring Multiple Destination Dial Strings Example
- Configuring Dialer Rotary Groups Example
- Dialing a Single Site or Multiple Sites Example
- X.25 Encapsulation Example
- Using Chat Scripts Example
- Writing and Implementing Chat Scripts Example
- Chat Scripts and Dialer Mapping Example
- System Scripts and Modem Scripts Example
- Dial-on-Demand PPP Configuration Examples
- DTR Dialing Configuration Example
- Snapshot Routing Examples

- DDR over Frame Relay Examples
- In-Band Dialing (V.25bis) and Static Map
- LAPB Support Configuration Example
- X.25 Support Configuration Example
- AppleTalk Configuration Example
- Set Up a One-Way Client-to-Server DDR
- Set Up a Two-Way Reciprocal Client-Server DDR without Authentication
- Set Up a Two-Way DDR with Authentication
- Set Up a Hub-and-Spoke DDR with Authentication
- Set Up Two-Way DDR for Novell IPX
- Configuration for A Fully Meshed DDR for Novell (IP and IPX with Authentication)

### Dial Backup Example

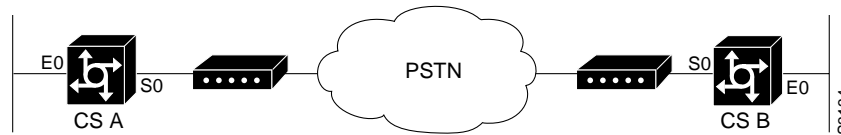
The following is an example of dial backup on interface async 1:

```
interface serial 0
ip address 1.2.3.4 255.255.255.0
backup interface async1
backup delay 10 10
!
interface async 1
ip address 1.2.3.5 255.255.255.0
dialer in-band
dialer string 5551212
dialer-group 1
async dynamic routing
!
dialer-list 1 protocol ip permit
!
chat-script foo "" "atdt 5551212" TIMEOUT 60 "CONNECT"
!
line 1
modem chat-script foo
modem inout
speed 9600
```

## DTR Dialing Configuration Example

In the following example, CS A and CS B are connected to a PSTN network.

**Figure 7-6 DTR Dialing Through a PSTN**



### Configuration for CS A

CS A is configured for DTR dialing.

```
interface serial 0
ip address 131.108.170.19 255.255.255.0
dialer dtr
dialer-group 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101
```

### Configuration for CS B

Remote CS B is configured for in-band dialing so it can disconnect an idle call.

```
interface serial 0
ip address 131.108.170.20 255.255.255.0
dialer in-band
dialer string cs A
pulse-time 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101
```

## Configuring DDR in an IP Environment Example

The following example illustrates how DDR can be used on an asynchronous interface in an IP environment. The same configuration could be used on an asynchronous serial interface by changing “interface serial 1” to specify an asynchronous interface (for example, “interface async 0”).

```
interface serial 1
ip address 131.108.126.1 255.255.255.0
dialer in-band
! The next command sets the dialer idle time-out to 10 minutes
dialer idle-timeout 600
! The next command inserts the phone number
dialer string 555-1234
! The next command gives the modem enough time to recognize that
! DTR has dropped so the modem disconnects the call
pulse-time 1
! The next command adds this interface to the dialer access group defined with
```

```
! the dialer-list command
dialer-group 1
!
! The first access list statement, below, specifies that IGRP updates are not
! interesting packets. The second access-list statement specifies that all
! other IP traffic such as Ping, Telnet, or any other IP packet are interesting
! packets. The dialer-list command then creates dialer access group 1 and
! states that access list 101 is to be used to classify packets as interesting
! or uninteresting. The ip route commands
! specify that there is a route to network 131.108.29.0 and to network
! 131.108.1.0 via 131.108.126.2. This means that several destination networks
! are available through a communication server that is dialed from interface async 1.
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 255.255.255.255 0.0.0.0
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
dialer-list 1 list 101
ip route 131.108.29.0 131.108.126.2
ip route 131.108.1.0 131.108.126.2
```

With many modems, the **pulse-time** command must be used so that DTR is dropped for sufficient time to allow the modem to disconnect.

The **redistribute static** command can be used to advertise static route information for DDR applications. See the **redistribute static ip** command, described in the “IP Commands” chapter in the *Access and Communication Servers Command Reference* publication. Without this command, static routes to the hosts or network that the communication server can access with DDR will not be advertised to other communication servers with which the communication server is communicating. This can block communication because some routes will not be known.

### Configuring DDR in an IPX Environment Example

The following example illustrates how DDR can be in an IPX environment to allow the local communication server with the DDR link to idle out the link and still make the server believe the clients are active by responding to the watchdog packets on behalf of the clients. The same configuration could be used on an asynchronous serial interface by changing “interface serial 1” to specify an asynchronous interface (for example, “interface async 0”).

```
bottomright(config)# interface serial 1
bottomright(config-if)# dialer in-band
bottomright(config)# no ipx route cache
bottomright(config-if)# ipx watchdog-spoof
```

### Configuring Multiple Destination Dial Strings Example

The following example demonstrates how to specify multiple destination dial strings (phone numbers):

```
interface serial 1
ip address 131.108.126.1 255.255.255.0
dialer in-band
dialer wait-for-carrier-time 100
pulse-time 1
dialer-group 1
dialer map ip 131.108.126.10 555-8899
dialer map ip 131.108.126.15 555-5555
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 255.255.255.255 0.0.0.0
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
dialer-list 1 LIST 101
```

A pulse time is assigned, and a dialer access group is specified.

The first **dialer map** command specifies that the number 555-8899 is to be dialed for IP packets with a *next-hop-address* of 131.108.126.10. The second **dialer map** then specifies that the number 555-5555 will be called when an IP packet with a *next-hop-address* of 131.108.126.15 is detected.

## Configuring Dialer Rotary Groups Example

The following configuration places interfaces serial 1 and 2 into dialer rotary group 1, defined by the **interface dialer 1** command.

```
! PPP encapsulation is enabled for interface dialer 1.
interface dialer 1
encapsulation ppp
dialer in-band
ip address 131.108.2.1 255.255.255.0
ip address 131.126.2.1 255.255.255.0 secondary

! The first dialer map command allows remote site YYY and the
! central site to call each other. The second dialer map command, with no
! dialer string, allows remote site ZZZ to call the central site but
! the central site can not call remote site ZZZ (no phone number).
dialer map ip 131.108.2.5 name YYY 14155553434
dialer map ip 131.126.2.55 name ZZZ

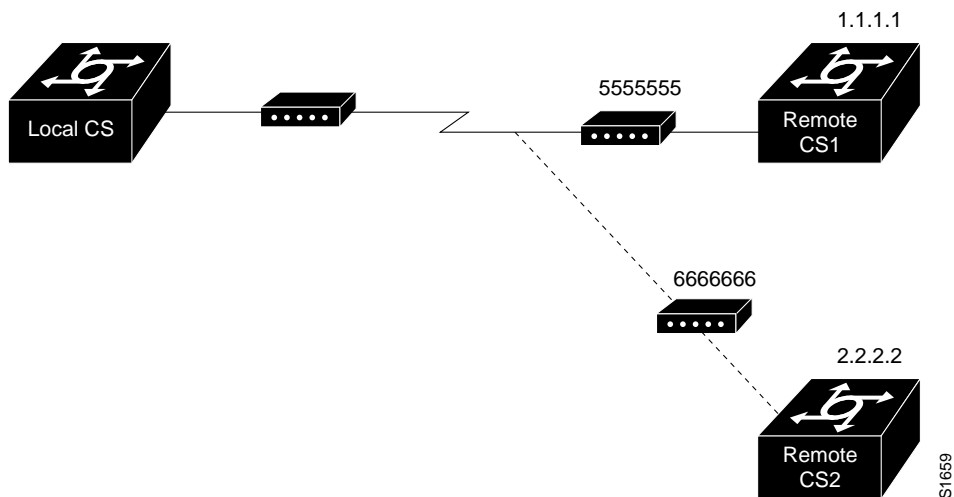
! The DTR pulse signals for three seconds on the interfaces in dialer
! group 1. This holds the DTR low so the modem can recognize that DTR has been
! dropped.
pulse-time 3

! Interfaces serial 1 and 2 are placed in dialer rotary group 1. All of
! the interface configuration commands (the encapsulation and dialer map commands shown
! earlier in this example) applied to interface dialer 1 apply
! to these interfaces.
interface serial 1
dialer rotary-group 1
interface serial 2
dialer rotary-group 1
```

## Dialing a Single Site or Multiple Sites Example

Assume your configuration is as shown in Figure 7-7 and your communication server receives a packet with a next hop address of 1.1.1.1:

**Figure 7-7 Sample Dialer String or Dialer Map Configuration**



If the interface on your communication server is configured to call a single site with phone number 5555555, it will send the packet to that site, assuming that the next hop address 1.1.1.1 indicates the same remote device as phone number 5555555. The **dialer string** command is used to specify the string (telephone number) to be called.

```
interface serial 1
dialer in-band
dialer string 5555555
```

If the interface is configured to dial multiple sites, the interface or dialer rotary group must be configured so that the correct phone number, 5555555, is mapped to the address 1.1.1.1. If this mapping is not configured, the interface or dialer rotary group would not know what phone number to call to deliver the packet to its correct destination, which is the address 1.1.1.1. In this way, a packet with a destination of 2.2.2.2 will not be sent to 5555555. The **dialer map** command is used to map next hop addresses to phone numbers.

```
interface serial 1
dialer in-band
dialer map ip 1.1.1.1 5555555
dialer map ip 2.2.2.2 6666666
```

## X.25 Encapsulation Example

In the following example, a communication server is configured for X.25 encapsulation and DTR dialing:

```
interface serial 0
ip address 131.108.170.19 255.255.255.0
encapsulation x25
x25 address 12345
x25 map ip 131.108.171.20 67890 broadcast
dialer dtr
dialer-group 1
```



```

!
access-list 101 deny igmp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101

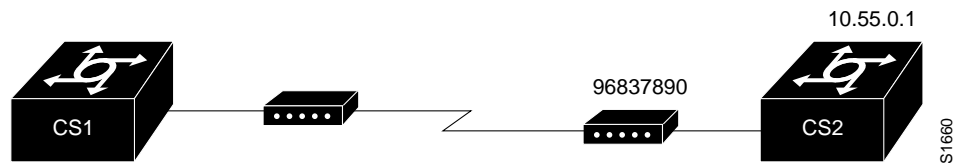
```

## Using Chat Scripts Example

Figure 7-8 shows the following configuration:

- Configuration is on communication server CS1.
- Chat script “dial” is used to dial communication server CS2’s modem.
- Chat script “login” is used to log in to communication server CS2.
- The phone number is the number of the modem attached to communication server CS2.
- The IP address is the address of communication server CS2.

**Figure 7-8 Chat Script Configuration and Function**



```

chat-script dial ABORT ERROR "" "AT Z" OK "ATDT \T" TIMEOUT 30 CONNECT \c
chat-script login ABORT invalid TIMEOUT 15 name: billw word: wewpass ">"
"slip default"
interface async 10
dialer in-band
dialer map ip 10.55.0.1 modem-script dial system-script
login 96837890

```

## Writing and Implementing Chat Scripts Example

In the following chat script example, quotation marks (“”) mean expect anything and \r means send a return.

```
" " \r "name:" "myname" "ord:" "mypassword" ">" "slip default"
```

The following example shows a configuration in which, when there is traffic, a random line will be used. The dialer code will try to find a script that matches both the modem script “.\*-v32” and the system script “cisco.” If there is no match for both the modem script and the system script, you will see a “no matching chat script found” message.

```

interface dialer 1
! v.32 rotaries are in rotary 1
dialer rotary-group 1
! Use v.32 generic script
dialer map ip 1.0.0.1 modem-script .*-v32 system-script cisco 1234

```

The following example shows line chat scripts being specified for lines connected to Telebit and US Robotics modems:

```
! Some lines have telebit modems
```

```

line 1 6
modem chat-script telebit.*
! Some lines have US robotics modems
line 7 12
modem chat-script usr.*
    
```

## Chat Scripts and Dialer Mapping Example

The following example shows a dialing chat script and a login chat script. The **dialer in-band** command enables DDR on asynchronous interface 10 and the **dialer map** command dials 96837890 after finding the specified dialing and the login scripts.

```

chat-script dial ABORT ERROR "" "AT Z" OK "ATDT \T" TIMEOUT 30 CONNECT \c
chat-script login ABORT invalid TIMEOUT 15 name: billw word: wewpass ">"
"slip default"
interface async 10
dialer in-band
dialer map ip 10.55.0.1 modem-script dial system-script login 96837890
    
```

When a packet is received for 10.55.0.1, the first thing that happens is that the modem script is implemented. Table 7-2 shows the functions that are implemented with each expect-send pair in the modem script called “dial.”

**Table 7-2 Modem Script Execution**

Expect and Send Pairs	Execution
ABORT ERROR	End the script execution if the text “ERROR” is found. You can have as many active abort entries as you like.
" " "AT Z"	Without expecting anything, send an “AT Z” command to the modem. Note the use of quotes to allow a space in the send string.
OK "ATDT \T"	Wait to see “OK.” Send “ATDT 96837890.”
TIMEOUT 30	Wait up to 30 seconds for next expect string.
CONNECT \c	Expect "connect," but do not send anything. Note that \c is effectively nothing. Double quotation marks ("" ) would have been nothing followed by a carriage return.

After the modem script is successfully executed, the login script is executed. Table 7-3 shows the functions that are executed with each expect-send pair in the system script “login.”

**Table 7-3 System Script Execution**

Expect and Send Pairs	Implementation
ABORT invalid	End the script execution if the message “invalid username or password” is displayed.
TIMEOUT 15	Wait up to 15 seconds.
name: billw	Look for “name:” and send “billw.” Using just “name:” will help avoid any capitalization issues.
word: wewpass	Wait for “word:” and send the password.
">" "slip default"	Wait for the cs prompt, and then put the line into slip mode with its default address.

## System Scripts and Modem Scripts Example

The following example shows the use of chat scripts, implemented with the **system-script** and **modem-script** options of the **dialer map** command.

If there is traffic for IP address 1.2.3.4, the communication server will dial the 91800 number using the usrobotics-v32 script, matching the regular expression in the modem chat script. Then the communication server will run the unix-slip chat script as the system script to log in.

If there is traffic for 4.3.2.1, the communication server will dial 8899 using usrobotics-v32, matching both the modem script and modem chat script regular expressions. The communication server will then log in using the cisco-compressed script.

```

! script for dialing a usr v.32 modem:
chat-script usrobotics-v32 ABORT ERROR "" "AT Z" OK "ATDT \T" TIMEOUT 30
CONNECT \c
!
! Script for logging into a unix system and starting up slip:
chat-script unix-slip ABORT invalid TIMEOUT 15 name: billw word: wewpass ">"
"slip default"
! Script for logging into a cisco comm server and starting up TCP header
! compression
chat-script cisco-compressed...
!
Line 15
modem chat-script usrobotics-*
!
Interface async 15
dialer map ip 1.2.3.4 system-script unix-slip 918005551212
dialer map ip 4.3.2.1 modem-script *-v32 system-script cisco-compressed 8899

```

## Dial-on-Demand PPP Configuration Examples

The following example shows a configuration in which several aspects of DDR are used to provide DDR capabilities between local and remote communication servers. The following features are shown in this example:

- **dialer map** command
- PPP encapsulation
- CHAP
- Dialer rotary groups
- **pulse-time** command

See the “Interface Configuration Commands,” in the *Access and Communication Servers Command Reference* publication for a description of the **pulse-time** command.)

```

! Enable PPP encapsulation and CHAP on interface dialer 1.
interface dialer 1
ip address 131.108.2.1 255.255.255.0
ip address 131.126.4.1 255.255.255.0 secondary
encapsulation ppp
ppp authentication chap

! Specify dial-on-demand routing supported on a line and
! assign a set of access-list expressions.
dialer in-band
dialer group 1

```

```

! The first dialer map command indicates that calls between the remote site
! YYY and the central site will be placed at either end. The second dialer
! map command, with no dialer string, indicates that remote site ZZZ will call
! the central site but the central site will not call out.
dialer map ip 131.108.2.5 name YYY 14155553434
dialer map ip 131.126.4.5 name ZZZ

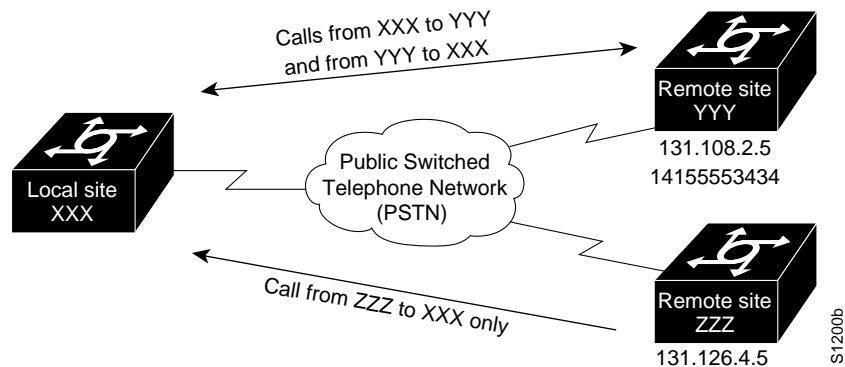
! The DTR pulse holds the DTR low for three seconds, so the modem can recognize
! that DTR has been dropped.
pulse-time 3

! Place asynchronous serial interfaces 1 and 2 in dialer rotary group 1. The
! interface subcommands applied to dialer rotary group 1 (for example,
! PPP encapsulation and CHAP) apply to these interfaces.
interface async 1
dialer rotary-group 1
interface async 2
dialer rotary-group 1

! CHAP passwords are specified for remote servers.
username YYY password theirsystem
username ZZZ password thatsystem
    
```

Figure 7-9 shows a configuration in which remote communication servers YYY and ZZZ and local communication server XXX are using dial-on-demand routing, as configured in the previous example. In this configuration, remote communication servers YYY and ZZZ can call communication server XXX. Communication server XXX has dialer string information only for communication server YYY and cannot call communication server ZZZ.

**Figure 7-9 Dial-on-Demand Routing Configuration**



### DTR Dialing Configuration Example

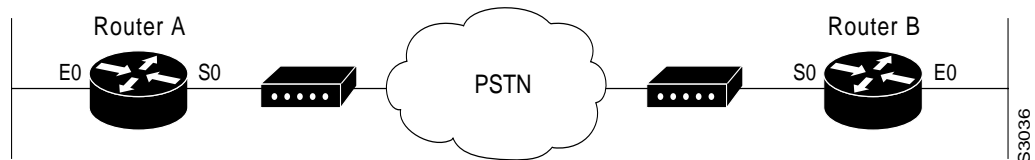
---

**Note** IP extended access list commands are shown in many of the following examples. These commands can now be simplified. See the **access-list** (extended) command in the “IP Commands” chapter of this manual for more information.

---

In the following example, Router A and Router B (or Access and Communication Servers with router functionality) are connected to a public switched telephone network (PSTN). Router A is configured for DTR dialing. Remote Router B is configured for in-band dialing so it can disconnect an idle call.

**Figure 7-10 DTR Dialing through a PSTN**



#### Configuration for Router A

```
interface serial 0
ip address 131.108.170.19 255.255.255.0
dialer dtr
dialer-group 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101
```

#### Configuration for Router B

```
interface serial 0
ip address 131.108.170.20 255.255.255.0
dialer in-band
dialer string 9876543
pulse-time 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101
```

## Snapshot Routing Examples

The following example configures snapshot routing on a DDR interface on the client router. In this configuration, a single client router can call multiple server routers. It dials to all different locations during each active period to get routes from all those remote locations.

The absence of the **suppress-statechange-updates** keyword means that routing updates will be exchanged each time the line protocol goes from “down” to “up” or from “dialer spoofing” to “fully up.” The **dialer** keyword on the **snapshot client** command allows the client router to dial the server router in the absence of regular traffic if the active period time expires.

```
interface serial 0
dialer rotary-group 3
!
interface dialer 3
dialer in-band
snapshot client 5 360 dialer
snapshot retry-interval 5
dialer map snapshot 2 4155556734
dialer map snapshot 3 7075558990
```

The following commands configure the server router:

```
interface serial 2
snapshot server 5 dialer
```

## DDR over Frame Relay Examples

The examples in this section present various combinations of interfaces, Frame Relay features, and DDR features.

### In-Band Dialing (V.25bis) and Static Map

In this example, a router is configured for IP over Frame Relay using in-band dialing. A Frame Relay static map is used to associate the next-hop protocol address to the DLCI. The dialer string allows dialing to only one destination.

```
interface Serial0
ip address 1.1.1.1 255.255.255.0
encapsulation frame-relay
frame-relay map ip 1.1.1.2 100 broadcast
dialer in-band
dialer string 4155551212
dialer-group 1
!
access-list 101 deny igrp any host 255.255.255.255
access-list 101 permit ip any any
!
dialer-list 1 protocol ip list 101
```

### LAPB Support Configuration Example

In the following example, the router is configured for LAPB encapsulation and in-band dialing:

```
interface serial 0
ip address 131.108.170.19 255.255.255.0
encapsulation lapb
dialer in-band
dialer string 4155551212
dialer-group 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 protocol ip list 101
```

## X.25 Support Configuration Example

In the following example, a router is configured to support X.25 and DTR dialing:

```
interface serial 0
ip address 131.108.170.19 255.255.255.0
encapsulation x25
x25 address 12345
x25 map ip 131.108.171.20 67890 broadcast
dialer dtr
dialer-group 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
!
dialer-list 1 list 101
```

## AppleTalk Configuration Example

In the following example, DDR is configured for AppleTalk access using an ISDN BRI. Two access lists are defined: one for IP and IGRP, and one for AppleTalk. AppleTalk packets from network 2141 only (except broadcast packets) can initiate calls.

```
interface BRI0
ip address 130.1.20.107 255.255.255.0
encapsulation ppp
appletalk cable-range 2141-2141 2141.65
appletalk zone SCruz-Eng
no appletalk send-rtmps
dialer map ip 130.1.20.106 broadcast 1879
dialer map appletalk 2141.66 broadcast 1879
dialer-group 1
!
access-list 101 deny igrp 0.0.0.0 255.255.255.255 255.255.255.255 0.0.0.0
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 601 permit cable-range 2141-2141 broadcast-deny
access-list 601 deny other-access
!
dialer-list 1 list 101
dialer-list 1 list 601
```

## Set Up a One-Way Client-to-Server DDR

You can set up a one-way client-to-server dial-on-demand (DDR) so that the client can dial into the server but the server does not have dial-in access to the client. This configuration is demonstrated in the following two subsections.

### Remote Configuration

The following example configuration is performed on the remote side of the connection:

```
interface ethernet 0
ip address 128.150.44.1 255.255.255.0
!
interface async 7
ip unnumber e 0
async mode interactive
encap ppp
dialer in-band
dialer map IP 128.150.44.1 modem-script generic 1234
dialer-group 1
```

```
!  
ip route 128.150.43.0 255.255.255.0 async 7  
ip default-network 128.150.0.0  
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT  
dialer-list 1 protocol ip permit  
!  
line 7  
no exec  
modem InOut  
speed 38400  
flowcontrol hardware  
modem chat-script generic
```

### Local Configuration

The following example configuration is performed on the local side of the connection:

```
interface ethernet 0  
ip address 128.150.43.1 255.255.255.0  
!  
interface async 7  
ip unnumber e 0  
async mode dedicated  
async default ip address 128.150.43.0  
encap ppp  
!  
ip route 128.150.44.0 255.255.255.0 async 7  
!  
line 7  
modem RI-is-CD  
speed 38400  
flowcontrol hardware
```

### Set Up a Two-Way Reciprocal Client-Server DDR without Authentication

You can set up a two-way reciprocal dial-on-demand (DDR) without authentication in which both the client and server have dial-in access to each other. This configuration is demonstrated in the following two subsections.

#### Remote configuration

The following example configuration is performed on the remote side of the connection:

```
interface ethernet 0  
ip address 128.150.44.1 255.255.255.0  
!  
interface async 7  
ip address 128.150.45.2 255.255.255.0  
async mode dedicated  
async default ip address 128.150.45.1  
encap ppp  
dialer in-band  
dialer string 1234  
dialer-group 1  
!  
ip route 128.150.43.0 255.255.255.0 async 7  
ip default-network 128.150.0.0  
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT  
dialer-list 1 protocol ip permit  
!
```



```

line 7
no exec
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

## Local Configuration

The following example configuration is performed on the local side of the connection:

```

interface ethernet 0
ip address 128.150.43.1 255.255.255.0
!
interface async 7
async mode dedicated
async default ip address 128.150.45.2
encapsulation ppp
dialer in-band
dialer string 1235
dialer rotary-group 1
!
interface async 8
async mode dedicated
async default ip address 128.150.45.2
dialer rotary-group 1
!
ip route 128.150.44.0 255.255.255.0 async 7
ip address 128.150.45.2 255.255.255.0
encap ppp
ppp authentication chap
dialer in-band
dialer map ip 128.150.45.2 name remote 4321
dialer load-threshold 80
!
ip route 128.150.44.0 255.255.255.0 128.150.45.2
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
dialer-list 1 protocol ip permit
!
route igrp 109
network 128.150.0.0
redistribute static
passive-interface async 7
!
line 7
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

## Set Up a Two-Way DDR with Authentication

You can set up a two-way dial-on-demand (DDR) with authentication in which both the client and server have dial-in access to each other. This configuration is demonstrated in the following two subsections.

### Remote Configuration

The following example configuration is performed on the remote side of the connection. It provides authentication by identifying a password that must be provided on each end of the connection.

```
username local password secret1
username remote password secret2
interface ethernet 0
ip address 128.150.44.1 255.255.255.0
!
interface async 7
ip address 128.150.45.2 255.255.255.0
async mode dedicated
async default ip address 128.150.45.1
encap ppp
dialer in-band
dialer string 1234
dialer-group 1
!
ip route 128.150.43.0 255.255.255.0 async 7
ip default-network 128.150.0.0
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
dialer-list 1 protocol ip permit
!
line 7
no exec
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic
```

### Local Configuration

The following example configuration is performed on the local side of the connection. As with the remote side configuration, it provides authentication by identifying a password for each end of the connection

```
username remote password secret1
username local password secret2
!
interface ethernet 0
ip address 128.150.43.1 255.255.255.0
!
interface async 7
async mode dedicated
async default ip address 128.150.45.2
dialer rotary-group 1
!
interface async 8
async mode dedicated
async default ip address 128.150.45.2
dialer rotary-group 1
!
interface dialer 1
ip address 128.150.45.2 255.255.255.0
encap ppp
ppp authentication chap
dialer in-band
dialer map ip 128.150.45.2 name remote 4321
dialer load-threshold 80
!
ip route 128.150.44.0 255.255.255.0 128.150.45.2
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
!
route igrp 109
network 128.150.0.0
redistribute static
passive-interface async 7
```

```

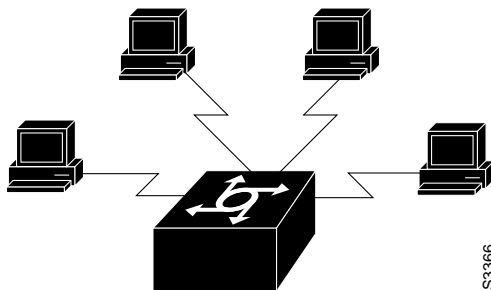
!
line 7
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

## Set Up a Hub-and-Spoke DDR with Authentication

You can set up dial-on-demand (DDR) to provide service to multiple remote sites. In a hub-and-spoke configuration, you can use a generic configuration script to set up each remote connection. Figure 7-11 illustrates a typical hub-and-spoke configuration.

**Figure 7-11 Hub-and-spoke DDR configuration**



This configuration is demonstrated in the following two subsections.

### Remote Configuration

The following example configuration is performed on the remote side of the connection. (A different spoke password must be specified for each remote client.) It provides authentication by identifying a password that must be provided on each end of the connection.

```

interface ethernet 0
ip address 128.150.44.1 255.255.255.0
!
interface async 7
async mode dedicated
async default ip address 128.150.45.1
ip address 128.150.45.2 255.255.255.0
encap ppp
ppp authentication chap
dialer in-band
dialer map ip 128.150.45.1 name hub system-script hub 1234
dialer map ip 128.150.45.255 name hub system-script hub 1234
dialer-group 1
!
ip route 128.150.43.0 255.255.255.0 128.150.45.1
ip default-network 128.150.0.0
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
chat-script hub "" "" name: spokel word" <spokel-passwd> PPP
dialer-list 1 protocol ip permit
!
username hub password <spokel-passwd>
!

```

```
router igrp 109
network 128.150.0.0
passive-interface async 7
!
line 7
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic
```

### Local Configuration

The following example configuration is performed on the local side of the connection—the hub server. It configures the server for communication with three clients and provides authentication by identifying a unique password for each “spoke” in the hub-and-spoke configuration.

```
interface ethernet 0
ip address 128.150.43.1 255.255.255.0
!
interface async 7
async mode interactive
async dynamic address
dialer rotary-group 1
!
interface async 8
async mode interactive
async dynamic address
dialer rotary-group 1
!
interface dialer 1
ip address 128.150.45.2 255.255.255.0
no ip split-horizon
encap ppp
ppp authentication chap
dialer in-band
dialer map ip 128.150.45.2 name spoke1 3333
dialer map ip 128.150.45.2 name spoke2 4444
dialer map ip 128.150.45.2 name spoke3 5555
dialer map ip 128.150.45.255 name spoke1 3333
dialer map ip 128.150.45.255 name spoke2 4444
dialer map ip 128.150.45.255 name spoke3 5555
dialer-group 1
!
ip route 128.150.44.0 255.255.255.0 128.150.45.2
ip route 128.150.44.0 255.255.255.0 128.150.45.3
ip route 128.150.44.0 255.255.255.0 128.150.45.4
dialer-list 1 list 101
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
!
username spokel password <spokel-passwd>
username spoke2 password <spoke2-passwd>
username spoke3 password <spoke3-passwd>
username spokel autocommand ppp 128.150.45.2
username spoke2 autocommand ppp 128.150.45.3
username spoke3 autocommand ppp 128.150.45.4
!
router igrp 109
network 128.150.0.0
redistribute static
!
```

```

line 7
login tacacs
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

## Set Up Two-Way DDR for Novell IPX

You can set dial-on-demand (DDR) for Novell IPX so that both the client and server have dial-in access to each other. This configuration is demonstrated in the following two subsections.

### Remote Configuration

The following example configuration is performed on the remote side of the connection:

```

username local password secret
ipx routing
!
interface ethernet 0
ipx network 40
!
interface async
ip unnumbered e0
encap ppp
async mode dedicated
async dynamic routing
ipx network 45
ipx watchdog-spoof
dialer in-band
dialer map ipx 45.0000.0cff.d016 broadcast name local 1212
dialer-group 1
ppp authentication chap
!
access-list 901 deny 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 457
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 457
access-list 901 permit 0
ipx route 41 45.0000.0cff.d016
ipx route 50 45.0000.0cff.d016
ipx sap 4 SERVER 50.0000.0000.0001 451 2
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
!
dialer-list 1 list 901
!
line 7
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

### Local Configuration

The following example configuration is performed on the local side of the connection:

```

username remote password secret
ipx routing

```

```

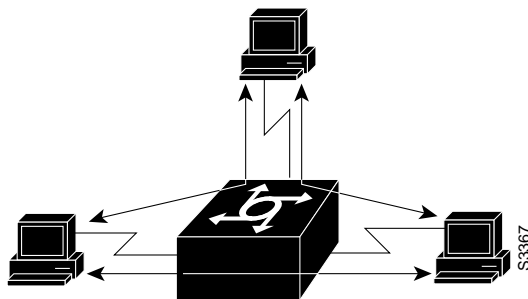
!
interface ethernet 0
ipx network 41
!
interface async
ip unnumbered e0
encap ppp
async mode dedicated
async dynamic routing
ipx network 45
ipx watchdog-spoof
dialer in-band
dialer map ipx 45.0000.0cff.d016 broadcast name remote 8888
dialer-group 1
ppp authentication chap
!
access-list 901 deny 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 457
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 457
access-list 901 permit 0
ipx route 40 45.0000.0cff.d016
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
!
dialer-list 1 list 901
!
line 7
modem InOut
speed 38400
flowcontrol hardware
modem chat-script generic

```

### Configuration for A Fully Meshed DDR for Novell (IP and IPX with Authentication)

You can set up a fully meshed dial-on-demand (DDR) for Novell IPX so that both clients and server have DDR access to other members of the network. This configuration is illustrated in Figure 7-12.

**Figure 7-12 Fully Meshed DDR Configuration for Novell**



This configuration is demonstrated below.

#### Host Configuration

The following example configuration for three fully meshed sites is performed on the host side of the connection:

```

ip routing
ipx routing
!
interface ethernet 0
ip address 128.150.41.1 255.255.255.0
ipx network 41
!
interface async 7
async mode interactive
async dynamic address
async dynamic routing
dialer rotary-group 1
!
interface async 8
async mode interactive
async dynamic address
dialer rotary-group 1
!
interface dialer 1
ip address 128.150.45.1 255.255.255.0
ipx network 45
ipx watchdog-spoof
encap ppp
dialer in-band
dialer map ip 128.150.45.2 name site2 system-script site2 2222
dialer map ip 128.150.45.3 name site3 system-script site3 3333
dialer map ipx 45.0000.0cff.d012 broadcast name site2 system-script site2 2222
dialer map ipx 45.0000.0cff.d013 broadcast name site3 system-script site3 3333
dialer-group 1
ppp authentication chap
!
ip route 128.150.44.0 255.255.255.0 128.150.45.2
ip route 128.150.48.0 255.255.255.0 128.150.45.3
ipx route 42 45.0000.0cff.d012
ipx route 43 45.0000.0cff.d013
ipx route 52 45.0000.0cff.d012
ipx route 53 45.0000.0cff.d013
ipx sap 4 SITE2 52.0000.0000.0001 451 2
ipx sap 4 SITE3 53.0000.0000.0001 451 2
dialer-list 1 list 101
dialer-list 1 list 901
access-list 101 deny igrp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 101 permit ip 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255
access-list 901 deny 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 457
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 452
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 453
access-list 901 deny 0 FFFFFFFF 0 FFFFFFFF 457
access-list 901 permit 0
!
username site2 password sitel&2
username site3 password sitel&3
username site2 autocommand ppp 128.150.45.2
username site3 autocommand ppp 128.150.45.3
!
chat-script site2 " " " " name: site2 word: sitel&2 PPP
chat-script site3 " " " " name: site3 word: sitel&3 PPP
chat-script generic ABORT BUSY ABORT NO ## AT OK ATDT\T TIMEOUT 30 CONNECT
!
router igrp 109
network 128.150.0.0
redistribute static
!
line 7 8

```

```
login tacacs  
modem InOut  
speed 38400  
flowcontrol hardware  
modem chat-script generic
```