



Store and Forward Fax with ESMTP

This document describes how to configure the Store and Forward Fax feature, which enables Cisco AS5300 access servers to send and receive faxes across packet-based networks.

This chapter includes the following sections:

- Feature Overview, page 1
- Supported Standards, MIBs, and RFCs, page 5
- Prerequisites, page 6
- Configuration Tasks, page 15
- Configuration Examples, page 50
- Glossary, page 60

Feature Overview

Store and Forward Fax enables Cisco AS5300 access servers to send and receive faxes across packet-based networks. This feature is an implementation of the RFC 2305 proposed standard from the Internet Engineering Task Force (IETF), which is the same as the T.37 recommendation from the International Telegraph Union (ITU). With this feature, your access server becomes a multiservice platform, supplying both data and fax communication. With Store and Forward Fax, you can:

- Send and receive faxes to and from Group 3 fax devices
- Receive faxes that will be delivered as an e-mail attachment
- Create and send a standard e-mail message that will be delivered as a fax to a standard Group 3 fax device

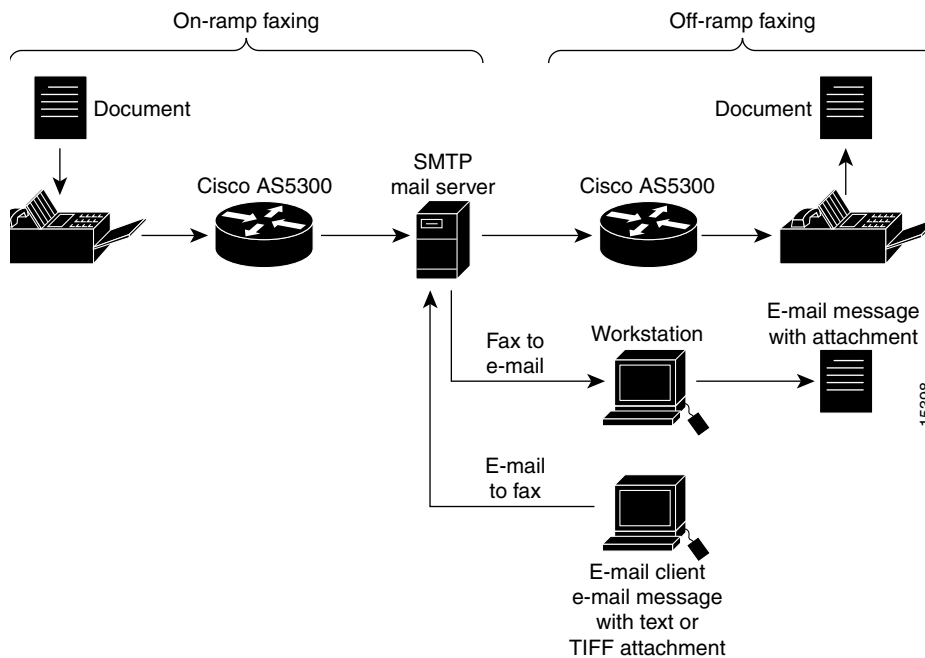
Store and Forward Fax functionality is facilitated through Simple Mail Transfer Protocol (SMTP). Additional functionality is provided in this product to provide confirmed delivery using existing SMTP mechanisms, such as Extended Simple Mail Transfer Protocol (ESMTP).

With Store and Forward Fax, the Cisco AS5300, acting as the on-ramp gateway, receives faxes from end users and converts them into TIFF files. It then creates a standard Multipurpose Internet Mail Extensions (MIME) e-mail message and attaches the TIFF file to it. The on-ramp gateway then forwards this “fax-mail” to the messaging infrastructure of a designated SMTP server, where the fax-mail message is stored. The messaging infrastructure performs message routing, message storage, and transport, and can be either a standard Internet Message Transfer Agent (MTA)—for example, UNIX sendmail—or custom store-and forward fax software. The responsibility of delivering the fax-mail message falls to SMTP and the mail server.

Fax-mail stored on the SMTP server can be delivered either as an e-mail message with attachment when the recipient downloads messages or as a standard fax to a Group 3 fax device. In the latter case, the SMTP server mail delivery infrastructure delivers the fax-mail to the Cisco AS5300 acting as an off-ramp gateway. The off-ramp router converts the attached TIFF file back into standard fax format and then sends the information to a standard Group 3 fax device. The off-ramp gateway is also responsible for generating delivery status notifications (DSNs) and message disposition notifications (MDNs).

Figure 1 shows a simple network topology using Store and Forward Fax.

Figure 1 Topology Showing Store and Forward Fax Functionality



Note

We strongly recommend that you configure your Cisco AS5300 acting as an off-ramp gateway to only accept incoming SMTP connections from trusted mailers. Configure packet filters to allow only certain “trusted” IP addresses to send faxes to the Store and Forward Fax off-ramp gateway.

Store and Forward Fax is used in conjunction with Voice over IP (VoIP) for the Cisco AS5300; to use Store and Forward Fax, you must have the VoIP software component for the Cisco AS5300 installed on your access server.

Handling of Enclosures

Store and Forward Fax can process e-mail with the following MIME media content types:

- text/plain
- text/enriched
- image/tiff (“Profile S” described in RFC 2301)

Store and Forward Fax supports the following content transfer encodings:

- 7 bit
- 8 bit
- Base 64
- Quotable-printable

These content transfer encodings can be wrapped in any multipart/* content type. When Store and Forward Fax receives messages with multiple sections, it processes the first part of the multipart message and records a count of what is and is not successfully sent. Store and Forward Fax then discards the rest of the message. For example, if a multipart/alternative message has a text/plain part and a text/html part (and the text/plain part is first), Store and Forward Fax processes only the text/plain part.

**Note**

The TIFF file format must conform to RFC 2301 (*File Format for Internet Fax* by L. McIntyre, S. Zilles, R. Buckley, D. Venable, G. Parsons, and J. Rafferty; March 1998). Store and Forward Fax does not support uuencoded text, JPEG or JBIG files, or multiraster content.

**Caution**

The Cisco AS5300 only recognizes the listed file attachment types for Store and Forward Fax activities. If the Cisco AS5300 receives a file format different from one of the defined acceptable formats, it discards the data.

Benefits

Universal Inbox for Fax and E-Mail

You can configure direct inward dialing (DID) numbers so that faxes and e-mails go to the same mailbox.

E-Mail Can Be Sent as a Fax Transmission

With Store and Forward Fax, you can create an e-mail message and send that transmission as a fax; this feature allows you to combine e-mail and fax recipients.

Toll Bypass

In an enterprise environment, where offices in different cities are connected via a WAN, you can bypass toll charges by transmitting faxes over the network connection. Because the fax message is stored on the mail server until SMTP forwards messages to the recipient, you can configure SMTP to forward fax e-mail attachments during off-peak hours (for example, during evenings and weekends), thereby reducing long distance charges.

Broadcast to Multiple Recipients

Because Store and Forward Fax uses e-mail messages as the transporting vehicle for the fax, you can send e-mail fax attachments to multiple recipients simultaneously.

Restrictions

Two modem cards are available for the Cisco AS5300: the Microcom modem card and the MICA technologies modem card. Microcom modem cards support both on-ramp and off-ramp fax activities. MICA technologies modem cards are unidirectional and only support off-ramp faxing.

Store and Forward Fax on-ramp has been designed to work in one of two ways: either using a feature called direct inward dial (DID) or using a redialer, which is an interface hardware device that interconnects between a fax device and a Public Switched Telephone Network (PSTN) network. If you choose not to enable DID, you must configure and enable a redialer on the originating fax machine for Store and Forward Fax to be operational.

Related Features and Technologies

The Store and Forward Fax feature module is related to the existing Voice over IP feature, which is documented in the Cisco IOS Release 12.0 *Voice, Video, and Home Applications Configuration Guide* and in the Cisco IOS Release 12.0(3)T feature module, *Voice over IP for the Cisco AS5300*. In addition, Store and Forward Fax uses elements from authentication, authorization, and accounting (AAA) security services, supporting the use of the RADIUS security server protocol. AAA and RADIUS are documented in the Cisco IOS Release 12.0 *Security Configuration Guide*.

Related Documents

For related information on this feature, refer to the following documents:

- Cisco IOS Release 12.0 *Voice, Video, and Home Applications Configuration Guide*
- Cisco IOS Release 12.0 *Voice, Video, and Home Applications Command Reference*
- Cisco IOS Release 12.0 *Security Configuration Guide*
- Cisco IOS Release 12.0 *Security Command Reference*
- Cisco IOS Release 12.0(3)T *Voice over IP for the Cisco AS5300* feature module
- Cisco AS5300 Universal Access Server Software Configuration Guide
- Cisco AS5300 Universal Access Server Module Installation Guide
- Draft document: draft-ietf-fax-smtp-session-04.txt *Immediate delivery*

Supported Platforms

- Cisco AS5300 access server

Supported Standards, MIBs, and RFCs

MIBs

- MMOIP DIAL-CONTROL-MIB
- MODEM-MANAGEMENT-MIB
- CISCO-ANALOG-VOICE-IF-MIB
- CISCO-VOICE-DIAL-CONTROL-MIB
- CISCO-VOICE-IF-MIB

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on CCO at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

RFCs

- RFC 821, *Simple Mail Transfer Protocol*
- RFC 822, *Standard for the Format of ARPA Internet Text Messages*
- RFC 1652, *SMTP Service Extension for 8bit-MIME Transport*
- RFC 1869, *SMTP Service Extensions*
- RFC 1891, *SMTP Service Extension for Delivery Status Notifications*
- RFC 1892, *The Multipart/Report Content Type for the Reporting of Mail System Administrative Messages*
- RFC 1893, *Enhanced Mail System Status Codes*
- RFC 1894, *An Extensible Message Format for Delivery Status Notifications*
- RFC 1896, *The Text/Enriched MIME Content-Type*
- RFC 2034, *SMTP Service Extension for Returning Enhanced Error Codes*
- RFC 2045, *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*
- RFC 2046, *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*
- RFC 2047, *MIME (Multipurpose Internet Mail Extensions) Part Three: Message Header Extensions for Non-ASCII Text*
- RFC 2197, *SMTP Service Extension for Command Pipelining*
- RFC 2298, *An Extensible Message Format for Message Disposition Notifications*
- RFC 2301, *File Format for Internet Fax*
- RFC 2302, *Tagged Image File Format (TIFF) - Image/TIFF MIME Sub-Type Registration*
- RFC 2303, *Minimal PSTN Address Format in Internet Mail*
- RFC 2304, *Minimal Fax Address Format in Internet Mail*
- RFC 2305, *A Simple Mode of Fax Using Internet Mail*
- RFC 2532, *Extended Facsimile Using Internet Mail*

Store and Forward Fax is also compliant with the SMTP requirements in RFC 1123, *Requirements for Internet Hosts—Application and Support*.

Prerequisites

The following sections describe prerequisite tasks you need to perform and background information you need to understand before you configure Store and Forward Fax:

- Basic Prerequisite Task List
- Configuring the SMTP Server to Support Store and Forward Fax
- Using Redialers with Store and Forward Fax
- Understanding Dial Peers
- Understanding Destination Patterns and Prefixes
- Understanding Number Expansion

Basic Prerequisite Task List

Before you can configure Store and Forward Fax, you must perform the following basic prerequisite tasks:

- Establish a working IP network. For more information about configuring IP, refer to the “IP Overview,” “Configuring IP Addressing,” and “Configuring IP Services” chapters in the *Cisco IOS IP and IP Routing Configuration Guide*.
- Complete basic configuration for the Cisco AS5300. Basic configuration includes, as a minimum, the following tasks:
 - Configure a host name and password for the Cisco AS5300.
 - Configure the Ethernet 10BaseT/100BaseT interface of your Cisco AS5300 so that it can be recognized as a device on the Ethernet LAN.
 - Configure the Cisco AS5300 interfaces for ISDN PRI lines or T1 lines.
 - Configure the ISDN D channels for each ISDN PRI line or T1 line.

For more information about any of these configuration tasks, refer to the *Cisco AS5300 Universal Access Server Software Configuration Guide*.

- Install a modem card into the appropriate slot of the Cisco AS5300. Both MICA and Microcom modem cards support Store and Forward Fax, although (as mentioned) MICA modem cards only support off-ramp faxing. For more information about installing Microcom and MICA modem cards, refer to the *Cisco AS5300 Universal Access Server Module Installation Guide* and the *Cisco AS5300 Universal Access Server Chassis Installation Guide*.
- Download and install the appropriate version of portware for the modem card that you have installed. You need to download the following portware versions to support Store and Forward Fax:
 - For Microcom modem cards—V.90n firmware
 - For MICA modem cards—Standard MICA portware with fax transmission capabilities

For more information about downloading and installing new portware on your modem cards, refer to the *Cisco AS5300 Universal Access Server Module Installation Guide* and the *Cisco AS5300 Universal Access Server Chassis Installation Guide*.



Note Be sure to update the Cisco AS5300 software configuration if modem cards are added or removed.

- Install a version of the Cisco IOS software that includes the software component of VoIP for the Cisco AS5300. Store and Forward Fax uses some of the internal functionality provided by the VoIP for the Cisco AS5300 software. VoIP for the Cisco AS5300 is included in Cisco IOS Release 12.0(3)T. For more information about VoIP for the Cisco AS5300, refer to the Cisco IOS Release 12.0(3)T *Voice over IP for the Cisco AS5300* feature module.



Note Voice over IP need not be configured for Store and Forward Fax to function.

Configuring the SMTP Server to Support Store and Forward Fax

Although it is not required, another prerequisite task is to configure your SMTP server to better support Store and Forward Fax. If you choose to configure your SMTP server, perform the following tasks:

- Edit the SMTP server alias file to include an alias for fax transmissions—meaning an e-mail address that has “fax=” prefix included in it. For example, suppose you create the following alias: fax=5551212; user@hostname.com. In this example, if a fax is sent to the telephone number 5551212, the on-ramp gateway will automatically forward it to the mailbox for user@hostname.com.

If you create aliases to forward faxes to particular e-mail addresses, you need to configure the on-ramp multimedia over IP (MMoIP) dial peer **session-target** command as follows:

```
session target mailto: $d$@hostname.com.
```

The **\$d\$** keyword specifies that the destination fax machine telephone number is inserted in the envelope to: field of the fax-mail that gets sent to the SMTP server.

- Modify parameters involving SMTP delivery requirements.

Fax transmission has delivery requirements that are different from e-mail; for example, in certain countries, it is illegal to try to send a fax more than three times in a row if transmission fails. In addition, the time between retransmission attempts can be extremely short. SMTP mail delivery requirements are not governed by such strict regulations; in general, if an e-mail message cannot be delivered, the SMTP server will continue trying to deliver the message every 30 minutes for up to 5 days. To avoid any complications arising from the difference between the SMTP e-mail and fax delivery requirements, modify the following parameters:

- Delivery to one recipient
- Message priority
- Connection Cache Size
- Minimum Queue Age



Caution

It is extremely important to modify SMTP delivery requirement parameters. Failure to do so can result in a monopoly of bandwidth and fax resources.

Reconfiguring the Message Transfer Agents

Message Transfer Agents (MTAs), such as sendmail, Post.Office, and others are normally configured to provide fast and reliable service for transferring e-mail. However, the needs of fax users are different. The most concrete example is retry timeouts. A typical MTA configuration will retry sending failed message transmissions every 30 minutes for up to 4 days. Resending e-mail every 30 minutes is usually

unacceptable to fax users—they want retries more often than every 30 minutes and usually want transmission aborted well before the typical 4-day retry limit. Therefore, although a typical unmodified MTA can be used with the AS5300 for off-ramp operations, you need to tune the MTA for fax operation.

Fax Operation

The AS5300 off-ramp accepts only one e-mail recipient per SMTP transaction for the following reasons:

- The SMTP server that is part of Store and Forward Fax does not queue messages in the AS5300 memory because of their size and the lack of sufficient nonvolatile storage.
- SMTP does not include a mechanism to allow the receiving MTA to indicate success/failure of each recipient. Instead, the receiving MTA must indicate the success/failure of the entire transaction.

The AS5300 prevents multiple recipients in one SMTP transaction by responding to the second and subsequent RCPT commands with a “450” reply code. Because of the typical mailer configuration, this will cause a cumulative 30-minute delay for each recipient (immediate delivery for the first recipient, 30-minute delay for the second recipient, 60-minute delay for the third recipient, and so on).

Forcing All Mail Through One Mailer

To simplify system administration, it is desirable to have all mail to the Cisco AS5300 go through one mailer. One way to do this is to set up a DNS MX record for the Cisco AS5300 pointing to that mailer, and set up that mailer to skip MX record processing for that one host (the Cisco AS5300).

For example, the following two records would exist in DNS:

```
sj-offramp in mx 10 sj-mailer
sj-offramp in mx 20 sj-offramp
sj-offramp in a 1.2.3.4
```

To help prevent unauthorized use of the fax off-ramp and to force all mail to go through this one mailer, we recommend that the Cisco AS5300 be configured with access control lists (ACLs) to block incoming mail from other mailers. If ACLs have been set up on the router, the second MX record should NOT be placed in the DNS. For more information about ACLs, refer to the *Cisco IOS Security Configuration Guide*.

Procedure for Tuning the Sending Mailer (sendmail) for Single Recipient

The following procedure describes how to tune the sending mailer (in this case, sendmail) to work faster with Store and Forward fax off-ramps and to reduce delays caused by attempting to send to multiple recipients. This procedure configures sendmail to send to each recipient serially, but without delays between each transmission. Configuring sendmail to send messages in parallel would require sending the single messages back through sendmail again (perhaps on a different port) and running multiple sendmail client processes on the system. Such sendmail configuration changes are beyond the intended scope of this document.



Note

These instructions are for sendmail 8.8.5.

Do not modify the sendmail configuration on any system without a full-understanding of what mail that system is processing and without the approval of the postmaster of the site. At most sites, the postmaster is a different person from the network administrator. Interfering with a company mail system can cause a loss of mail service, which many companies rely upon for day-to-day operation.

**Caution**

Modifying the sendmail configuration can break all e-mail into and out of the box for your entire enterprise. Perform sendmail configuration modifications only after you have notified your site postmaster.

1. The sendmail configuration file should be modified to contain the following line. The sendmail configuration file is usually named `/etc/sendmail.cf`. Note that the line may already exist but may be commented out.

```
Kmailertable hash /etc/mailetable
```

If this line (Kmailetable) already exists in the configuration file, determine the name of the source text file used to build the mailetable.db file and edit that in Step 4 or the existing mailetable.db of the site will be overwritten. If not present, the line should be added toward the top of the configuration file with other “K” settings.

2. For the mailetable entry shown to be used by sendmail, a rewrite rule must be specified that causes a matching of the hosts in the mailetable. Make sure the rewrite rules (starting with “R”) for mailetable are not commented out. They can be found by searching for “mailetable,” and usually look like this:

```
# not local -- try mailer table lookup
R$* <@ $+ > $*      $: < $2 > $1 < @ $2 > $3      extract host name
R< $+ . > $*        $: < $1 > $2              strip trailing dot
R< $+ > $*          $: < $(mailetable $1 $) > $2  lookup
R< error : $- $+ > $*  $#error $@ $1 $: $2              check -- error?
R< $- : $+ > $*      $# $1 $@ $2 $: $3          check -- resolved?
R< $+ > $*          $: $>90 <$1> $2            try domain
```

If they are not present, place the lines in Ruleset 0 (which starts at the line containing “S0”) before the rules that deliver local mail (R\$=L \$#local ...).

3. A new mailer specification line needs to be created. The new mailer specification line should be created in the section with other mailer specifications, which is usually toward the bottom of the file. Create the following line:

```
Mfaxofframp,      P=[IPC], F=DFMuXa0, S=11/31, R=21, E=\r\n, L=2040,
T=DNS/RFC822/SMTP,
A=IPC $h
```

It is important that the S= and R= values are the same as those for the existing mailer specifications for mail relaying (existing S= and R= values can be found by looking for the lines beginning with an uppercase “M,” usually toward the end of the sendmail.cf file). The S= and R= values control that sendmail rewrites rules are applied to the Sender and Recipient address of the message. The rule numbers (and the rules themselves) are often different on each system, especially at sites that have complex sendmail configurations.

It is important that the “F=m” flag is omitted, and the “F=0” (zero) flag is present, as shown. The “m” flag causes delivery to multiple recipients (which we do not want) and the “0” (zero) flag disables MX lookups (which we want). Note that the “0” (zero) flag is only available in sendmail version 8.8 or later (if you are running an earlier version of sendmail, omit the “0” and use [] in the mailetable as described in Step 4).

4. The file `/etc/mailetable.txt` should be created with one line for each fax off-ramp device, listing the host name, white space, then the string “faxofframp:” and the host name again.

For example, the hosts `offramp-seattle.cisco.com` and `as5300-denver.csico.com` would be as follows:

```
offramp-seattle.cisco.com  faxofframp:offramp-seattle.cisco.com
as5300-denver.cisco.com   faxofframp:as5300-denver.cisco.com
```

If you are running a pre-V8.8 version of sendmail, use brackets around the right-side host name as follows:

```
offramp-seattle.cisco.com  faxofframp:[offramp-seattle.cisco.com]
```

5. Compile the new `mailertable.txt` using `makemap` (sometimes located in `/usr/sbin`), for example:

```
/usr/sbin/makemap hash /etc/mailertable.db < mailertable.txt
```



Note If your system does not have `makemap`, your sendmail was probably built without support for `hash`. You can have sendmail look at the `mailertable.txt` file by using “text” instead of “hash” on the `Kmailertable` line (Step 1).

6. Close and restart sendmail:

```
ps -e | grep sendmail
kill pid # using PID indicated by above output
/usr/lib/sendmail -bd
```

7. In DNS, set up A and MX records:

```
as5300-hostname      in a    a.b.c.d
in mx 10  sendmail-system
in mx 20  as5300-hostname
```

This will cause mail to be delivered to `sendmail-system` first. Because the sendmail configuration disables MX lookups (“F=0”) for the Cisco AS5300, sendmail will deliver directly to the Cisco AS5300's IP address.

Also, if the sendmail system is down or otherwise unavailable, mail will be queued directly to the Cisco AS5300. Alternatively, you can use the following configuration:

```
as5300-hostname      in a    a.b.c.d
in mx 10  sendmail-system
in mx 20  backup-mta
```

In this example, `backup-mta` is another sendmail (or other) mailer.

8. Tune the following parameters to control sendmail and provide behavior more desirable for the needs of users that want near-real-time delivery of messages:
 - The configuration file setting “O MinQueueAge” controls how long an entry must be in the queue before an attempt will be made to process it. It is likely a site will want to reduce this setting for use with Cisco fax off-ramps (normal value is 30 minutes).
 - The “-q” switch used to start sendmail controls how often the queue is checked for reprocessing entries.
 - The configuration file setting “O Timeout.queuereturn” controls the lifetime of a message in the queue.
 - The configuration file setting “O Timeout.queuwarn” controls when sendmail issues a warning that the message has not been successfully relayed.
 - The configuration file setting “O QueueSortOrder=XXX” controls how sendmail sorts the queue for processing. The string XXX should be one of: host, priority, or time.

- The configuration file settings “O QueueLA” and “O QueueFactor” control the system load average, which causes sendmail to queue new messages instead of delivering them.
 - The configuration file setting “O ConnectionCacheSize” and “O ConnectionCacheTimeout” can be used to process more than one mail transaction in one TCP session with the fax off-ramp.
9. We recommend that the configuration file setting “O DoubleBounceAddress” be set to the local postmaster or other administrative human address.



Note If the sending MTA supports the X-SESSION SMTP service extension, the AS5300 will support multiple recipients in one SMTP transaction, and will only store one copy of each fax data page in its memory.

Using Redialers with Store and Forward Fax

Store and Forward Fax on-ramp has been designed to work either using DID or using a redialer. If you choose not to implement DID, you must configure and enable a redialer on the originating fax machine for Store and Forward Fax to be operational.

Use a redialer in the following circumstances:

- Provisioning a DID service is not possible
- You need user information, such as a PIN from the redialer
- T1-CAS signaling is in use

For Store and Forward Fax to work with a redialer, you must perform the following tasks:

- Program the redialer to dial the Cisco AS5300 acting as the on-ramp gateway and capture the dialed digits.

A redialer is an interface hardware device that interconnects between a fax device and a PSTN network that maps the numbers that a user dials to reach a specific destination to a different number, and forwards the dialed digits to that new number, transparent to the user. The user enters the complete telephone number into the fax device, and the attached redialer captures and stores those dialed digits. The redialer then dials the on-ramp Cisco AS5300, which provides a secondary dial tone.

When the **no direct-inward-dial** command is configured for the on-ramp POTS dial peer, the on-ramp gateway will answer the call and provide secondary dial tone. The redialer should be programmed to wait 2 seconds, then send the PIN and destination digits to the on-ramp gateway.

- Configure an MMoIP dial peer to match the forwarded dialed digits from the redialer.

When the redialer forwards the original dialed digits to the on-ramp Cisco AS5300, the on-ramp gateway will collect the digits, separate the PIN from the destination, and attempt to match an on-ramp MMoIP dial peer with the destination. If the **debug fax receive** command is enabled, you can see the digits as they are received by the on-ramp gateway. If a dial peer is matched, the fax proceeds. If a dial peer is not matched, the fax fails.

Store and Forward Fax allows 19 digits (maximum) for the PIN and 32 digits (maximum) for the destination number. The PIN and destination number must be separated by a #, for example:

```
0000000012345678#01127116650945
```

The fax protocol starts after 52 digits are detected or the interdigit timeout exceeds 5 seconds.

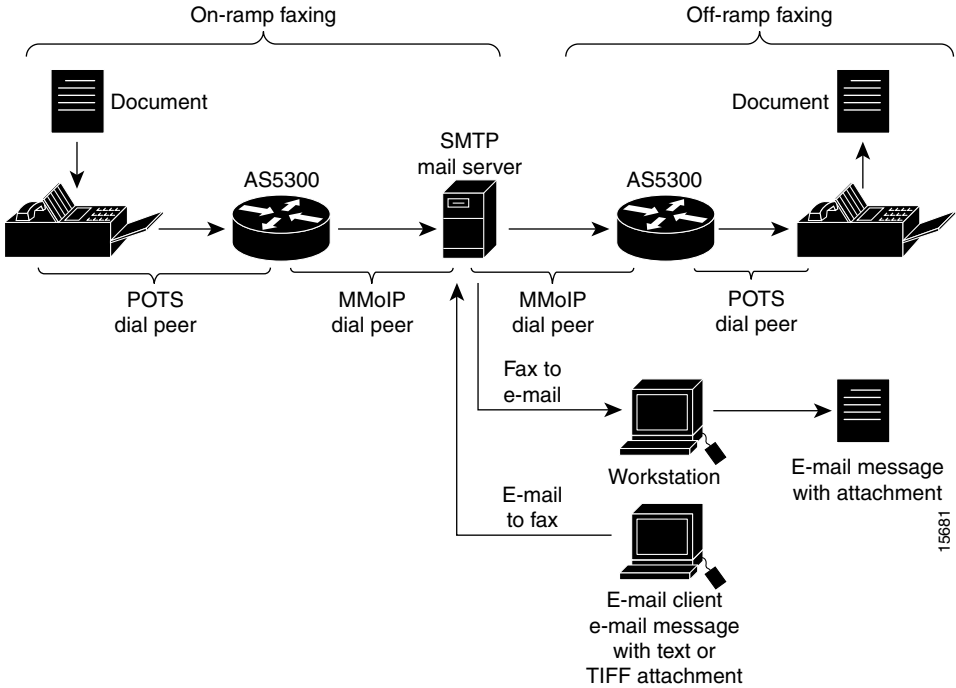
The following redialers are supported:

- Mitel
- Telecom Research

Understanding Dial Peers

Although you need not configure VoIP to use the Store and Forward Fax feature, you need to be familiar with the concept of dial peers. In fact, the key to understanding the Cisco telephony implementation is to understand the use of dial peers. Dial peers define the line characteristics associated with a call leg; a call leg is a discrete segment of a call connection. In general, the Cisco telephony implementation uses four call legs to establish an end-to-end call, as shown in Figure 2. Store and Forward Fax also uses four call legs to establish an end-to-end call, but one of the call legs, the leg from the SMTP server to the off-ramp gateway, is optional.

Figure 2 Dial Peer Call Legs



You use dial peers to apply specific attributes to call legs, such as identifying call origin and destination. In Store and Forward Fax, you also use dial peers to configure MDNs, DSNs, fax image resolution, and encoding type.

Two different kinds of dial peers are used in Store and Forward Fax as follows:

- POTS dial peers—POTS dial peers define the line characteristics generally associated with a typical or traditional telephony network connection. In Store and Forward Fax, there are two different implementations of POTS dial peers: one that defines the line characteristics of the

connection between the sending fax machine and the Cisco AS5300 acting as the on-ramp gateway, and another defining the line characteristics between the receiving fax machine and the Cisco AS5300 acting as the off-ramp gateway. For more information about on-ramp POTS dial peers—for example, how to configure them and how the on-ramp router uses them—see the “Configuring On-Ramp POTS Dial Peers” section later in this chapter. For more information about off-ramp POTS dial peers, see the “Configuring Off-Ramp POTS Dial Peers” section later in this chapter.

- MMoIP dial peers—MMoIP dial peers describe the line characteristics generally associated with a packet network connection; for example, in the case of Store and Forward Fax, this is the IP network connection between the on-ramp (and optionally, the off-ramp) gateway and the SMTP server.

For more information about on-ramp MMoIP dial peers—for example, how to configure them and how the on-ramp router uses them—see the “Configure On-Ramp MMoIP Dial Peers” section later in this chapter. For more information about how and when to configure optional off-ramp MMoIP dial peers, refer to the “Configure Off-Ramp MMoIP Dial Peers” section later in this chapter. For more general background or supplementary information about voice-related dial peers, refer to the “Voice over IP” chapter.

Understanding Destination Patterns and Prefixes

Another VoIP concept that is important to understand is how the AS5300 uses destination patterns and prefixes in processing a call. A destination pattern is the telephone number of the destination telephony or fax device. When an off-ramp gateway receives a call, it selects an off-ramp POTS dial peer by comparing the called number (the full E.164 telephone number) in the call information with the number configured as the destination pattern for the POTS dial peer. The off-ramp gateway then strips the left-justified numbers corresponding to the destination pattern matching the called number. If you have configured a prefix, the prefix will be put in front of the remaining numbers, creating a dial string, which the router will then dial. If all numbers in the destination pattern are stripped, the user will receive (depending on the attached equipment) a dial tone.

For example, suppose there is a fax device whose E.164 called number is 1(408)555-1234 and that this fax device can be reached within the company by dialing its extension number, 51234. If you configure a destination pattern of “1408555...” (the periods represent wild cards) for the associated off-ramp POTS dial peer, the off-ramp gateway will strip out the digits “1408555” when it receives a call for 1(408)555-1234. For the off-ramp gateway to forward the call to the appropriate destination, the digit “5” needs to be prepended to the remaining digits. In this case, you would configure a prefix of 5.

Suppose there is a fax device whose E.164 called number is 1(408)555-1234 and to reach this device you need to dial “9.” In this case, you might configure “1408.....” as the destination pattern, and “9” as the prefix. In this example, the off-ramp router will strip the digits “1408” from the called number and append the digit “9” to the front of the remaining numbers, so that the actual number dialed is “9,5551234.” The comma in this example means that the router will pause for one second between dialing the “9” and the “5551234” to allow for a secondary dial tone.

For more information about the **destination-pattern** and **prefix** commands, refer to the *Cisco IOS Multiservice Applications Command Reference* publication.

Understanding Number Expansion

Another VoIP concept that is important to understand is number expansion. In many cases, when you define a destination pattern or an incoming called number for a Store and Forward Fax dial peer, you define the full E.164 telephone number associated with it. There may be times, though, when you might need to use number expansion in connection with your defined destination pattern. In most corporate

environments, the telephone network is configured so that you can reach a destination by dialing only a portion (the extension number) of the full E.164 telephone number. VoIP functionality (which Store and Forward Fax uses) lets you define an extension number as the destination pattern for a dial peer. If you need to expand the extension to its full E.164 set of digits, you use number expansion. Number expansion lets you define a set of digits to be prepended to the front of a defined and identified destination pattern.

You implement number expansion by using the **num-exp** command. The *extension-number* argument defines the number pattern to be expanded. The *extension-string* argument defines the number to be prepended to the defined extension number. You can verify the number expansion information by using the **show num-exp** command to show that you have mapped the telephone numbers correctly. After you have configured dial peers and assigned destination patterns to them, you can verify number expansion information by using the **show dialplan number** command to see how a telephone number maps to a dial peer.

Using a simple telephony-based example, suppose John works in a company where you dial the last four digits of the full E.164 telephone number to reach his extension. The E.164 telephone number is 555-2123; his extension number is 2123. Suppose every employee on his floor has a telephone number that begins with the same first four digits: 555-2. You could define each dial peer's destination pattern using each peer's extension number, and then use number expansion to prepend the first four digits on to the extension. In John's case, the Cisco AS5300 could be configured as follows:

```
configure terminal
num-exp 2... 5552...
dial peer voice 1 pots
destination pattern 2123
```

Number expansion can also be used to replace a dialed number with another number, as in the case of call forwarding. Suppose John, for some reason, needs to have all of his telephone calls forwarded to another number, 555-6611. In this case, you would configure the Cisco AS5300 as follows:

```
configure terminal
num-exp 2123 5556611
dial peer voice 1 pots
destination pattern 2123
```

In this example, every time the device receives a call for extension 2123, the dialed digits will be replaced with 555-6611 and forwarded to that telephone.

The way that you use number expansion with Store and Forward Fax depends on how you have implemented your dial plan. In general, you can use number expansion if you have used the **destination-pattern** command to define a destination telephone number for a dial peer. For example, off-ramp POTS dial peers define the telephone number of the destination fax device using the **destination-pattern** command. In this case, if you need to, you could use number expansion.

Configuration Tasks

To configure Store and Forward Fax, perform the tasks in the following sections :

- Configuring the On-Ramp Gateway
- Configuring the Off-Ramp Gateway
- Configuring On-Ramp Gateway Security
- Configuring Off-Ramp Gateway Security
- Configuring MDN
- Configuring DSN

Configuring the On-Ramp Gateway

As mentioned, the Cisco AS5300, acting as the on-ramp gateway, receives faxes from end users and converts them into TIFF files, creates standard MIME e-mail messages, attaches the TIFF files to them, and then forwards these fax-mail messages to the messaging infrastructure of a designated SMTP server, where fax-mail messages are stored. The on-ramp gateway accomplishes these activities by using the sending MTA and dial peers. The sending MTA (which is the Cisco AS5300) defines delivery parameters associated with the e-mail message to which the fax TIFF file is attached. These delivery parameters include defining a return e-mail path or designating a destination mail server. The on-ramp POTS dial peers define the call as being a fax transmission and the DNIS of the incoming fax call. The on-ramp MMoIP dial peer defines the destination fax telephone number and the session target, which in this case is the SMTP server.

To configure the on-ramp gateway, perform the tasks described in the following sections:

- Configuring the Called Subscriber Number
- Configuring the Sending MTA
- Configuring On-Ramp POTS Dial Peers
- Configuring On-Ramp MMoIP Dial Peers
- Configuring On-Ramp Modem Pooling
- Enabling the Nagle Congestion Control Algorithm

Configuring the Called Subscriber Number

The first step in configuring the on-ramp gateway is to configure called subscriber number—the number displayed in the LCD of the fax device when you are sending a fax to a recipient. Typically, with a standard Group 3 fax device, this is the telephone number associated with the receiving fax device. To configure the called subscriber number, use the following commands beginning in privileged EXEC mode:

| Command | Purpose |
|---|--|
| Step 1 Router# configure terminal | Enters global configuration mode. |
| Step 2 Router(config)# fax receive called-subscriber { sd <i>string</i> } | Defines the number that is displayed in the LCD of the sending fax machine. This parameter defines the called subscriber identification (CSI). |

Configuring the Sending MTA

The next step in configuring inbound faxing is to define the characteristics associated with the sending MTA. You use MTAs to define the elements of the e-mail message to which the fax TIFF file is attached; these elements include the following:

- Subject
- Destination
- Return path
- Postmaster
- Any additional identifying e-mail header information
- Address to which any disposition notices are sent

Of these configuration steps, you must define the originator of the e-mail fax, the destination mail server, the subject of the message, and the postmaster, which is the default mail station for undeliverable e-mail messages. The remaining configuration steps are optional.



Note

You use the **mta send mail-from username** and **mta send mail-from hostname** commands to configure the From: user name in the e-mail message. The To: address of the fax-mail is derived from the **session target** command configured for the MMoIP dial peer for the on-ramp gateway.

To configure the sending MTA, use the following commands in global configuration mode:

| Command | Purpose |
|--|--|
| <p>Step 1 Router(config)# mta send mail-from hostname <i>string</i></p> | <p>Specifies the originator (host name portion) of the e-mail fax message. This information appears in the RFC 822 From: field and the RFC 821 MAIL FROM field of the e-mail fax message. This information is also used for generating DSNs.</p> <p>When you configure the mta send mail-from hostname command, the host name configured is used with the mta send mail-from username command to form a complete e-mail address, like <code>faxuser@onramp-gateway.com</code>.</p> |
| <p>Step 2 Router(config)# mta send mail-from {username <i>string</i> username <i>ss\$</i></p> | <p>Specifies the originator (username portion) of the e-mail fax message. This information appears in the RFC 822 From: field and the RFC 821 MAIL FROM field of the e-mail fax message. This information is also used for generating DSNs.</p> <p>When you configure the mta send mail-from username command, the username configured is used with the mta send mail-from hostname command to form a complete e-mail address, like <code>faxuser@onramp-gateway.com</code>.</p> |

| Command | Purpose |
|---|---|
| Step 3 Router(config)# mta send server {host-name IP-address} | Specifies the destination server. DNS MX records are not used to determine the IP address of the host specified with the mta send server command. |
| Step 4 Router(config)# mta send subject string | Defines the text that appears in the Subject field of the e-mail fax message. |
| Step 5 Router(config)# mta send postmaster e-mail-address | Defines address to be used as the mta send mail-from address if the evaluated string is blank. An address such as fax-administrator@example.com is recommended (where company.com is replaced with your domain name, and fax-administrator is aliased to the person responsible for the operation of the Cisco AS5300 fax functions). At some sites this may be the same person as the e-mail postmaster, but at most sites this is likely to be a different person. |
| Step 6 Router(config)# mta send origin-prefix string | (Optional) Defines additional identifying information to be prepended to the e-mail header. |
| Step 7 Router(config)# mta send return-receipt-to {hostname string username string} | (Optional) Specifies the address where MDNs are sent, if you request MDN. |

Configuring On-Ramp POTS Dial Peers

On-ramp POTS dial peers define the characteristics of the telephony (PSTN) connection between the sending fax device and the on-ramp gateway. In general, the on-ramp gateway uses the line characteristics defined by POTS dial peers to determine call type and call destination. The on-ramp gateway determines call type and call destination through call discrimination. It matches various POTS peer configuration parameters until it comes up with an appropriate match.

On-Ramp Gateway POTS Dial Peer/Call Discrimination Process

An understanding of how the on-ramp gateway uses POTS dial peers in the course of call discrimination is helpful before you configure on-ramp POTS dial peers. First, though, some functional definitions should be created. As mentioned, Store and Forward Fax uses either DID or a redialer to process a fax call. In both of these cases, a different telephone number is used. For the purposes of the following discussion, the term *destinationDN* refers to the telephone number of the fax machine where the user wants a fax to be sent and *accessDN* refers to the telephone number dialed by a redialer to access an on-ramp gateway.

The process of call discrimination begins when the on-ramp router receives a call. It immediately identifies whether the call is being delivered via a PRI interface or a T1-CAS interface. If the on-ramp gateway determines that the call is coming in over a T1-CAS interface, it checks the service type field of the CAS group configuration. If the service type of the CAS group is fax, it flags the call as a Store and Forward Fax call and forwards it to the MMoIP dial peer to be processed as a fax call. If it determines that the call is coming in over a PRI interface, then the on-ramp gateway begins to look at several POTS dial peer data fields to determine what kind of call it has received.

The on-ramp gateway looks at the incoming called number field of each POTS dial peer listed in the dial peer lookup table. It compares the number configured as the incoming called number to the number received and selects the first POTS dial peer where the data matches. If the on-ramp router does not find a match, it assumes that this is a data call and processes the call accordingly.

If the on-ramp router does find a match, it will then look at the service type field of the POTS dial peer to determine whether this is a voice or fax call. If this call has been flagged as a voice call, the on-ramp gateway will process it appropriately as a voice call. If the call has been flagged as a fax call, the on-ramp gateway checks to see whether DID has been enabled. If DID has been enabled, it concludes that the telephone number it has received is the destinationDN and forwards the call to be matched with the appropriate on-ramp MMoIP dial peer.

If DID has not been enabled, the on-ramp gateway assumes that the telephone number it received is the accessDN. In this case, the on-ramp router provides a secondary dial tone and collects another telephone number from the redialer at the other end of the connection that it will use as the destinationDN. After it has received this number from the redialer, the on-ramp gateway forwards the call to be matched to the appropriate on-ramp MMoIP dial peer.

Redialers Versus DID for POTS Peers

By default, DID is disabled, which means that the on-ramp gateway assumes that the fax call it receives is being placed using a redialer. In this situation, when a call arrives on the on-ramp gateway, it presents a dial tone and collects digits until it can identify the destination, as described. After the destination has been identified, it forwards the call through to the next call leg (in this case, the MMoIP dial peer) to the destination.

If DID is enabled, the on-ramp gateway uses the called number (DNIS) to find a dial peer for the outgoing call leg. DID enables the gateway to match the incoming called number with a dial peer and then directly place the outbound call. With DID, the server does not present a dial tone to the fax machine and does not collect digits; it forwards the call directly to the configured destination.

To configure on-ramp gateway POTS dial peers, use the following commands beginning in global configuration mode:

| Command | Purpose |
|---|--|
| Step 1 Router(config)# dial-peer voice <i>number</i> pots | Defines the POTS dial peer tag number and enters dial-peer configuration mode. |
| Step 2 Router(config-dial-)# information-type fax | Identifies calls associated with this dial peer as being fax transmissions, as opposed to being voice calls. |
| Step 3 Router(config-dial-)# direct-inward-dial | (Optional) Specifies DID. If you are not using a redialer, you must enable DID to use Store and Forward Fax. |
| Step 4 Router(config-dial-)# incoming called-number <i>string</i> | Defines the telephone number associated with the POTS dial peer—in Store and Forward Fax, if DID is enabled, the incoming called number (DNIS number) is used to match the destination pattern of outgoing MMoIP dial peers. |
| Step 5 Router(config-dial-)# max-conn <i>number</i> | (Optional) Defines the maximum number of on-ramp connections used simultaneously on this Cisco AS5300 to send fax-mail. |

Configuring On-Ramp MMoIP Dial Peers

MMoIP dial peers describe the line characteristics generally associated with a packet network connection; in the case of Store and Forward Fax, this is the IP network connection between the on-ramp gateway and the SMTP server.

On-ramp MMoIP dial peers are used to define the destination fax telephone number, to specify a destination e-mail address (which in this case identifies the SMTP server), to define the image encoding and resolution specifics for the associated fax-mail TIFF files, and to request either DSNs, MDNs, or both. If you enabled DID and specified an incoming called number for the on-ramp POTS dial peer, the destination pattern of the on-ramp MMoIP dial peer should be the same as the configured incoming called number. If you did not enable DID, then you need to configure and enable a redialer to use Store and Forward Fax. If you use a redialer, you need to configure the destination pattern to match the forwarded dialed digits from the redialer.

On-Ramp Gateway MMoIP Dial Peer/Call Discrimination Process

An understanding of how the on-ramp gateway uses MMoIP dial peers is helpful before configuring on-ramp MMoIP dial peers. As with on-ramp POTS dial peers, for the purposes of the following discussion, the term *destinationDN* refers to the telephone number of the fax machine where the user wants a fax to be sent, and *accessDN* refers to the telephone number dialed by a redialer to access an on-ramp gateway.

The function of the on-ramp call discrimination process using MMoIP dial peers is to determine the destination of the fax-mail, which in this case means the off-ramp gateway over which the fax-mail is sent to the destination fax machine.

The on-ramp gateway looks at the destination pattern field of each MMoIP dial peer listed in the dial peer lookup table. It compares the number configured as the destination pattern to the number received and selects the first MMoIP dial peer where the data matches. The on-ramp gateway then looks at the session target field for the selected MMoIP dial peer to identify the destination of the fax-mail message—this could be a specific off-ramp gateway for a Store and Forward fax or, if the fax is being delivered as an e-mail message, an e-mail address for a specific mail server.

Image Encoding and Image Resolution

Depending on your specific needs, you might want to increase or decrease the resolution of the received fax image. As a default, image resolution in Store and Forward Fax is set to passthrough, which means that the image is forwarded exactly as it is received. If you want to specify a different resolution for the fax TIFF image, whether greater or lesser, use the **image resolution** dial-peer configuration command as an attribute of the on-ramp MMoIP dial peer.

Depending on the capacity of the fax machines in your network, you might want to use a different image encoding (compression) scheme for the fax TIFF image Store and Forward Fax creates. As a default, image encoding in Store and Forward Fax is set to passthrough, which means that the image is forwarded exactly as it is received. If you want to specify a specific encoding (compression) scheme for the fax TIFF image, use the **image encoding** dial-peer configuration command.

DSN

DSNs are messages or responses that are automatically generated and sent to the sender or originator of an e-mail message by the SMTP server, notifying the sender of the status of the e-mail message. Three different states can be reported back to the sender as follows:

- Delay—Indicates that, for some reason, the message was delayed in being delivered to the recipient.
- Success—Indicates that the message was successfully delivered to the recipient mailbox.

- **Failure**—Indicates that, for some reason, the SMTP server was unable to deliver the message to the recipient.

Because these delivery states are not mutually exclusive, you can configure Store and Forward Fax to generate these messages for all or any combination of these events.

You enable DSN requests as part of the on-ramp MMoIP dial peer configuration. For complete instructions on how to configure DSNs using Store and Forward Fax, refer to the “Configuring Delivery Status Notification” section later in this chapter.

MDN

One basic e-mail operation that Store and Forward Fax supports is MDN. Described in RFC 2298, MDN is where a message is returned to the originator of an e-mail message indicating that the e-mail message has been opened. To configure MDN for Store and Forward Fax, you need to configure elements on both the on-ramp and off-ramp gateways. You enable MDN requests as part of the on-ramp MMoIP dial peer configuration. For complete instructions on how to configure MDNs using Store and Forward Fax, see the “Configuring Message Delivery Notification” section later in this chapter.

To configure on-ramp gateway MMoIP dial peers, use the following commands beginning in global configuration mode:

| Command | Purpose |
|---|---|
| Step 1 Router(config)# dial-peer voice <i>number</i> mmoip | Defines the MMoIP dial peer tag number and enters dial-peer configuration mode. |
| Step 2 Router(config-dial-)# information-type fax | Identifies calls associated with this dial peer as being fax transmissions, as opposed to strictly being voice calls. |
| Step 3 Router(config-dial-)# destination-pattern [+] <i>string</i> | Identifies the destination fax telephone number. If DNIS has been enabled, this number should be the same as the configured incoming called number. If DNIS is not enabled, this should be the number from the redialer DNIS. |
| Step 4 Router(config-dial-)# session target { mailto: { <i>name</i> \$d\$ }@ domain-name ipv4: <i>destination-address</i> dns: { \$s\$. \$d\$. \$u\$. \$e\$.} <i>host-name</i> loopback:rtp loopback:compressed loopback:uncompressed } | Defines the destination e-mail address for the fax-mail, meaning the e-mail address identifying the SMTP server. |
| Step 5 Router(config-dial-)# session protocol smtp | Identifies the session protocol being used between the on-ramp gateway and the remote mail server as SMTP. |
| Step 6 Router(config-dial-)# image encoding { mh mr mmr passthrough } | Selects a specific encoding method for the fax-mail messages forwarded via this dial peer. |
| Step 7 Router(config-dial-)# image resolution { fine standard super-fine passthrough } | Selects a specific resolution for the TIFF images attached to the fax-mail message forwarded via this dial peer. |
| Step 8 Router(config-dial-)# max-conn <i>number</i> | (Optional) Defines the maximum number of connections used simultaneously on this Cisco AS5300 to send fax-mail. |

| Command | Purpose |
|---|---|
| Step 9 Router(config-dial-)# dsn { delay failure success } | (Optional) Requests that a delivery status notification be generated by the last hop mailer if the delivery was successful. This DSN is sent to the address specified by the mta send mail-from command. Three types of DSNs can be requested: delay, failure, and success. DSN must be supported by the remote mail server. |
| Step 10 Router(config-dial-)# mdn | (Optional) Requests that a message disposition notification be generated by the mail user agent when the message is processed (typically opened or read). The MDN is generated by the receiving mail user agent and sent to the address defined by the mta send return-receipt-to command. Return receipt must be supported/initiated by the receiving e-mail client. |

Configuring On-Ramp Modem Pooling

You can use modem pooling on the on-ramp gateway to determine which modems are available for the following:

- Fax and data
- Data only

As a default, Store and Forward Fax receives faxes on modems that are in the on-ramp gateway default modem pool—meaning that these modems are available for both fax and data calls. The on-ramp gateway determines the call type by using the DNIS. The on-ramp gateway compares the DNIS to the configured value for the incoming called-number POTS dial-peer configuration command; if the DNIS matches the incoming called number, then it treats the call as a fax transmission. If it does not find a match in its dial peer lookup table, it treats the call as a data call.

You can specify which incoming fax calls will not be presented to the default modem pool by defining a named modem pool. This is particularly useful if you have both MICA and Microcom faxes; it allows you to divert fax traffic from MICA modems, which at this time do not support fax transmission.

To configure on-ramp modem pooling, use the following commands beginning in privileged EXEC mode:

| Command | Purpose |
|--|--|
| Step 1 Router# configure terminal | Enters global configuration mode. |
| Step 2 Router(config)# modem-pool <i>name</i> | Creates a modem pool. |
| Step 3 Router(config)# pool-range <i>number-number</i> | Assigns a range of modems to the specified modem pool. |

Enabling the Nagle Congestion Control Algorithm

In the past, when a standard TCP application sent data between machines, TCP tended to send a series of small packets—for example, TCP would send one packet for each keystroke typed when sending keystrokes between machines. On larger networks, many small packets use up bandwidth and contribute to congestion. John Nagle’s algorithm (RFC 896) helped alleviate the small-packet problem in TCP and now is being used, by default, in most modern TCP applications. The effect of this algorithm is to accumulate characters into larger chunks and pace them out to the network at a rate matching the round-trip time of the given connection. For more information about the Nagle algorithm (including a good description of how this algorithm works), refer to RFC 2001.

You need to enable Cisco routers and access servers to support the Nagle congestion control algorithm. To optimize Store and Forward Fax performance and to avoid packet congestion, enable the Nagle congestion control algorithm by using the **service nagle** global configuration command.

To enable the Nagle Congestion Algorithm, use the following command in global configuration mode:

| Command | Purpose |
|--------------------------------------|--|
| Router(config)# service nagle | (Optional) Enables the Nagle congestion control algorithm to optimize Store and Forward Fax performance. |



Note

There may be unexpected side effects with other services that run over TCP sockets on this same Cisco AS5300 if you enable the Nagle congestion algorithm when using Store and Forward Fax. However, we are unaware of any side effects at this time.

Verifying the On-Ramp Gateway Configuration

- To verify the configured called-subscriber number, use the **debug fax receive called-number** command.
- To check the configured called subscriber number, send a fax and check the number in the sending machine LCD.
- To verify that Store and Forward Fax dial peers have been configured correctly, use the **show dialplan number fax** command.
- To display Class 2 fax tracing information on all on-ramp fax connections, use the **debug fax receive all** command.
- To display output for all of the on-ramp client connections—meaning the messages exchanged (for example, the handshake) between the e-mail server and the on-ramp gateway, use the **debug mta send all** command.
- To display output for a specific on-ramp SMTP client connection during e-mail transmission, use the **debug mta send rcpt-to** command.
- To test connectivity between the on-ramp gateway and the e-mail server by sending a test e-mail to a specified e-mail address, use the **debug mmoip send email** command.
- If DID is not enabled, the server presents a dial tone to collect the digits. Make a POTS call to the on-ramp gateway and listen for a secondary dial tone to determine if DID is enabled or disabled.

Configuring the Off-Ramp Gateway

Off-ramp faxing requires the Cisco AS5300 acting as the off-ramp gateway to dial the POTS and communicate with a remote fax machine using standard fax protocols. The off-ramp gateway can send a message containing a TIFF image, a plain text message, or a message containing both.

The off-ramp gateway performs the following activities:

- Converts a fax-mail TIFF file (or plain text file) back into a standard format and delivers it to the recipient, which in this case is a Group 3 fax device. Store and Forward Fax does not alter the TIFF or plain text file in any way from its original format when converting it back into a standard fax format. The off-ramp gateway uses the receiving MTA and dial peers to perform this conversion.
- Delivers an e-mail message as a standard fax transmission, which is received and processed by a Group 3 fax device. The source of this transmission is an e-mail message. The Cisco AS5300 generates information to be appended to the top of each “faxed” page (meaning, text-to-fax pages) and creates a fax cover sheet. The off-ramp gateway uses the receiving MTA, dial peers, and commands specific to formatting the appended information and generating a fax cover sheet to deliver e-mail messages as fax transmissions.

**Note**

Off-ramp faxing activities are not mutually exclusive. You can create an e-mail to be sent as a fax and attach a TIFF file to it; when the Cisco AS5300 converts the e-mail to fax format, it also converts the attached TIFF file to standard Group 3 fax format.

The off-ramp gateway usually uses only POTS dial peers to define the line characteristics between the off-ramp gateway forwarding the converted e-mail message and the fax device; as an option, you can configure MMoIP dial peers, but MMoIP dial peers have limited functionality in off-ramp faxing activities. In general, off-ramp MMoIP dial peers merely define fax compression schemes and resolution and are useful only if you want to alter those parameters for the fax-mails being received.

**Note**

You can set up the off-ramp dial peers to steer a specific outgoing fax call to a specific T1 controller port. See “Configuring Off-Ramp POTS Dial Peers” below.

The off-ramp gateway uses receiving MTAs to define the parameters associated with the AS5300 SMTP server, such as its SMTP host alias(es), which can be different than its normal DNS host name(s) or internal Cisco IOS host name. Off-ramp POTS dial peers basically define the telephone number of the destination fax device. Because a destination pattern is defined for an outbound POTS peer, you can use number expansion.

To configure the off-ramp gateway, perform the tasks in the following sections:

- Configuring the Transmitting Subscriber Number
- Configuring the Fax Transmission Speed
- Configuring the Receiving Mail Transfer Agent
- Configuring Off-Ramp POTS Dial Peers
- Configuring Off-Ramp MMoIP Dial Peers (Optional)
- Configuring the Faxed Header Information
- Configuring the Fax Cover Page Information

The first four tasks are applicable to all off-ramp faxing activities. The last two tasks apply only to off-ramp faxing activities where the fax transmission originates as an e-mail message.

Configuring the Transmitting Subscriber Number

The first step in configuring the off-ramp gateway, whether the off-ramp gateway will be converting a fax TIFF file to a standard fax or sending an e-mail message as a fax, is to configure the transmitting subscriber number. The transmitting subscriber number is the number that will be displayed in the LCD of the receiving fax device. Typically, with a standard Group 3 fax device, this is the telephone number associated with the transmitting or sending fax device.

To configure the transmitting subscriber number, use the following commands beginning in privileged EXEC mode:

| Command | Purpose |
|--|--|
| Step 1 Router# <code>configure terminal</code> | Enters global configuration mode. |
| Step 2 Router (config)# <code>fax send transmitting-subscriber {<i>sd</i> <i>string</i>}</code> | Defines the number that appears in the LCD of the receiving fax device. This parameter defines the transmitting subscriber identification (TSI). |

Configuring the Fax Transmission Speed

The next step is to configure the maximum speed of the fax transmission. This is particularly helpful if the off-ramp gateway is sending faxes into an area where the fax transmission speed is always negotiated down to a slower speed.

To configure the fax transmission speed, use the following command in global configuration mode:

| Command | Purpose |
|--|---|
| Router (config)# <code>fax send max-speed {12000 14400 2400 4800 7200 7600}</code> | Specifies the maximum speed at which an off-ramp fax is sent. |

Configuring the Receiving Mail Transfer Agent

The next step in configuring the off-ramp gateway is to configure the receiving MTA. Receiving MTAs define the parameters associated with the SMTP server, such as defining the SMTP host alias(es). To configure the receiving MTA, use the following commands in global configuration mode:

| Command | Purpose |
|---|--|
| Step 1 Router (config)# <code>mta receive aliases <i>string</i></code> | <p>Defines a host name to be used as an alias for the off-ramp Cisco AS5300 device. You can define up to ten different aliases.</p> <p>The Cisco AS5300 SMTP server will only accept incoming mail if the destination host name of the incoming mail matches one of the aliases as configured by the <code>mta receive aliases</code> command.</p> <p>This command does not automatically include reception for a domain IP address—it must be explicitly added. If you add an IP address, you must enclose the address in brackets as follows: [xxx.xxx.xxx.xxx].</p> |

| Command | Purpose |
|--|---|
| Step 2 Router (config)# mta receive generate-mdn | (Optional) Configures the Cisco AS5300 to actually generate an MDN message when requested to do so. Some sites may want to enable or disable this feature depending on the types of mailers in use. |
| Step 3 Router (config)# mta receive maximum-recipients <i>number</i> | Defines the number of simultaneous SMTP recipients handled by this device. This is intended to limit the number of resources (modems) allocated for fax transmissions. |

Configuring Off-Ramp MMoIP Dial Peers

When implementing Store and Forward Fax on a modem card, the off-ramp gateway does not necessarily need to have MMoIP dial peers configured to establish connectivity with the receiving fax device; therefore, off-ramp MMoIP dial peers are optional when using a modem card. You basically use off-ramp MMoIP dial peers if you need to specify a particular resolution for the fax transmission or if you need to define an encoding type. For example, it might suit your company's needs to send the fax-mail using the least definition as possible to save network resources. In that case, you might want to define a higher image resolution using an off-ramp MMoIP dial peer. Another case where you might want to use an MMoIP dial peer would be if the fax devices in your network could only process a particular type of encoding or compression. If you do decide to configure a MMoIP dial peer, be sure to match the incoming called number command value with the destination pattern telephone number you configured for the corresponding on-ramp POTS dial peer.

Only two resolutions are available for this release: standard and fine. If you select any other **image resolution** command options (such as **passthrough** or **super-fine**), the fax will be sent using the fine resolution. Encoding type defines the type of compression scheme the off-ramp gateway uses for the TIFF image. There are four available compression options: Modified Huffman, Modified Read, Modified Modified Read, and passthrough.

Off-Ramp Gateway MMoIP Dial Peer/Call Discrimination Process

Once again, understanding how the off-ramp gateway uses MMoIP dial peers in the course of call discrimination is helpful before you configure off-ramp MMoIP dial peers. For the purposes of the following discussion, the term *destinationDN* refers to the telephone number of the fax machine where the user wants a fax to be sent, and *accessDN* refers to the telephone number dialed by a redialer to access an on-ramp gateway. For the on-ramp gateway to forward the fax-mail to the appropriate SMTP server, it converts the destinationDN into an e-mail address. The left side of this address is the destinationDN; the right side of this e-mail address defines the domain.

When the off-ramp router receives the fax-mail message, it looks at the destinationDN portion of the e-mail address and tries to match that value with the incoming called number field for each of the defined off-ramp MMoIP dial peers in its lookup table. If the off-ramp gateway finds an appropriate match, it uses the specified resolution and encoding values for the fax-mail message. If it cannot find a match, or if no resolution or encoding information has been defined for a matched off-ramp MMoIP dial peer, it applies fine resolution and non (passthrough) encoding for those parameters.

To configure off-ramp gateway MMoIP dial peers, use the following commands beginning in global configuration mode:

| Command | Purpose |
|--|--|
| Step 1 Router(config)# dial-peer voice <i>number</i> mmoip | Defines the MMoIP dial peer tag number and enters dial-peer configuration mode |
| Step 2 Router(config-dial-)# information-type fax | Identifies calls associated with this dial peer as being fax transmissions, as opposed to strictly being voice calls. |
| Step 3 Router(config-dial-)# incoming called-number <i>string</i> | Identifies the destination fax telephone number. |
| Step 4 Router(config-dial-)# image resolution { fine standard super-fine passthrough } | Specifies the fax image resolution for TIFF files associated with this particular MMoIP dial peer. Only standard and fine fax resolutions are supported for Cisco IOS Release 12.1. |
| Step 5 Router(config-dial-)# image encoding { mh mr mmr passthrough } | Specifies the type of encoding to be used for TIFF files associated with this MMoIP dial peer. |

Configuring Off-Ramp POTS Dial Peers

POTS dial peers configured for the off-ramp gateway define the line characteristics between the off-ramp gateway forwarding the converted e-mail message and the receiving fax device.

Off-Ramp Gateway POTS Dial Peer/Call Discrimination Process

Once again, understanding how the off-ramp gateway uses POTS dial peers in the course of call discrimination is helpful before you configure off-ramp POTS dial peers. For the purposes of the following discussion, the term *destinationDN* refers to the telephone number of the fax machine where the user wants a fax to be sent, and *accessDN* refers to the telephone number dialed by a redialer to access an on-ramp gateway. For the on-ramp gateway to forward the fax-mail to the appropriate SMTP server, it converts the destinationDN into an e-mail address. The left side of this address is the destinationDN; the right side of this e-mail address defines the domain.

The off-ramp gateway looks at the destination-pattern field of each POTS dial peer listed in the dial peer lookup table. It compares the number configured as the destination pattern to the destination DN portion of the fax-mail address and selects the first POTS dial peer where the data matches.

After the off-ramp gateway identifies the appropriate POTS dial peer, it then matches call type information. If the call type is identified as fax, it forwards the fax-mail message to off-ramp services. If the off-ramp router does not find a match, the recipient identified by this address will not be accepted by the off-ramp router.

To generate E.164 e-mail addresses compliant with RFC 2304, use the following address format: fax=+\$d\$@your.hostname.com. If the off-ramp gateway receives this type of e-mail address, it strips the + and matches an off-ramp POTS dial peer on the remaining digits. The number contained in “\$d\$” must be a fully qualified E.164 telephone number (that is, it must include the country code) and it must not include an access code (such as “9” to get an outside line).

To configure off-ramp gateway POTS dial peers, use the following commands beginning in global configuration mode:

| Command | Purpose |
|--|---|
| Step 1 Router(config)# dial-peer voice <i>number</i> pots | Defines the POTS dial peer tag number and enter dial-peer configuration mode. |
| Step 2 Router(config-dial-)# information-type fax | Identifies calls associated with this dial peer as being fax transmissions, as opposed to strictly being voice calls. |
| Step 3 Router(config-dial-)# destination-pattern [+] <i>string</i> T | Identifies the destination fax telephone number. |
| Step 4 Router(config-dial-)# prefix <i>number</i> | (Optional) Specifies the prefix of the dialed digits associated with this dial peer. If you configure a prefix, when an outgoing call is initiated, the prefix <i>string</i> value is sent to the modem first, before the telephone number configured for this dial peer. |

Configuring the Faxed Header Information

Store and Forward Fax lets you convert standard e-mail messages into fax transmissions. When you send a fax using a standard Group 3 device, there is usually header information appended to the top of each faxed cover and text page, indicating (among other things) the telephone number of the sending fax device, the date, and the time of transmission. Faxes created using an e-mail application need that header information appended to each faxed page. Store and Forward Fax lets you configure exactly what header information is appended to the top of each faxed cover and text page, along with its placement. In addition, you can also use the destination address of an e-mail message to control the cover page generation on a per-recipient basis.



Note

Because the off-ramp gateway does not alter fax TIFF attachments, you cannot configure faxed header information for faxes being converted from TIFF files to standard fax transmissions.

To configure faxed header information, use the following commands in global configuration mode:

| Command | Purpose |
|--|--|
| Step 1 Router(config)# fax send center-header { \$a\$ \$d\$ \$p\$ \$s\$ \$t\$ <i>string</i> } | Specifies the header information to be displayed in the center position. The wildcards used in this command are used to insert the following information: <ul style="list-style-type: none"> • \$a\$—date • \$d\$—destination address • \$s\$—sender address • \$p\$—page count • \$t\$—transmission time You use the <i>string</i> argument in this command to insert personalized text string. |

| Command | Purpose |
|---|--|
| Step 2 Router(config)# fax send right-header { <i>\$a\$</i> <i>\$d\$</i> <i>\$p\$</i> <i>\$s\$</i> <i>\$t\$</i> <i>string</i> } | Specifies the header information to be displayed on the right. The wildcards used in this command are used to insert the following information: <ul style="list-style-type: none"> • <i>\$a\$</i>—date • <i>\$d\$</i>—destination address • <i>\$s\$</i>—sender address • <i>\$p\$</i>—page count • <i>\$t\$</i>—transmission time You use the <i>string</i> argument in this command to insert personalized text string. |
| Step 3 Router(config)# fax send left-header { <i>\$a\$</i> <i>\$d\$</i> <i>\$p\$</i> <i>\$s\$</i> <i>\$t\$</i> <i>string</i> } | Specifies the header information to be displayed on the left. The wildcards used in this command are used to insert the following information: <ul style="list-style-type: none"> • <i>\$a\$</i>—date • <i>\$d\$</i>—destination address • <i>\$s\$</i>—sender address • <i>\$p\$</i>—page count • <i>\$t\$</i>—transmission time You use the <i>string</i> variable in this command to insert personalized text string. |

Configuring the Fax Cover Page Information

You can configure the off-ramp gateway to create fax cover pages for those faxes that originate from e-mail messages.



Note

Because the off-ramp gateway does not alter fax TIFF attachments, you cannot configure cover pages for faxes being converted from TIFF files to standard fax transmissions.

To configure fax cover page information, use the following commands in global configuration mode:

| Command | Purpose |
|---|--|
| Step 1 Router(config)# fax send coverpage enable | Enables the off-ramp gateway to send a cover sheet with faxes that originate from e-mail messages. |
| Step 2 Router(config)# fax send coverpage comment <i>string</i> | (Optional) Adds personalized text in the title field of the fax cover sheet. |
| Step 3 Router(config)# fax send coverpage show-detail | (Optional) Prints all of the e-mail header information as part of the fax cover sheet text. |

You can also use the destination address of an e-mail message to control the cover page generation on a per-recipient basis. You use the **fax send coverage e-mail-controllable** command to configure the router to defer to the cover page setting in the e-mail header.

In essence, the off-ramp router defers to the setting configured in the e-mail address itself. For example, if the address has a parameter set to `cover=no`, this parameter will override the setting for the **fax send coverage enable** command and the off-ramp gateway will not generate and send a fax cover page. If the address has a parameter set to `cover=yes`, the off-ramp gateway will defer to the setting configured in the e-mail address and generate and send a fax cover page.

Table 1 contains examples of what the user would enter in the To: field of the e-mail message.

Table 1 To: Field Entry Examples

| Example for To: Field Entries | Description |
|---|--|
| FAX=+1-312-555-3260@fax.com | Fax sent to an E.164-compliant long distance telephone number in the United States. If the fax coverage enable command has been configured, Store and Forward Fax will generate a fax cover page. |
| FAX=+1-312-555-3260/cover=no@fax.com | Fax sent to an E.164-compliant long distance telephone number in the United States. In this example, the fax coverage enable command is superseded by the <code>cover=no</code> statement. No cover page will be generated. |
| FAX=+1-312-555-3260/cover=yes@fax.com | Fax sent to an E.164-compliant long distance telephone number in the United States. In this example, the fax coverage enable command is superseded by the <code>cover=yes</code> statement. Store and Forward Fax will generate a fax cover page. |
| FAX=+1-312-555-3260/T33S=123456@fax.com | Fax sent to an E.164-compliant long distance telephone number in the United States; this example has an attached T.33 substring. |
| FAX=+49-515-555-5637@faxgateway.com | Fax sent to an E.164-compliant long distance telephone number in Germany. |
| FAX=+61-2-555-8765@fax.host.com | Fax sent to an E.164-compliant long distance telephone number in Australia. |
| FAX=+33-65-555-5555@fax.com | Fax sent to an E.164-compliant long distance telephone number in France. |

To configure the router to defer to the cover page setting in the e-mail header, use the following commands in global configuration mode:

| Command | Purpose |
|--|---|
| Step 1 Router (config)# fax send coverpage enable | Enables the off-ramp gateway to send a cover page with faxes that originate from e-mail messages. |
| Step 2 Router (config)# fax send coverpage e-mail controllable | Configures the router to defer to the cover page setting in the e-mail header. For example, if the address has a parameter set to cover=no or cover=yes, it will override the setting for the fax send coverpage enable command. |

Verifying the Off-Ramp Gateway Configuration

You can verify the off-ramp gateway configuration by performing the following tasks:

- To verify the information configured for the transmitting subscriber number, use the **debug fax send calling-number**.
- To display Class 2 fax protocol tracing information for all off-ramp faxing activities, use the **debug fax send all** command.
- Send a fax-mail message via a mail client (such as Eudora) to the off-ramp gateway. The destination e-mail address must have the appropriate fax=user@receive alias to be allowed. Request return receipt in the e-mail message. You should receive a returned receipt if the fax-mail is processed correctly.
- To show output relating to the activity on the SMTP server—meaning the messages exchanged (for example, the handshake) between the e-mail server and the off-ramp gateway, use the **debug mta receive all** command.
- To show information relating to the off-ramp text-to-fax conversion, use the **debug text-to-fax** command.
- To display output about the on-ramp TIFF reader, use the **debug tiff reader** command.
- To display output about the on-ramp TIFF writer, use the **debug tiff writer** command.
- If you have enabled fax cover pages, check whether the fax cover page generates correctly by sending an e-mail message to the off-ramp gateway.

Configuring On-Ramp Gateway Security

On-ramp security controls who is allowed to send Store and Forward Fax messages into the network. On-ramp security is facilitated by AAA security services using either RADIUS or TACACS+ as the local security protocol. On-ramp faxing is a client of the authentication server, whether RADIUS or TACACS+. User information is forwarded to the AAA interface, which is then forwarded as an authentication request to the security server. The server responds with either a success or failure to authenticate the on-ramp client. Authentication must be completed before the first page of faxed material is accepted from the modem by the Fax Application Process (FAP). If a response is not received from the AAA server before the first page is received, the fax modem disconnects the call.

To configure on-ramp security, use the following commands in global configuration mode:

| | Command | Purpose |
|----------------|---|---|
| Step 1 | <code>Router(config)# aaa new model</code> | Enables AAA security services. |
| Step 2 | <code>Router(config)# mmoip aaa method fax authentication <i>method-list-name</i></code> | Defines the name of the method list to be used for Store and Forward Fax AAA authentication. |
| Step 3 | <code>Router(config)# mmoip aaa method fax accounting <i>method-list-name</i></code> | Defines the name of the method list to be used for Store and Forward Fax AAA accounting. |
| Step 4 | <code>Router(config)# aaa authentication login {default <i>list-name</i>} <i>method1</i> [<i>method2</i>...]</code> | Creates a local authentication method list and enables authentication. |
| Step 5 | <code>Router(config)# aaa accounting {system network exec connection commands <i>level</i>} {default <i>list-name</i>} {stop-only} [<i>method1</i> [<i>method2</i>...]]</code> | Creates an accounting method list and enables accounting. We recommend the following configuration: aaa accounting connection list-name stop-only . |
| Step 6 | <code>Router(config)# mmoip aaa receive-id primary {ani dnis gateway redialer-id redialer-dnis}</code> | Specifies the primary location where AAA retrieves its identifying information for on-ramp faxing. |
| Step 7 | <code>Router(config)# mmoip aaa receive-id secondary {ani dnis gateway redialer-id redialer-dnis}</code> | (Optional) Specifies the secondary location where AAA retrieves its identifying information for on-ramp faxing. |
| Step 8 | <code>Router(config)# mmoip aaa receive-authentication enable</code> | Enables on-ramp AAA authentication services. |
| Step 9 | <code>Router(config)# mmoip aaa receive-accounting enable</code> | Enables on-ramp AAA accounting services. |
| Step 10 | <code>Router(config)# radius-server host {hostname <i>ip-address</i>} [auth-port <i>port-number</i>] [acct-port <i>port-number</i>]</code> | Specifies the IP address or host name of the remote RADIUS server host and assigns authentication and accounting destination port numbers. (Typical authentication and accounting destination ports are 1645 and 1646.) |
| Step 11 | <code>Router(config)# radius-server key <i>string</i></code> | Specifies the shared secret text string used between the router and the RADIUS server. |
| Step 12 | <code>Router(config)# radius-server vsa send accounting</code> | Enables the network access server to recognize and use accounting vendor-specific attributes (VSAs) as defined by RADIUS IETF attribute 26. |
| Step 13 | <code>Router(config)# radius-server vsa send authentication</code> | Enables the network access server to recognize and use authentication VSAs as defined by RADIUS IETF attribute 26. |

Verifying the On-Ramp Gateway Security Configuration

You can verify the on-ramp gateway security configuration by performing the following tasks:

- To verify that you have configured the on-ramp security for Store and Forward Fax correctly, use the **debug mmoip aaa** command.
- Verify connection to the RADIUS server by checking the console log file (this is dependent on the version of RADIUS you are using).
- To verify AAA performance, use the **debug aaa** command.

Configuring Off-Ramp Gateway Security

Off-ramp security controls who is allowed to send outgoing Store and Forward Fax messages. Off-ramp security is facilitated by AAA security services using either RADIUS or TACACS+ as the local security protocol. In off-ramp authentication, authentication begins as soon as a fax e-mail message header is received from the e-mail server on the off-ramp gateway. The Cisco AS5300 does not dial the destination fax device until authentication for each fax-mail is successfully completed.

When you enable authentication, the on-ramp gateway inserts whatever value you configure for the **mmoip aaa receive-id primary** command in the X-account-ID field of the e-mail header. This X-account ID field contains the value that is used for authentication and accounting by the on-ramp gateway. For example, if the **mmoip aaa receive-id primary** command is set to **gateway**, the on-ramp gateway name (for example, hostname.domain-name) is inserted in the X-account-ID field of the e-mail header of the fax-mail message.

If you want to use this configured gateway value in the X-account-ID field, you must configure the **mmoip aaa send-id primary** command with the **account-id** keyword. This particular keyword enables Store and Forward Fax to generate end-to-end authentication and accounting tracking records. If you do not enable authentication on the on-ramp gateway, the X-account-ID field is left blank.



Note

We recommend that you configure access control lists (ACLs) to restrict which IP addresses can connect to the SMTP port (port 25). For information about configuring ACLs, refer to the *Cisco IOS Security Configuration Guide*.



Note

We strongly recommend that you configure your Cisco AS5300 acting as an off-ramp gateway to only accept incoming SMTP connections from trusted mailers. Configure packet filters to allow only certain trusted IP addresses to send faxes to the Store and Forward Fax off-ramp gateway.

To configure off-ramp security, use the following commands in global configuration mode:

| Step | Command | Purpose |
|--------|---|--|
| Step 1 | Router(config)# aaa new model | Enables AAA security services. |
| Step 2 | Router(config)# mmoip aaa method fax authentication <i>method-list-name</i> | Defines the name of the method list to be used for Store and Forward Fax AAA authentication. |
| Step 3 | Router(config)# mmoip aaa method fax accounting <i>method-list-name</i> | Defines the name of the method list to be used for Store and Forward Fax AAA accounting. |
| Step 4 | Router(config)# aaa authentication login {default <i>list-name</i> } <i>method1</i> [<i>method2</i> ...] | Creates a local authentication method list and enables authentication. |
| Step 5 | Router(config)# aaa accounting {system network exec connection commands <i>level</i> } {default <i>list-name</i> } {stop-only} [<i>method1</i> [<i>method2</i> ...]] | Creates an accounting method list and enables accounting. We recommend the following configuration: aaa accounting connection list-name stop-only . |
| Step 6 | Router(config)# mmoip aaa send-id primary {account-id <i>envelope-from</i> <i>envelope-to</i> <i>gateway</i> } | Specifies the primary location where AAA retrieves its identifying information for off-ramp faxing. |

| Step | Command | Purpose |
|---------|---|---|
| Step 7 | Router(config)# mmoip aaa send-id secondary { account-id envelope-from envelope-to gateway } | (Optional) Specifies the secondary location where AAA retrieves its identifying information for off-ramp faxing. |
| Step 8 | Router(config)# mmoip aaa send-authentication enable | Enables off-ramp AAA authentication services. |
| Step 9 | Router(config)# mmoip aaa send-accounting enable | Enables off-ramp AAA accounting services. |
| Step 10 | Router(config)# radius-server host { <i>hostname</i> <i>ip-address</i> } [auth-port <i>port-number</i>] [acct-port <i>port-number</i>] | Specifies the IP address or host name of the remote RADIUS server host and assigns authentication and accounting destination port numbers. (Typical authentication and accounting destination ports are 1645 and 1646.) |
| Step 11 | Router(config)# radius-server key <i>string</i> | Specifies the shared secret text string used between the router and the RADIUS server. |
| Step 12 | Router(config)# radius-server vsa send accounting | Enables the network access server to recognize and use accounting VSAs as defined by RADIUS IETF attribute 26. |
| Step 13 | Router(config)# radius-server vsa send authentication | Enables the network access server to recognize and use authentication VSAs as defined by RADIUS IETF attribute 26. |

Verifying the Off-Ramp Gateway Security Configuration

You can verify your off-ramp gateway security configuration by performing the following tasks:

- To verify that you have configured the off-ramp security for Store and Forward Fax correctly, use the **debug mmoip aaa** command.
- Verify connection to the RADIUS server by checking the console log file (this is dependent on the version of RADIUS you are using).
- To verify AAA performance, use the **debug aaa** command.

Configuring Off-Ramp ACLs

You can use incoming ACLs on Ethernet or FastEthernet interfaces to filter SMTP traffic for Store and Forward Fax. We recommend that you configure ACLs to restrict access to the SMTP port (port 25) to only trusted e-mail servers.

Creating ACLs is a relatively complicated task and beyond the scope of this document. The following example, though, provides a starting point.

The following configuration example shows how to restrict access to the SMTP port 25 to a trusted e-mail server (IP address 10.0.0.1):

```
! Enter global configuration mode.
configure terminal
!
! Configure ACLs to restrict access to the SMTP port (port 25) to only "trusted"
! e-mail servers. Depending on the topology of your particular network, replace the
! any keyword with the destination IP addresses of the Ethernet and FastEthernet
! interfaces. Define all trusted e-mail servers using the tcp host ip-address
! portion of this command.
```

```

access-list 100 permit tcp host 10.0.0.1 any eq smtp
access-list 100 deny tcp any any eq smtp
access-list 100 permit ip any any
!
! Enter interface configuration mode for Ethernet interface 0.
interface ethernet 0
! Apply the access list to this interface.
access-group 100 in
!
! Enter interface configuration mode for FastEthernet interface 0.
interface fastethernet 0
! Apply the access list to this interface.
access-group 100 in

```

For complete information about configuring ACLs, refer to the relative chapters in the *Cisco IOS Security Configuration Guide*.

Attribute-Value Pairs for Store and Forward Fax

RADIUS attributes are used to define specific AAA elements in a user profile, which is stored on the RADIUS daemon. The Cisco implementation of RADIUS supports both IETF and vendor-proprietary attributes. IETF RADIUS attribute 26 allows vendors to support their own extended attributes not suitable for general use. Store and Forward Fax uses the Cisco RADIUS implementation of vendor-specific options using the format recommended in the specification. The Cisco vendor-ID company code is 9; the vendor-specific options are represented by subtype numbers from 3 through 21. Table 2 lists the Store and Forward Fax vendor-specific options supported using vendor-specific IETF RADIUS attribute 26.

Table 2 Vendor-Specific RADIUS Attributes for Store and Forward Fax

| IETF RADIUS Attribute | Vendor-Specific Company Code | Subtype Number | Attribute | Description |
|-----------------------|------------------------------|----------------|-----------------------------|---|
| 26 | 9 | 3 | Cisco-Fax-Account-Id-Origin | Indicates the account ID origin as defined by the system administrator for the mmpip aaa receive-id or the mmpip aaa send-id command. |
| 26 | 9 | 4 | Cisco-Fax-Msg-Id= | Indicates a unique fax message identification number assigned by Store and Forward Fax. |
| 26 | 9 | 5 | Cisco-Fax-Pages | Indicates the number of pages sent or received during this fax session. This page count includes cover pages. |

Table 2 Vendor-Specific RADIUS Attributes for Store and Forward Fax (continued)

| IETF RADIUS Attribute | Vendor-Specific Company Code | Subtype Number | Attribute | Description |
|------------------------------|-------------------------------------|-----------------------|------------------------------|--|
| 26 | 9 | 6 | Cisco-Fax-Coverpage-Flag | Indicates whether a cover page was generated by the off-ramp gateway for this fax session. True indicates that a cover page was generated; false means that a cover page was not generated. |
| 26 | 9 | 7 | Cisco-Fax-Modem-Time | Indicates the amount of time in seconds the modem sent fax data (x) and the amount of time in seconds of the total fax session (y), which includes both fax-mail and PSTN time, in the form x/y. For example, 10/15 means that the transfer time took 10 seconds, and the total fax session took 15 seconds. |
| 26 | 9 | 8 | Cisco-Fax-Connect-Speed | Indicates the modem speed at which this fax-mail was initially sent or received. Possible values are 1200, 4800, 9600, and 14400. |
| 26 | 9 | 9 | Cisco-Fax-Recipient-Count | Indicates the number of recipients for this fax transmission. Until e-mail servers support session mode, the number should be 1. |
| 26 | 9 | 10 | Cisco-Fax-Process-Abort-Flag | Indicates whether the fax session was aborted or successful. True means that the session was aborted; false means that the session was successful. |
| 26 | 9 | 11 | Cisco-Fax-Dsn-Address | Indicates the address to which DSNs will be sent. |
| 26 | 9 | 12 | Cisco-Fax-Dsn-Flag | Indicates whether DSN has been enabled. True indicates that DSN has been enabled; false means that DSN has not been enabled. |
| 26 | 9 | 13 | Cisco-Fax-Mdn-Address | Indicates the address to which MDNs will be sent. |

Table 2 Vendor-Specific RADIUS Attributes for Store and Forward Fax (continued)

| IETF RADIUS Attribute | Vendor-Specific Company Code | Subtype Number | Attribute | Description |
|-----------------------|------------------------------|----------------|-----------------------------|---|
| 26 | 9 | 14 | Cisco-Fax-Mdn-Flag | Indicates whether or not MDN has been enabled. True indicates that MDN has been enabled; false means that MDN has not been enabled. |
| 26 | 9 | 15 | Cisco-Fax-Auth-Status | Indicates whether authentication for this fax session was successful. Possible values for this field are success, failed, bypassed, or unknown. |
| 26 | 9 | 16 | Cisco-Email-Server-Address | Indicates the IP address of the e-mail server handling the on-ramp fax-mail message. |
| 26 | 9 | 17 | Cisco-Email-Server-Ack-Flag | Indicates that the on-ramp gateway has received a positive acknowledgment from the e-mail server accepting the fax-mail message. |
| 26 | 9 | 18 | Cisco-Gateway-Id | Indicates the name of the gateway that processed the fax session. The name appears in the following format: hostname.domain-name. |
| 26 | 9 | 19 | Cisco-Call-Type | Describes the type of fax activity: fax receive or fax send. |
| 26 | 9 | 20 | Cisco-Port-Used | Indicates the slot/port number of the Cisco AS5300 used to either send or receive this fax-mail. |
| 26 | 9 | 21 | Cisco-Abort-Cause | If the fax session aborts, indicates the system component that signaled the abort. Examples of system components that could trigger an abort are Fax Application Process (FAP), TIFF (the TIFF reader or the TIFF writer), fax-mail client, fax-mail server, ESMTP client, or ESMTP server. |

For more information about using vendor-specific RADIUS attributes, refer to “RADIUS Attributes” appendix in the *Cisco IOS Security Configuration Guide*. This appendix file contains a complete list of supported vendor-specific, vendor-proprietary, and IETF-compliant RADIUS attributes, the Cisco IOS releases in which they were implemented, and their definitions.

Configuring ESMTP Accounting Services

In Store and Forward Fax, you can collect accounting information about fax services in two ways:

- Using RADIUS accounting
- Collecting the accounting information using SMTP

The ESMTP Accounting in Store and Forward Fax feature enables you to collect accounting information about fax services as part of the SMTP session. This functionality is activated through the use of an intelligent fax client or MTA. In ESMTP accounting, the off-ramp gateway (acting in its capacity as an ESMTP server) advertises capabilities to the MTA, which is acting as an e-mail client. One of the capabilities the off-ramp gateway advertises is xaccounting, which means that it supports ESMTP accounting. If the MTA recognizes the xaccounting service extension, the MTA (acting as the client) can accept the ESMTP accounting information sent from the off-ramp gateway. If the MTA does not recognize the xaccounting service extension, it will not send the **xact** command to the off-ramp gateway. In that case, the off-ramp gateway will not respond with ESMTP accounting data.

To use SMTP to collect accounting data, then, you must configure the MTA to explicitly request accounting information as part of the e-mail session—meaning that you must program the MTA to do the following:

- Recognize the xaccounting service extension during the extended hello (ehlo) transaction
- Send the **xact** command to the off-ramp gateway to activate the ESMTP accounting feature

You need not configure any commands on the Cisco AS5300 to enable ESMTP accounting.

In the following example, ESMTP accounting is manually activated via a Telnet session. The output from the MTA is in **bold**; the output from the off-ramp Cisco AS5300 is in *italics*.



Note

In this particular example, the fax call was placed using a Microcom modem.

```
telnet 172.14.120.2 25
Trying 172.14.120.2...
Connected to 1.14.120.2.
Escape character is '^]'.
220 mmoip-b.cisco.com Cisco NetWorks ESMTP server
ehlo anyserver.com
250-mmoip-b.cisco.com, hello anyserver.com [223.255.254.10] (really)
250-ENHANCEDSTATUSCODES
250-8BITTIME
250-PIPELINING
250-HELP
250-DSN
250-XSESSION
250 XACCOUNTING
mail from:<>
250 2.5.0 Sender <> ok
rcpt to:<FAX=+1408555-7442@cisco.com>
250 2.1.5 Recipient <FAX=+1408555-7442@cisco.com> ok, maps to '5557442' (cp=yes)
xact
250 2.5.0 XACCOUNTING enabled
data
```


Table 3 Communication Between the MTA and the Off-Ramp Cisco AS5300 Access Server

| Message Transfer Agent | Off-Ramp Cisco AS5300 | Description |
|---|---|--|
| ehlo anyserver.com | | Extended hello—the MTA requests capability information from the off-ramp Cisco AS5300. |
| | 250-mmoip-b.cisco.com, hello anyserver.com [223.255.254.10] (really) 250-ENHANCEDSTATUSCODES 250-8BITMIME 250-PIPELINING 250-HELP 250-DSN 250-XSESSION 250 XACCOUNTING | The off-ramp gateway responds, advertising its capabilities. In this example, it provides its device name, its IP address, and a list of its capabilities. XACCOUNTING must be one of the enabled capabilities for ESMTP accounting to work. |
| mail from: < > | | The sender is defined. |
| | 250 2.5.0 Sender < > ok | The sender is acknowledged. |
| rcpt to:<FAX=+1408555-7442@ cisco.com> | | The recipient is defined. |
| | 250 2.1.5 Recipient <FAX=+1408555-7442@cisco.com> ok, maps to '5557442' (cp=yes) | Recipient is acknowledged. |
| xact | | The xact command is issued to enable ESMTP accounting. |
| | 250 2.5.0 XACCOUTNING enabled | ESMTP accounting is enabled. |
| data | | The MTA notifies the off-ramp gateway that the following information is the body text of the fax-mail message. |
| | 354 Enter mail, end with a single "." | The off-ramp gateway acknowledges the request to send data. |
| Testing 1 2 3 Testing 1 2 3 Testing 1 2 3 Testing 1 2 3 Testing 1 2 3 Testing 1 2 3 Testing 1 2 3 | | The body of the fax-mail message is sent. |
| . | | End of data. |

Table 3 Communication Between the MTA and the Off-Ramp Cisco AS5300 Access Server

| Message Transfer Agent | Off-Ramp Cisco AS5300 | Description |
|------------------------|--|---|
| | 250-2.5.0 Message delivered to remote fax machine 250-2.5.0 fax_modem_time = 32/41 250-2.5.0 fax_pages = 2 250-2.5.0 gateway_id = mmoip-b.cisco.com 250-2.5.0 fax_connect_speed = 14400bps 250-2.5.0 transmit_bytes = 16870 250-2.5.0 port_used = slot:1 port:2 250-2.5.0 call_type = Fax Send 250-2.5.0 abort_cause = 0 250-2.5.0 T30_error_code = 0 250-2.5.0 ISDN_disconnect_code = 16 250 2.5.0 CSID = 555-7442 | The off-ramp gateway sends the accounting data. These accounting fields are defined in Table 4. |

Table 4 defines the ESMTP accounting information provided by the off-ramp Cisco AS5300.

Table 4 ESMTP Accounting Field Definitions

| Accounting Field | Definition |
|---------------------|--|
| fax_modem_time = | Indicates the amount of time in seconds the modem sent fax data (x) and the amount of time in seconds of the total fax session (y), which includes both fax-mail and PSTN time, in the form x/y. |
| fax_pages = | Indicates the total number of faxed pages sent. |
| gateway_id = | Indicates the hostname.domain-name of the gateway. |
| fax_connect_speed = | Indicates the fax connection speed in bits per second (bps). |
| transmit_bytes = | Indicates the total number of bytes sent during the connection. |
| port_used = | Indicates the port over which this data was received. |
| call_type = | Indicates the type of call. |
| abort_cause = | Defines the internal gateway component that signaled that the fax transmission be aborted. Abort causes are defined as follows: <ul style="list-style-type: none"> • 0: No abort • 1: Fax application abort • 2: ESMTP abort • 3: TIF abort • 4: Text to fax process abort • 5: Authentication abort |
| T30_error_code = | Defines the standard applicable T.30 (Rockwell Class 2) error code, as defined in the T.30 specification. Table 6 lists the T.30 error codes. |

Table 4 ESMTP Accounting Field Definitions (continued)

| Accounting Field | Definition |
|-------------------------|--|
| ISDN_disconnect_code = | Defines the lists the applicable Q.931 (ISDN) call disconnection value. Table 7 lists the Q.931 call disconnection values. |
| CSID = | Indicates the CSI number, which is an identifier whose coding format contains the telephone number from the remote fax terminal. |

Table 5 explains the ESMTP mail system status codes in the previous examples.

Table 5 ESMTP (RFC 821) Mail System Status Codes

| SMTP Reply Code | Description |
|------------------------|---|
| 211 | System status or system help reply. |
| 214 | Help message. |
| 220 | Service ready (domain). |
| 221 | Service closing transmission channel (domain). |
| 250 | Requested mail action okay; completed. |
| 251 | User not local; will forward to <forward path>. |
| 354 | Start mail input; end with <carriage return; line forward (CRLF)>.<CRLF>. |
| 421 | Service not available (domain); closing transmission channel. |
| 450 | Requested mail action not taken: mailbox unavailable (for example, mailbox busy). |
| 451 | Request action aborted. Error in processing. |
| 452 | Requested action not taken: insufficient system storage. |
| 500 | Syntax error, command unrecognized. |
| 501 | Syntax error in parameters or arguments. |
| 502 | Command not implemented. |
| 503 | Bad sequence of commands. |
| 504 | Command parameter not implemented. |
| 550 | Requested action not taken: mailbox unavailable (for example, mailbox not found). |
| 551 | User not local; please try <forward path>. |
| 552 | Requested mail action aborted: exceeded storage allocation. |
| 553 | Requested action not taken: mailbox name not allowed (for example, mailbox syntax incorrect). |
| 554 | Transaction failed. |

Table 6 lists the T.30 (Rockwell Class 2) error codes used in the previous examples. Error code 0 indicates a normal connection.

**Note**

Error codes are sometimes specific to the modem sending the fax-mail. If the error codes in your ESMTP accounting data differ from the ones listed in Table 6, refer to the hardware documentation that came with your modem for implementation of T.30 error codes for that modem.

Table 6 Supported T.30 (Rockwell Class 2) Error Codes

| Number | Code |
|--------|-----------------------------|
| 0 | NORMAL_CONNECTION |
| 1 | RING_DETECT_NOCONNECT |
| 2 | USER_ABORT |
| 3 | NO_LOOP_CURRENT |
| 4 | AT_TIMEOUT |
| 5 | AT_ERROR |
| 6 | AT_NO_DIALTONE |
| 7 | AT_BUSY |
| 8 | AT_NO_CARRIER |
| 10 | PHASE_A_ERROR |
| 11 | NO_ANSWER_T30_TIMEOUT |
| 20 | TRANSMIT_PHASE_B_ERROR |
| 21 | REMOTE_CANNOT_RECEIVE_SEND |
| 22 | COMREC_ERR_TRANSMIT_PHASE_B |
| 23 | COMREC_INVALID_COMMAND |
| 24 | RSPEC_ERROR_B |
| 25 | DCS_NO_RESPONSE |
| 26 | DIS_DTC_RECEIVED_3_TIMES |
| 27 | FTT_2400 |
| 28 | RSPREC_INVALID_RESPONSE_B |
| 40 | TRANSMIT_PHASE_C_ERROR |
| 43 | DTE_DCE_UNDERFLOW |
| 50 | TRANSIT_PHASE_D_ERROR |
| 51 | RSPREC_ERROR_D |
| 52 | NO_RESPONSE_MPS |

Table 6 Supported T.30 (Rockwell Class 2) Error Codes (continued)

| Number | Code |
|--------|------------------------------------|
| 53 | INVALID_RESPONSE_MPS |
| 54 | NO_RESPONSE_EOP |
| 55 | INVALID_RESPONSE_EOP |
| 56 | NO_RESPONSE_EOM |
| 57 | INVALID_RESPONSE_EOM |
| 58 | UNABLE_CONTINUE |
| 70 | RECEIVE_PHASE_B_ERROR |
| 71 | RXSPREC_ERROR |
| 72 | COMREC_ERROR_RXB |
| 73 | T30_T2_TIMEOUT_PAGE |
| 74 | T30_T1_TIMEOUT_EOM |
| 90 | RECEIVE_PHASE_C_ERROR |
| 91 | MISSING_EOL |
| 92 | UNUSED_CODE |
| 93 | DCE_TO_DTE_OVERFLOW |
| 100 | RECEIVE_PHASE_D_ERROR |
| 101 | RSPREC_INVALID_RESPONSE_RECEIVED_D |
| 102 | COMREC_INVALID_RESPONSE_RECEIVED_D |
| 103 | UNABLE_TO_CONTINUE_AFTER_PIN_PIP |

Table 7 lists the applicable Q.931 (ISDN) call disconnection cause values. Error code 16 indicates a normal transmission.

Table 7 Supported Q.931 (ISDN) Call Disconnection Cause Values

| Number | Code | Description |
|--------|--------------------------------------|--|
| 0 | CC_CAUSE_UNINITIALIZED | The disconnect code was never set. |
| 1 | CC_CAUSE_UANUM | Unallocated (unassigned) number. |
| 2 | CC_CAUSE_NO_ROUTE_TO_TRANSIT_NETWORK | No route to specified transit network. |
| 3 | CC_CAUSE_NO_ROUTE | No route to destination. |
| 4 | CC_CAUSE_SEND_INTO_TONE | Send special information tone. |
| 5 | CC_CAUSE_MISDIALLED_TRUNK_PREFIX | Misdialed prefix trunk. |
| 6 | CC_CAUSE_CHANNEL_UNACCEPTABLE | Channel unacceptable. |

Table 7 Supported Q.931 (ISDN) Call Disconnection Cause Values (continued)

| Number | Code | Description |
|---------------|---|---|
| 7 | CC_CAUSE_CALL AWARDED | Call awarded and being delivered in an established channel. |
| 8 | CC_CAUSE_PREEMPTION | Preemption. |
| 9 | CC_CAUSE_PREEMPTION_RESERVED | Preemption; circuit reserved for reuse. |
| 16 | CC_CAUSE_NORM | Normal call clearing. |
| 17 | CC_CAUSE_BUSY | User is busy. |
| 18 | CC_CAUSE_NORS | No user is responding. |
| 19 | CC_CAUSE_NOAN | No answer from user (user alerted). |
| 20 | CC-CAUSE_SUBSCRIBER_ABSENT | Subscriber is absent. |
| 21 | CC_CAUSE_REJECT | Call has been rejected. |
| 22 | CC_CAUSE_NUMBER_CHANGED | Number has been changed. |
| 26 | CC_CAUSE_NON_SELECTED_USER_CLEARING | Non selected user clearing. |
| 27 | CC_CAUSE_DESTINATION_OUT_OF_ORDER | Destination number is out of order. |
| 28 | CC_CAUSE_INVALID_NUMBER | Invalid number format (address is incomplete). |
| 29 | CC_CAUSE_FACILITY REJECTED | Facility rejected. |
| 30 | CC_CAUSE_RESPONSE_TO_STATUS_ENQUIRY | Response to STATUS ENQUIRY. |
| 31 | CC_CAUSE_UNSP | Normal, unspecified. |
| 34 | CC_CAUSE_NO_CIRCUIT | No circuit or channel is available. |
| 35 | CC_CAUSE_REQUESTED_VPCI_VCI_NOT_AVAILABLE | No description is available. |
| 36 | CC_CAUSE_VPCI_VCI_ASSIGNMENT_FAILURE | No description is available. |
| 37 | CC_CAUSE_CELL_RATE_NOT_AVAILABLE | No description is available. |
| 38 | CC_CAUSE_NETWORK_OUT_OF_ORDER | Network is out of order. |
| 39 | CC_CAUSE_PERM_FRAME_MODE_OUT_OF_SERVICE | Permanent frame mode connection is out of service. |
| 40 | CC_CAUSE_PERM_FRAME_MODE_OPERATIONAL | Permanent frame mode is operational. |
| 41 | CC_CAUSE_TEMPORARY_FAILURE | Temporary failure. |
| 42 | CC_CAUSE_SWITCH_CONGESTION | Switching equipment congestion. |
| 43 | CC_CAUSE_ACCESS_INFO_DISCARDED | Access information has been discarded. |

Table 7 Supported Q.931 (ISDN) Call Disconnection Cause Values (continued)

| Number | Code | Description |
|---------------|--|---|
| 44 | CC_CAUSE_NO_REQ_CIRCUIT | Requested circuit or channel is not available. |
| 45 | CC_CAUSE_NO_VPCI_VCI_AVAILABLE | No description is available. |
| 46 | CC_CAUSE_PRECEDENCE_CALL_BLOCKED | Precedence call blocked. |
| 47 | CC_CAUSE_NO_RESOURCE | Resource is unavailable; the reason is not specified. |
| 49 | CC_CAUSE_QOS_UNAVAILABLE | QoS is unavailable. |
| 50 | CC_CAUSE_FACILITY_NOT_SUBSCRIBED | Requested facility not subscribed. |
| 53 | CC_CAUSE_CUG_OUTGOING_CALLS_BARRED | Outgoing calls are barred within closed user groups (CUGs). |
| 55 | CC_CAUSE_CUG_INCOMING_CALLS_BARRED | Incoming calls are barred within CUGs. |
| 57 | CC_CAUSE_BEARER_CAPACITY_NOT_AUTHORIZED | Bearer capacity is not authorized. |
| 58 | CC_CAUSE_BEARER_CAPACITY_NOT_AVAILABLE | Bearer capacity is not available. |
| 62 | CC_CAUSE-INCONSISTENCY-IN-INFO-AND-CLASS | There is an inconsistency in designated outgoing access information and subscriber class. |
| 63 | CC_CAUSE_NOSV | Service or option is not available; the reason is not specified. |
| 65 | CC_CAUSE_BEARER_CAPACITY_NOT_IMPLEMENTED | Bearer capacity is not implemented. |
| 66 | CC_CAUSE_CHAN_TYPE_NOT_IMPLEMENTED | Channel type is not implemented. |
| 69 | CC_CAUSE_FACILITY_NOT_IMPLEMENTED | Requested facility is not implemented. |
| 70 | CC_CAUSE_RESTRICTED_DIGITAL_INFO_BC_ONLY | Only restricted digital information bearer capability is available. |
| 79 | CC_CAUSE_SERVICE_NOT_IMPLEMENTED | Service or option is not available; the reason is not specified. |
| 81 | CC_CAUSE_INVALID_CALL_REF_VALUE | Invalid call reference value. |
| 82 | CC_CAUSE_CHANNEL_DOES_NOT_EXIST | Identified channel does not exist. |
| 83 | CC_CAUSE_CALL_EXISTS_CALL_ID_IN_USE | A suspended call exists but this call identity does not exist. |
| 84 | CC_CAUSE_CALL_ID_IN_USE | Call identity is in use. |
| 85 | CC_CAUSE_NO_CALL_SUSPENDED | No call has been suspended. |

Table 7 Supported Q.931 (ISDN) Call Disconnection Cause Values (continued)

| Number | Code | Description |
|---------------|---|--|
| 86 | CC_CAUSE_CALL_CLEARED | Call having requested call identity has been cleared. |
| 87 | CC_CAUSE_USER_NOT_IN_CUG | User is not a member of CUG. |
| 88 | CC_CAUSE_INCOMPATIBLE_DESTINATION | Incompatible destination. |
| 90 | CC_CAUSE_NON_EXISTENT_CUG | Nonexistent CUG. |
| 91 | CC_CAUSE_INVALID_TRANSIT_NETWORK | Invalid transit network selection. |
| 93 | CC_CAUSE_AAL_PARAMS_NOT_SUPPORTED | No description available. |
| 95 | CC_CAUSE_INVALID_MESSAGE | Invalid message; the reason is not specified. |
| 96 | CC_CAUSE_MANDATORY_IE_MISSING | Mandatory information is missing. |
| 97 | CC_CAUSE_MESSAGE_TYPE_NOT_IMPLEMENTED | Message type is nonexistent or is not implemented. |
| 98 | CC_CAUSE_MESSAGE_TYPE_NOT_COMPATIBLE | Message type is not compatible with call state, nonexistent, or not implemented. |
| 99 | CC_CAUSE_IE_NOT_IMPLEMENTED | Information element or parameter is nonexistent or not implemented. |
| 100 | CC_CAUSE_INVALID_IE_CONTENTS | Contents of the information element are invalid. |
| 101 | CC_CAUSE_MESSAGE_IN_INCOM_CALL_STATE | Message is not compatible with call state. |
| 102 | CC_CAUSE_RECOVERY_ON_TIMER_EXPIRY | Recovery when the call timer expires. |
| 103 | CC_CAUSE_NON_IMPLEMENTED_PARAM_PASSED_ON | Parameter is nonexistent or not implemented. |
| 110 | CC_CAUSE_UNRECOGNIZED_PARAM_MSG_DISCARDED | Message has an unrecognized parameter and has been discarded. |
| 111 | CC_CAUSE_PROTOCOL_ERROR | Protocol error; the specific error is not specified. |
| 127 | CC_CAUSE_INTERWORKING | Unspecified interworking. |
| 128 | CC_CAUSE_NEXT_NODE_UNREACHABLE | No description is available. |
| 160 | CC_CAUSE_DTL_TRANSIT_NOT_MY_NODE_ID | No description is available. |

Configuring MDN

One basic e-mail operation that Store and Forward Fax supports is MDN. Described in RFC 2298, MDN is where a message is returned to the originator of an e-mail message indicating that the e-mail message has been opened. Basically, a sender can request that an MDN (otherwise known as a return receipt) be sent back when the receiver opens an e-mail message. An MDN request is initiated by the originating (or sender) e-mail client; the return response itself is generated by the receiving e-mail client. Most PC-based e-mail software applications (such as Eudora, Netscape Messenger, and Microsoft Outlook) understand requests to generate MDNs.

The MDN is sent to an address chosen by the sender. When the sender requests an MDN, the following header is included in the e-mail header of the message:

```
Disposition-Notification-To:
```

This header is followed by the address the recipient should use when sending the MDN itself.

RFC 2298 requires that the receiver be able to prevent the automatic generation of an MDN. Because of RFC requirement, it is difficult (if not impossible) to determine whether or not the user has actually received the e-mail message based solely on receiving an MDN, for example:

- The recipient can always choose not to respond to MDN requests.
- The recipient software may not understand or accept MDN requests.

To configure MDN for Store and Forward Fax, you need to configure elements on both the on-ramp and off-ramp gateways.

Configuring the On-Ramp Gateway Elements for MDN

To configure the on-ramp gateway to support MDN, use the following commands beginning in global configuration mode:

| Command | Purpose |
|--|--|
| Step 1 Router(config)# mta send return-receipt-to username <i>string</i> | Specifies the user name address where MDNs are sent. If this field is left blank, the on-ramp gateway inserts the postmaster address in this field as a default. |
| Step 2 Router(config)# mta send return-receipt-to hostname <i>string</i> | Specifies the host name address where MDNs are sent. If this field is left blank, the on-ramp gateway inserts the postmaster address in this field as a default. |
| Step 3 Router(config)# dial-peer voice <i>number</i> mmoip | Defines the MMoIP dial peer tag number and enters dial-peer configuration mode. |
| Step 4 Router(config-dial-)# mdn | Requests that an MDN be sent to the destination(s) defined by the mta send return-receipt-to command. |

Configuring the Off-Ramp Gateway Element for MDN

To configure the off-ramp gateway to support MDN, use the following command in global configuration mode:

| Command | Purpose |
|---|--|
| Router(config)# mta receive generate-mdn | Specifies that the Cisco AS5300 acting as the off-ramp gateway will respond to a request for an MDN. |

Verifying MDN Configuration

- To verify if DSN is enabled or disabled, use the **show dial-peer voice** command and look at the disposition notification field.
- To verify that you have configured the **mta send return-receipt-to username**, **mta send return-receipt-to hostname**, and **mta receive generate-mdn** commands, use the **show running-config** command.
- Send a fax to the on-ramp gateway. When the destination e-mail account client opens and responds to the MDN request, check the return-receipt-to user account for the MDN response message.
- Send a fax to the off-ramp gateway with MDN requested (return receipt). After the off-ramp gateway has processed the fax-mail message, check the original From user's account for the MDN response message.

Configuring DSN

DSNs are messages or responses that are automatically generated and sent to the sender or originator of an e-mail message by the SMTP server, notifying the sender of the status of the e-mail message. The on-ramp DSN request is included as part of the fax-mail message sent by the on-ramp gateway when the matching MMoIP dial peer has been configured. The on-ramp DSN response is generated by the

SMTP server when the fax-mail message is accepted. The DSN is sent back to the user defined in the **mta send mail-from** command. The off-ramp DSN is requested by the e-mail client. The DSN response is generated by the off-ramp gateway when it receives a request as part of the fax-mail message.

DSNs can only be generated if the mail client on the SMTP server is capable of responding to a DSN request.

Because the SMTP server generates the DSNs, you need to configure both the mail from: and rcpt to: commands for the DSN feature to be operational, for example:

```
mail from: <user@mail-server.company.com>
rcpt to: <fax=555-1212@company.com> NOTIFY=SUCCESS,FAILURE,DELAY
```

Three different states can be reported back to the sender as follows:

- Delay—Indicates that, for some reason, the message was delayed in being delivered to the recipient.
- Success—Indicates that the message was successfully delivered to the recipient mailbox.
- Failure—Indicates that, for some reason, the SMTP server was unable to deliver the message to the recipient.

Because these delivery states are not mutually exclusive, you can configure Store and Forward Fax to generate these messages for all or any combination of these events.

To configure DSN, use the following commands beginning in global configuration mode:

| Command | Purpose |
|---|---|
| Step 1 Router(config)# mta send mail-from {hostname string} | Specifies the originator (host name portion) of the e-mail fax message. This information appears in the RFC 822 From: field and the RFC 821 MAIL FROM field of the e-mail fax message. This information is also used for generating DSNs. When you configure the mta send mail-from hostname command, the host name configured is used with the mta send mail-from username command to form a complete e-mail address, like faxuser@onramp-gateway.com. |
| Step 2 Router(config)# mta send mail-from {username string username \$\$} | Specifies the originator (username portion) of the e-mail fax message. This information appears in the RFC 822 From: field and the RFC 821 MAIL FROM field of the e-mail fax message. If the wild card \$\$ is used, a transmission report is sent to the originating fax machine. This information is also used for generating DSNs. When you configure the mta send mail-from username command, the username configured is used with the mta send mail-from hostname command to form a complete e-mail address, like faxuser@onramp-gateway.com. |
| Step 3 Router(config)# dial-peer voice number mmoip | Defines the MMoIP dial peer tag number and enter dial-peer configuration mode. |
| Step 4 Router(config-dial-)# dsn {delay success failure} | Requests that a DSN be sent to the destination(s) defined by the mta send mail-from command. |

Verifying DSN Configuration

You can verify your DSN configuration by performing the following tasks:

- To verify that you have configured DSN, use the **show dial-peer voice** command and look at the delivery status notification field.
- To verify that you have configured the **mta send mail-from username** and **mta send mail-from hostname** commands, use the **show running-config** command. If these commands are not configured, the DSN will be delivered to the postmaster defined by the **mta send postmaster** command.
- To verify that you have configured the **mta send return-receipt-to username**, **mta send return-receipt-to hostname**, and **mta receive generate-mdn** commands, use the **show running-config** command.
- Send a fax to the on-ramp gateway. When the destination e-mail server receives the fax-mail message and responds to the DSN request, check the mail-from or postmaster user account for the DSN response message. (The mail-from or postmaster user account could be a fax machine.)
- Send a fax-mail message to the off-ramp gateway with DSN requested (rcpt to:<fax=555-1212@company.com> NOTIFY=SUCCESS, FAILURE, DELAY). After the off-ramp gateway has processed the fax-mail message, check the original From user's account for the DSN response message.

Configuration Examples

Store and Forward Fax configuration examples are provided in the following sections:

- On-Ramp Gateway Configuration Example
- Off-Ramp Gateway Configuration Example
- On-Ramp and Off-Ramp Security Configuration Example
- On-Ramp Modem Pool Configuration Example
- Store and Forward Fax Configuration Output Example

On-Ramp Gateway Configuration Example

The following example shows a general Store and Forward Fax configuration for a Cisco AS5300 acting as an on-ramp gateway:

```

! Enter global configuration mode.
configure terminal
!
! Define the called subscriber number—in this case, the number configured as the
! destination pattern will be used as the called subscriber identifier.
fax receive called-subscriber $d$
!
! Specify the originator of the e-mail address—in this case, the originator
information
! is derived from the calling number.
mta send mail-from username $s$
!
! (Optional) Provide additional information about the sending device. In this
example,
! the sending device's hostname is alabama
mta send origin-prefix alabama
!
! Define where this fax-mail should be delivered (which is the mail server postmaster
! account) if it cannot be delivered to the defined destination.
mta send postmaster postmaster@company.com
!
! (Optional) If you decide to configure MDNs, specify the address where they should
be
! sent.
mta send return-receipt-to username postmaster@company.com
!
! Specify the destination e-mail server that accepts on-ramp fax-mail.
mta send server california.fax.com
!
! Define the text string that will be displayed as the subject of the fax-mail.
mta send subject Fax-Mail Message
!
!
! Enter dial-peer configuration mode and define an on-ramp POTS peer.
dial-peer voice 1000 pots
!
! Designate fax as the type of information handled by this dial peer.
information-type fax
!
! Specify direct inward dial for this dial peer.
direct-inward-dial
!
! Define the incoming called number associated with this dial peer
incoming called number 5105551212
!
! (Optional) Define the maximum number of connections that will be used
simultaneously
! to transmit fax-mail.
max-conns 10
!
!
! Define an on-ramp MMoIP dial peer.
dial-peer voice 1001 mmqip
!
! Define the telephone number associated with this dial peer.
destination-pattern 14085554321
!
! Define a destination e-mail address for this dial peer

```

```
session-target mailto:$d$@yourcompany.com
!
! (Optional) Request that DSNs be sent.
dsn
!
! Specify a particular image encoding method to be used for fax images. In this
! example, Modified Huffman (IETF standard) is being specified.
image encoding mh
!
! Specify a particular fax image resolution. In this example, the image resolution
was
! set to 204 by 196 pixels per inch (fine).
image resolution fine
!
! Designate fax as the type of information handled by this dial peer.
info-type fax
!
! (Optional) Define the maximum number of connections that will be used
simultaneously
! to transmit fax-mail.
max-conn 10
!
! (Optional) Request that MDNs be sent.
mdn
!
! Specify SMTP as the protocol to be used for Store and Forward Fax.
session protocol smtp
```

Off-Ramp Gateway Configuration Example

The following example configures Store and Forward Fax on a Cisco AS5300 acting as the off-ramp gateway:

```

! Enter global configuration mode.
configure terminal
!
! Define the transmitting subscriber number (TSI); this is the number that is
! displayed in the LCD of the receiving fax machine. In this example, the sender's
! name, captured by the on-ramp from the sending fax machine) will be used.
fax send transmitting-subscriber $s$
!
! Configure the speed of the fax transmission. In this case, fax transmissions will
be
!sent at 14400 bits per second.
fax send max-speed 14400
!
! Define a hostname to be used as an alias for the off-ramp AS5300 device.
mta receive aliases yourcompany.com
!
! (Optional) Specify that the Cisco AS5300 will respond to an MDN request.
mta receive generate-mdn
!
! Define the number of simultaneous SMTP recipients (in this case, 10) handled by
this
! Cisco AS5300.
mta receive maximum-recipients 10
!
!
! Specify that the company name will appear in the center position of the fax.
! header information.
fax send center-header Acme Company
!
! Specify that the page count will appear in the right position of the fax header
! information.
fax send right-header $p$
!
! Specify that the date will appear in the left position of the fax header
! information.
fax send left-header $a$
!
! Enable the Cisco AS5300 to send a cover sheet with faxes that originate from e-mail
! messages.
fax send coverpage enable
!
! Add a personalized comment to the title field of the fax cover sheet. In this case,
! the phrase FAX TRANSMISSION was added.
fax send coverpage comment FAX TRANSMISSION
!
! Enter dial-peer configuration mode and define an off-ramp POTS peer.
dial-peer voice 1002 pots
!
! Designate fax as the type of information handled by this dial peer.
information-type fax
!
! Define a telephone number to be associated with this dial peer.
destination-pattern 1408555....
!
! Add prefix.
prefix 9,555
!
! Define an off-ramp MMoIP peer.

```

```

dial-peer voice 1003 mmoip
!
! Designate fax as the type of information handled by this dial peer.
information-type fax
!
! Define an incoming called number to be associated with this dial peer.
incoming called-number 14085556789
!
! Specify a particular fax image resolution. In this example, the image resolution
was
! set to 204 by 196 pixels per inch (fine).
image resolution fine

```

On-Ramp and Off-Ramp Security Configuration Example

The following example configures on-ramp and off-ramp security for Store and Forward Fax on the Cisco AS5300:

```

! Enter global configuration mode.
configure terminal
! Enable AAA security services.
aaa new-model
! Define the method list to be used with Store and Forward Fax authentication.
mmoip aaa method fax authentication onramp-auth
! Define the method list to be used with Store and Forward Fax accounting services.
mmoip aaa method fax accounting onramp-acct
! Define and enable the AAA authentication method list for Store and Forward Fax.
aaa authentication login onramp-auth radius local
! Define and enable the AAA accounting method list for Store and Forward Fax.
aaa accounting connection onramp-acct stop-only radius
! Enable on-ramp authentication.
mmoip aaa receive-authentication enable
! Enable on-ramp accounting services.
mmoip aaa receive-accounting enable
! Enable off-ramp authorization.
mmoip aaa send-authentication enable.
! Enable off-ramp accounting services.
mmoip aaa receive-accounting enable
! Define the gateway ID as the means by which AAA identifies the user for
! off-ramp authentication.
mmoip aaa send-id primary gateway
! Define the gateway ID as the means by which AAA identifies the user for on-ramp
! authentication.
mmoip aaa receive-id primary gateway
! Configure the Cisco AS5300 to support RADIUS.
radius-server host 173.13.11.13 auth-port 1645 acct-port 1646
radius-server key password
! Configure the RADIUS server to recognize and use vendor-specific attributes.
radius-server vsa send accounting
radius-server vsa send authentication

```

On-Ramp Modem Pool Configuration Example

The following example configures a named modem pool on a Cisco AS5300 with 24 Microcom and 60 MICA modems. Microcom modems are in slot 1 and MICA modems are in slot 2. The purpose of this named modem pool (mica-inbound) is to prevent fax calls from going to the MICA modems (modems 25 through 84).

```
configure terminal
modem-pool mica-inbound
pool-range 25-84
```

Store and Forward Fax Configuration Output Example

The following example provides output for the **show running configuration** command for a complete Store and Forward Fax configuration on the Cisco AS5300:

```

router# show running configuration

Building configuration...

Current configuration:
!
! Last configuration change at 19:20:39 PST Mon Jul 14 1997
! NVRAM config last updated at 19:11:04 PST Mon Jul 14 1997
!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service internal
service udp-small-servers
service tcp-small-servers
!
hostname mmoip-b
!
boot system tftp /auto/annex2/njoffe/c5300-is-mz 255.255.255.255
boot system flash c5300-is-mz
aaa new-model
aaa authentication login fax radius local
aaa accounting connection fax stop-only radius
!
username njoffe password 0 password
username jfitzhug password 0 password
username wooksong password 0 password
username gmercuri password 0 password
username faryaman password 0 password
username ilyau password 0 password
clock timezone PST -8
clock calendar-valid
!
modem-pool mica-inbound
modem poll time 2
ip subnet-zero
ip host mail-server 10.14.116.1
ip host keyer 223.255.254.254
ip host mail-server.cisco.com 10.14.116.1
ip domain-name cisco.com
ip name-server 10.14.116.1
!
isdn switch-type primary-5ess
fax receive called-subscriber $d$
fax send transmitting-subscriber $$
fax send left-header $$
fax send center-header $t$
fax send right-header Page:$p$
fax send coverpage enable
fax send coverpage email-controllable
fax send coverpage comment Cisco cover page comment
mta send server mail-server.cisco.com
mta send subject mmoip-b subject line here
mta send origin-prefix Cisco Powered Fax System
mta send postmaster gmercuri@mail-server.com
mta send mail-from hostname mail-from-hostname.com
mta send mail-from username $$

```

```
mta send return-receipt-to hostname mmoip-b.cisco.com
mta send return-receipt-to username $$
mta receive aliases mmoip-b.cisco.com
mta receive aliases [1.2.3.4]
mta receive aliases cisco.com
mta receive maximum-recipients 24
mta receive generate-mdn
mmoip aaa send-id primary gateway
mmoip aaa receive-id primary gateway
mmoip aaa method fax authentication fax
mmoip aaa method fax accounting fax
mmoip aaa send-accounting enable
mmoip aaa send-authentication enable
mmoip aaa receive-accounting enable
mmoip aaa receive-authentication enable
!
!
controller T1 0
framing esf
clock source line primary
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
controller T1 1
shutdown
framing esf
clock source line secondary 1
linecode b8zs
cablelength short 133
cas-group 0 timeslots 1-24 type e&m-fgb service fax
!
controller T1 2
shutdown
framing esf
linecode b8zs
cablelength short 133
cas-group 0 timeslots 1-24 type e&m-fgb
!
controller T1 3
shutdown
framing esf
linecode b8zs
cablelength short 133
pri-group timeslots 1-24
!
!
voice-port 0:D
timeouts call-disconnect 0
!
voice-port 1:0
timeouts call-disconnect 0
!
voice-port 2:0
timeouts call-disconnect 0
!
voice-port 3:D
timeouts call-disconnect 0
!
dial-peer voice 5 mmoip
destination-pattern 55508..
information-type fax
mdn
dsn success
```

```

dsn failure
session target mailto:$d$email-server.cisco.com
!
dial-peer voice 1001 pots
incoming called-number 571....
port 0:D
!
dial-peer voice 2 pots
incoming called-number 5550839
information-type fax
direct-inward-dial
!
dial-peer voice 1 pots
destination-pattern 5.....
information-type fax
prefix 5
!
num-exp 01133..... 33.....
!
interface Loopback0
no ip address
no ip directed-broadcast
!
interface Tunnell
no ip address
no ip directed-broadcast
!
interface Ethernet0
ip address 10.14.120.2 255.255.0.0
no ip directed-broadcast
!
interface Serial0:23
no ip address
no ip directed-broadcast
encapsulation ppp
no ip route-cache
dialer rotary-group 1
dialer-group 1
isdn switch-type primary-5ess
isdn tei-negotiation first-call
isdn incoming-voice modem
no fair-queue
!
interface Serial3:23
no ip address
no ip directed-broadcast
shutdown
isdn switch-type primary-5ess
isdn tei-negotiation first-call
no cdp enable
!
interface FastEthernet0
no ip address
no ip directed-broadcast
shutdown
!
interface Group-Async1
ip unnumbered Ethernet0
no ip directed-broadcast
encapsulation ppp
ip tcp header-compression
dialer in-band
dialer-group 1
async mode interactive

```

```
peer default ip address pool default
no fair-queue
ppp multilink
group-range 1 12
hold-queue 10 in
!
interface Dialer1
ip unnumbered Loopback0
no ip directed-broadcast
encapsulation ppp
dialer in-band
dialer-group 1
peer default ip address pool def
no fair-queue
ppp multilink
!
ip default-gateway 10.14.0.1
no ip http server
ip classless
ip route 223.255.254.0 255.255.255.0 10.14.0.1
!
dialer-list 1 protocol ip permit
snmp-server engineID local 00000009020000E01EA48784
snmp-server community public RW
radius-server host 10.14.116.1 auth-port 1645 acct-port 1646
radius-server key password
radius-server vsa send accounting
radius-server vsa send authentication
!
line con 0
exec-timeout 0 0
logging synchronous
transport input none
line 1 12
autobaud
autoselect ppp
modem InOut
modem autoconfigure type microcom_hdms
rotary 1
transport input all
line aux 0
line vty 0 4
exec-timeout 0 0
password password
!
exception core-file /auto/annex2/gmercuri/coredump
exception dump 223.255.254.254
ntp source Ethernet0
ntp update-calendar
ntp peer 223.255.254.254
scheduler heapcheck process
scheduler interval 1000
end
```

Glossary

ANI—Automatic number identification. Feature of Signaling System 7 (SS7) in which a series of digits, either analog or digital, are included in the call, identifying the telephone number of the calling device. In other words, ANI identifies the number of the calling party.

Call leg—A discrete segment of a call connection.

CSI—Called subscriber identification. An identifier whose coding format contains the telephone number from the remote fax terminal.

DID—Direct inward dial. Allows a user outside a company to dial an internal extension number without having to pass through an operator or attendant. The dialed digits are passed to the PBX, which then completes the call.

DNIS—Dialed number identification service. Feature of trunk lines where the called number is identified; this called number information is used to route the call to the appropriate service.

DSN—Delivery status notification. Message returned to the originator indicating the delivery status of an e-mail message. There are three types of delivery status notifications that can be requested by a sender: delay, success, and failure. Specifications for DSN are described in RFC 1891, RFC 1892, RFC 1893, and RFC 1894.

E.164—ITU-T recommendation for international telecommunication numbering.

ESMTP—Extended Simple Mail Transfer Protocol. Extended version of the Simple Mail Transfer Protocol (SMTP), which includes additional functionality such as delivery notification and session delivery. ESMTP is described in RFC 1869, *SMTP Service Extensions*.

Group 3—Standard created by the International Telecommunications Union Telecommunications (ITU-T) relating to fax devices. A Group 3 fax device is a digital machine containing a 14400 baud modem that can transmit an 8 1/2 by 11 inch page in approximately 20 seconds with a resolution of either 203 by 98 dots per inch (dpi) or 203 by 196 dpi (fine), using Huffman code to compress fax data. Group 3 faxes use a standard dial-up telephone line for transmission.

LCD—Liquid crystal display. An alphanumeric display on computers and fax devices using liquid crystal sealed between two pieces of glass.

MDN—Message disposition notification. Message returned to the originator of an e-mail message indicating that the e-mail message has been opened. Specifications for MDN are described in RFC 2298.

MICA—Modem ISDN channel aggregation. Modem module and card used in the Cisco AS5300 universal access servers. A MICA modem provides an interface between an incoming or outgoing digital call and an Integrated Services Digital Network (ISDN) telephone line; the call does not have to be converted to analog as it does with a conventional modem and an analog telephone line. Each line can accommodate, or aggregate, up to 24 (T1) or 30 (E1) calls.

MIME—Multipurpose Internet Mail Extension. MIME is the standard for transmitting non-text data (or data that cannot be represented in plain ASCII code) in Internet mail, such as binary, foreign language text (such as Russian or Chinese), audio, or video data. MIME is defined in RFC 2045.

MMoIP—Multimedia Mail over Internet Protocol. Dial peer specific to Store and Forward Fax. The MMoIP dial peer is the vehicle you use to assign particular line characteristics (such as a destination telephone number) to the connection between the Cisco AS5300 and the SMTP mail server during on-ramp faxing.

MTA—Mail Transfer Agent. Software that implements SMTP and provides storage for mail messages to be forwarded or delivered to a local user. MTAs implement SMTP (RFC 821).

POTS dial peer—"Plain old telephone service" dial peer used as a vehicle to assign particular line characteristics to the connection between the user and the receiving Cisco AS5300 during inbound (or on-ramp) faxing and to the connection between the Cisco AS5300 and the receiving fax device during outbound (or off-ramp) faxing.

Redialer—Interface hardware device that interconnects between a fax device and a Public Switched Telephone Network (PSTN) network. A redialer is used to forward a dialed number to another destination. Redialers contain a database of referral telephone numbers. When the user dials a specific number, the redialer collects the dialed digits and matches them to a listing in its database. If there is a match, the redialer dials the referral number (transparent to the user) and forwards the call to the referral number.

SMTP—Simple Mail Transfer Protocol. Application-level protocol in the TCP/IP protocol suite involved with the transmission and reception of electronic mail. Specifications for SMTP are described in RFC 821 and RFC 822.

Store and Forward—Function whereby a message is transmitted to some intermediate relay point and temporarily stored before forwarding to the next relay point.

TSI—Transmitting subscriber information. A frame that can be sent by the caller with the caller's telephone number that can be used to screen calls.

