TCP/IP Configuration Commands

The Internet Protocol (IP) is a packet-based protocol used to exchange data over computer networks. IP handles addressing, fragmentation, reassembly, and protocol demultiplexing. It is the foundation on which all other Internet protocols, collectively referred to as the IP suite, are built. IP is a network-layer protocol that contains addressing information and some control information that allows data packets to be routed.

The Transmission Control Protocol (TCP) is built upon the IP layer. TCP is a connection-oriented protocol that specifies the format of data and acknowledgments used in the transfer of data. TCP also specifies the procedures that the computers use to ensure that the data arrives correctly. TCP allows multiple applications on a system to communicate concurrently because it handles all demultiplexing of the incoming traffic among the application programs.

Use the commands in this chapter to configure TCP/IP on your protocol translator. For configuration information and examples, refer to the *Protocol Translator Configuration Guide.*

access-class

To restrict incoming and outgoing connections between a particular virtual terminal line (into a Cisco device) and the addresses in an access list, use the **access-class** line configuration command. To remove access restrictions on the line for the specified connections, use the **no** form of the command.

access-class *access-list-number* {**in** | **out**}
no access-class *access-list-number* {**in** | **out**}

Syntax Description

access-list-number	Number of the access list. It is a decimal integer from 1 through 99 that identifies a specific access list of Internet addresses.
in	Restricts incoming connections between a particular Cisco device and the addresses in the access list.
out	Restricts outgoing connections between a particular Cisco device and the addresses in the access list.

Default

None

Command Mode

Line configuration command

Usage Guidelines

You must set identical restrictions on all the virtual terminal lines, because a user can connect to any of them.

To display the access lists for a particular terminal line, use the **show line** EXEC command and specify the line number.

Examples

The following example defines an access list that permits only hosts on network 192.89.55.0 to connect to the virtual terminal ports on the protocol translator:

```
access-list 12 permit 192.89.55.0 0.0.0.255
line 1 5
access-class 12 in
```

The following example defines an access list that denies connections to networks other than network 36.0.0.0 on terminal lines 1 through 5:

```
access-list 10 permit 36.0.0.0 0.255.255.255
line 1 5
access-class 10 out
```

Related Command

A dagger (†) indicates that the command is documented in the *Router Products Command Reference* publication.

show line †

access-list (standard)

To create an access list, use the **access-list** global configuration command. To delete an entire access lists, use the **no** form of the command.

access-list *access-list-number* {**permit** | **deny**} *source source-mask*
no access-list *access-list-number*

Syntax Description

access-list-number	Number of the access list. This is a decimal integer from 1 through 99 that you assign to identify one or more permit/deny conditions as an access list. Access list 0 (zero) is predefined; it permits any address and is the default access list for all interfaces.
permit	Permits access for matching conditions.
deny	Denies access to matching conditions.
source	Source address. It is a 32-bit quantity written in dotted-decimal format. See the examples later in this section.
source-mask	Source address mask. It is 32-bit quantity written in dotted-decimal format. Address bits corresponding to wildcard mask bits set to 1 are ignored in comparisons; address bits corresponding to wildcard mask bits set to zero are used in comparisons. See the examples later in this section.

Default

The access list defaults to an implicit deny statement for everything that has not been permitted.

Command Mode

Global

Usage Guidelines

Plan your access conditions carefully and be aware of the implicit deny.

You can use access lists to control the transmission of packets on an interface, to control virtual terminal line access, and to restrict contents of routing updates.

To display the contents of all access lists, use the **show access-lists** EXEC command.

Examples

The following example allows access for only those hosts on the three specified networks. It assumes that subnetting is not used; the masks apply to the host portions of the network addresses. Any hosts with a source address that does not match the access list statements will be rejected.

```
access-list 1 permit 192.5.34.0 0.0.0.255
access-list 1 permit 128.88.1.0 0.0.255.255
access-list 1 permit 36.0.0.0 0.255.255.255
! (Note: all other access implicitly denied)
```

To specify a large number of individual addresses more easily, you can omit the address mask; that is, all zeros from the **access-list** global configuration command. Thus, the following two configuration commands are identical in effect:

```
access-list 2 permit 36.48.0.3
access-list 2 permit 36.48.0.3 0.0.0.0
```

Related Commands

access-list (extended)
show access-lists

access-list (extended)

To create an extended access list, use the extended **access-list** global configuration command. To remove the access lists, use the **no** form of the command.

access-list *access-list-number* {**permit** | **deny**} *protocol source source-mask*
destination destination-mask [*operator operand*] [**established**]
no access-list *access-list-number*

Syntax Description

access-list-number

Number of the access list. This is a decimal integer from 100 through 199 that you assign to identify one or more extended permit/deny conditions as an extended access list. Note that a list number in the range 100 to 199 distinguishes an extended access list from a standard access list.

permit

Permits access to matching conditions.

deny

Denies access to matching conditions.

protocol

Protocol name. It can be one of the following: **ip**, **tcp**, **udp**, **icmp**, or **igrp** or an integer in the range of 0 to 255 representing an IP protocol number. The keyword **ip** to matches any Internet protocol, including TCP, UDP, and ICMP.

source

Source address in dotted-decimal format.

source-mask

Source address mask. It is 32-bit quantity written in dotted-decimal format. Address bits corresponding to wildcard mask bits set to 1 are ignored in comparisons; address bits corresponding to wildcard mask bits set to zero are used in comparisons. See the example later in this section.

destination

Destination address in dotted-decimal format.

destination-mask

Destination address mask. It is 32-bit quantity written in dotted-decimal format. Address bits corresponding to wildcard mask bits set to 1 are ignored in comparisons; address bits corresponding to wildcard mask bits set to zero are used in comparisons. See the example later in this section.

operator

(Optional.) Compares destination ports, service access points, or contact names. Note that the **ip** and **icmp** protocol keywords do not allow port distinctions. Possible operands include **lt** (less than), **gt** (greater than), **eq** (equal), and **neq** (not equal).

operand

(Optional.) Decimal destination port, service access point, or contact name to compare. Note that the **ip** and **icmp** protocol keywords do not allow port distinctions.

established

(Optional.) Used for the TCP protocol only to indicate an established connection. A match occurs if the TCP datagram has the ACK or RST bits set. The nonmatching case is that of the initial TCP datagram to form a connection.

Default

An extended access list defaults to an implicit deny statement for everything that has not been permitted.

Command Mode

Global configuration

Usage Guidelines

You can use extended access lists to control the transmission of packets on an interface, to control virtual terminal line access, and to restrict contents of routing updates. The protocol translator stops checking the extended access list after a match occurs.

After an access list is created initially, any subsequent additions (possibly entered from the terminal) are placed at the end of the list. In other words, you cannot selectively add or remove access list command lines from a specific access list.

Example

In the following example, the Ethernet network is a Class B network with the address 128.88.0.0, and the mail host's address is 128.88.1.2. The keyword **established** is used only for the TCP protocol to indicate an established connection. A match occurs if the TCP datagram has the ACK or RST bits set, which indicate that the packet belongs to an existing connection.

```
access-list 102 permit tcp 0.0.0.0 255.255.255.255 128.88.0.0 0.0.255.255 established
access-list 102 permit tcp 0.0.0.0 255.255.255.255 128.88.1.2 0.0.0.0 eq 25
interface ethernet 0
ip access-group 102
```

Related Commands

access-list (standard)
ip access-group
show access-lists

arp (global)

To add a permanent entry to the ARP cache, use the **arp** global configuration command. To remove an entry from the ARP cache, use the **no** form of the command.

arp *internet-address hardware-address type* [**alias**]
no arp *internet-address hardware-address type* [**alias**]

Syntax Description

internet-address	IP address in dotted-decimal format corresponding to the local data link address.
hardware-address	Local data link address (a 48-bit address).
type	Encapsulation description. This is typically the **arpa** keyword for Ethernet and is always **snap** for FDDI and Token Ring interfaces.
alias	(Optional.) Indicates that the protocol translator should respond to ARP requests as if it were the owner of the specified address.

Default

None

Command Mode

Global configuration

Usage Guidelines

The protocol translator ARP cache entries to translate 32-bit IP addresses into 48-bit hardware addresses.

Because most hosts support dynamic resolution, you generally do not need to specify static ARP cache entries.

To remove all nonstatic entries from the ARP cache, use the **clear arp-cache** privileged EXEC command.

Example

The following is an example of a static ARP entry for a typical Ethernet host:

```
arp 192.31.7.19 0800.0900.1834 arpa
```

Related Command

clear arp-cache

arp (interface)

To control the interface-specific handling of IP address resolution into 48-bit Ethernet, FDDI, and Token Ring hardware addresses, use the **arp** interface configuration command. To disable an encapsulation type, use the **no** form of the command.

arp {**arpa** | **probe** | **snap**}
no arp {**arpa** | **probe** | **snap**}

Syntax Description

arpa	Standard Ethernet style ARP (RFC 826).
probe	HP Probe protocol for IEEE-802.3 networks.
snap	ARP packets conforming to RFC 1042.

Default

arpa

Command Mode

Interface configuration

Usage Guidelines

Unlike most commands that take multiple arguments, arguments to the **arp** interface command are not mutually exclusive. Each command enables or disables a specific type of ARP. For example, if you enter the **arp arpa** command followed by the **arp probe** command, the protocol translator would send three packets (two for **probe** and one for **arpa**) each time it needed to discover a MAC address.

The **arp probe** command allows the protocol translator to use the Probe protocol (in addition to ARP) whenever it attempts to resolve an IEEE-802.3 or Ethernet local data link address. The subset of Probe that performs address resolution is called Virtual Address Request and Reply. Using Probe, the protocol translator can communicate transparently with Hewlett-Packard IEEE-802.3 hosts that use this type of data encapsulation.

Note Our support for HP Probe proxy support changed as of software Release 8.3(2) and subsequent software releases. The **no arp probe** command is now the default. All interfaces that will use Probe must now be explicitly configured for **arp probe**.

The **show interfaces** EXEC command displays the type of ARP being used on a particular interface. To remove all nonstatic entries from the ARP cache, use the **clear arp-cache** privileged EXEC command.

Example

The following example enables Probe services:

```
interface ethernet 0
arp probe
```

Related Commands

clear arp-cache

arp timeout

To control how long an ARP cache entry will stay in the cache, use the **arp timeout** interface configuration command. To restore the default timeout value, use the **no** form of the command.

arp timeout *seconds*
no arp timeout *seconds*

Syntax Description

seconds	Time, in seconds, that entries remain in the ARP cache before they are removed. A value of 0 (zero) seconds sets no timeout; then cache entries are never cleared.

Default

14400 seconds (four hours)

Command Mode

Interface configuration

Usage Guidelines

This command is ignored when issued on interfaces that do not use ARP. The **show interfaces** EXEC command displays the ARP timeout value. The value follows the “Entry Timeout:” heading, as seen in this sample **show interfaces** display:

```
ARP type: ARPA, PROBE, Entry Timeout: 14400 sec
```

Example

The following example illustrates how to set the ARP timeout to 12000 seconds to allow entries to time out more quickly than the default.

```
interface ethernet 0
arp timeout 12000
```

clear arp-cache

To remove all dynamic entries from the ARP cache, clear the fast-switching cache, and clear the IP route cache, use the **clear arp-cache** EXEC command.

clear arp-cache

Syntax Description

This command has no arguments or keywords.

Command Mode

Privileged EXEC

Example

The following example removes all dynamic entries from the ARP cache and clears the fast-switching cache:

```
clear arp-cache
```

Related Commands

arp (global)
arp (interface)

clear host

To remove one or all entries from the host name-and-address cache, use the **clear host** EXEC command.

clear host {*name* | *}

Syntax Description

name	Particular host entry to remove.
*	Remove all entries.

Command Mode

EXEC

Usage Guidelines

The **clear host** command removes host name entries from running memory, but not from NVRAM.

Example

The following example clears all entries from the host name-and-address cache:

```
clear host *
```

Related Command

show hosts

ip access-group

To control access to an interface**,** Use the **ip access-group** interface configuration command. To remove an access group, use the **no** form of the command.

ip access-group *access-list-number* {**in** | **out**}
no ip access-group *access-list-number* {**in** | **out**}

Syntax Description

access-list-number	Number of an access list. This is a decimal integer from 1 through 199.
in	Filters on inbound packets.
out	Filters on outbound packets.

Default

None

Command Mode

Interface configuration

Usage Guidelines

For inbound access lists, after receiving a packet, the protocol translator checks the source address of the packet against the access list. If the access list permits the address, the protocol translator continues to process the packet. If the access list rejects the address, the protocol translator discards the packet and returns an ICMP "Host Unreachable" message.

For outbound access lists, after receiving and routing a packet to a controlled interface, the protocol translator checks the source address of the packet against the access list. If the access list permits the address, the protocol translator transmits the packet. If the access list rejects the address, the protocol translator discards the packet and returns an ICMP "Host Unreachable" message.

An access lists is applied either on an outbound or on an inbound interfaces.

Note Enabling input access lists on any interface disables fast switching of IP for the entire protocol translator.

Example

The following example applies list 101 on packets outbound from Ethernet 0:

```
interface ethernet 0
ip access-group 101 out
```

Related Commands

access-list (extended)
ip access-list
show ip access-list

ip address

To set an IP address for an interface, use the **ip address** interface configuration command. To remove an address, use the **no** form of the command.

ip address *IP-address mask*
no ip address *IP-address mask*

Syntax Description

IP-address	IP address
mask	Mask for the associated IP subnet

Default

None

Command Mode

Interface configuration

Usage Guidelines

Hosts can determine subnet masks using the Internet Control Message Protocol (ICMP) Mask Request message. Protocol translators respond to this request with an ICMP Mask Reply message.

To disable IP processing on a particular interface, remove its IP address with the **no ip address** command. If the protocol translator detects another host using one of its IP addresses, it will print an error message on the console.

Example

In the following example, 131.108.1.27 is the primary address for Ethernet 0:

```
interface ethernet 0
ip address 131.108.1.27 255.255.255.0
```

ip alias

To assign an IP address to the service provided on a TCP port, use the **ip alias** global configuration command. To disable the address assignment, use the **no** form of this command.

ip alias *IP-address tcp-port*

Syntax Description

IP-address	Internet address of the host providing the service. It must be on the same network or subnet as the protocol translator's main address and must not be used by another host on the network or subnet.
TCP-port	Number of the TCP port to which to connect.

Default

None

Command Mode

Global configuration

Usage Guidelines

You can use the **ip alias** command to assign multiple IP addresses to the protocol translator. For example, in addition to the primary alias address, you can specify addresses that correspond to lines or rotary groups. Using the **ip alias** command in this way makes the process of connecting to a specific rotary group transparent to the user.

Example

The following example configures connections to IP address 131.108.0.1 to act identically to connections made to the server's primary IP address on TCP port 3001. In other words, users trying to connect will get connected to the first free line in rotary group 1 using the Telnet protocol.

```
ip alias 131.108.0.1 3001
```

ip broadcast-address

To define a broadcast address for an interface, use the **ip broadcast-address** interface configuration command. To restore the IP broadcast address to the default, use the **no** form of the command.

ip broadcast-address [*address*]
no ip broadcast-address [*address*]

Syntax Description

address	(Optional.) IP broadcast address for a network.

Default

255.255.255.255 (all ones)

Command Mode

Interface configuration

Example

The following example specifies an IP broadcast address of 0.0.0.0:

```
ip broadcast-address 0.0.0.0
```

ip default-gateway

To define a default gateway (protocol translator) when IP routing is disabled, use the **ip default-gateway** global configuration command. To disable this function, use the **no** form of the command.

ip default-gateway *address*
no ip default-gateway *address*

Syntax Description

address	IP address of the protocol translator.

Default

Disabled

Command Mode

Global configuration

Usage Guidelines

The host sends any packets that need the assistance of a gateway to the address you specify. If another gateway has a better route to the requested host, the default gateway sends an ICMP redirect message to the server. The ICMP redirect message indicates which local protocol translator the server should use.

Example

The following example defines the protocol translator on Internet address 192.31.7.18 as the default protocol translator:

```
ip default-gateway 192.31.7.18
```

Related Command

show ip redirects

ip domain-list

To define a list of default domain names to complete unqualified host names, use the **ip domain-list** global configuration command. To delete a name from the list, use the **no** form of the command.

ip domain-list *name*
no ip domain-list *name*

Syntax Description

name	Domain name. Do not include the initial period that separates an unqualified name from the domain name.

Default

None

Command Mode

Global configuration

Usage Guidelines

If there is no domain list, the domain name that you specified with the **ip domain-name** global configuration command is used. The **ip domain-list** command is similar to the **ip domain-name** command, except that with **ip domain-list** you can define a list of domains, each to be tried in turn.

Examples

The following example adds several domain names to a list:

```
ip domain-list martinez.com
ip domain-list stanford.edu
```

The following example adds a name to and then deletes a name from the list:

```
ip domain-list sunya.edu
no ip domain-list stanford.edu
```

Related Command

ip domain-name

ip domain-lookup

To enable the IP Domain Name System-based host name-to-address translation, use the **ip domain-lookup** global configuration command. To disable the Domain Name System, use the **no** form of the command.

ip domain-lookup
no ip domain-lookup

Syntax Description

This command has no arguments or keywords.

Default

Enabled

Command Mode

Global configuration

Example

The following example enables the IP Domain Name System-based host name-to-address translation.

```
ip domain-lookup
```

Related Commands

ip domain-name
ip ipname-lookup
ip name-server

ip domain-name

To define a default domain name that the protocol translator uses to complete unqualified host names (names without a dotted-decimal domain name), use the **ip domain-name** global configuration command. To disable the use of the Domain Name System, use the **no** form of the command.

ip domain-name *name*
no ip domain-name

Syntax Description

name	Default domain name used to complete unqualified host names. Do not include the initial period that separates an unqualified name from the domain name.

Default

Enabled

Command Mode

Global configuration

Usage Guidelines

Any IP host name that does not contain a domain name (that is, any name without a dot) will have the dot and cisco.com appended to it before being added to the host table.

Example

The following example defines cisco.com as the default domain name:

```
ip domain-name cisco.com
```

Related Commands

ip domain-list
ip domain-lookup
ip name-server

ip gdp gdp

To configure the router discovery feature using the Cisco GDP routing protocol, use the **ip gdp gdp** interface configuration command. To disable this feature, use the **no** form of the command.

ip gdp gdp
no ip gdp gdp

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Example

The following example configures router discovery using GDP on the Ethernet 0 interface:

```
interface ethernet 0
ip gdp gdp
```

ip gdp igrp

To configure the router discovery feature using the Cisco IGRP routing protocol, use the **ip gdp igrp** interface configuration command. To disable this feature, use the **no** form of the command.

ip gdp igrp
no ip gdp igrp

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

IP routing must be disabled before you can configure this feature.

Example

The following example configures router discovery using IGRP on the Ethernet 1 interface:

```
interface ethernet 1
ip gdp igrp
```

ip gdp irdp

To configure the router discovery feature using the ICMP Router Discovery Protocol (IRDP), use the **ip gdp irdp** interface configuration command. To disable this feature, use the **no** form of the command.

ip gdp irdp
no ip gdp irdp

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

IP routing must be disabled before you can configure this feature.

Example

The following example configures router discovery using IRDP on the Ethernet 0 interface:

```
interface ethernet 0
ip gdp irdp
```

ip gdp rip

To configure the router discovery feature using the RIP routing protocol, use the **ip gdp rip** interface configuration command. To disable this feature, use the **no** form of the command.

ip gdp rip
no ip gdp rip

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

IP routing must be disabled before you can configure this feature.

Example

The following example configures router discovery using RIP on the Ethernet 1 interface:

```
interface ethernet 1
ip gdp rip
```

ip host

To define a static host name-to-address mapping in the host cache, use the **ip host** global configuration command. To remove the name-to-address mapping, use the **no** form of this command.

ip host *name* [*TCP-port-number*] *address1* [*address2...address8*]
no ip host *name address*

Syntax Description

name	Name of the host.
TCP-port-number	(Optional.) TCP port number—Telnet by default (port 23).
address	Associated IP address. You can associate up to eight addresses with a host name.

Default

Disabled

Command Mode

Global configuration

Example

The following example uses the **ip host** command to define two static mappings:

```
ip host croff 192.31.7.18
ip host bisso-gw 10.2.0.2 192.31.7.33
```

ip mask-reply

To have the protocol translator respond to ICMP mask requests by sending ICMP Mask Reply messages, use the **ip mask-reply** interface configuration command. To disable this function, use the **no** form of this command.

ip mask-reply
no ip mask-reply

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Example

The following example enables the sending of ICMP Mask Reply messages on Ethernet interface 0:

```
interface ethernet 0
ip mask-reply
```

ip mtu

To set the maximum transmission unit (MTU) size of IP packets sent on an interface, use the **ip mtu** interface configuration command. To restore the default MTU, use the **no** form of this command.

ip mtu *bytes*
no ip mtu

Syntax Description

bytes	IP MTU in bytes. The minimum size is 128 bytes. The maximum size depends on the interface medium type.

Default

Varies according to media type. See the **mtu** command in the *Router Products Command Reference* publication for default values.

Command Mode

Interface configuration

Usage Guidelines

If an IP packet exceeds the MTU set for the protocol translator's interface, the protocol translator will fragment it.

All devices on a physical medium must have the same protocol MTU in order to interoperate.

Changing the MTU value with the **mtu** interface configuration command can affect the IP MTU value. If the current IP MTU value is the same as the MTU value and you change the MTU value, the IP MTU value will be modified automatically to match the new MTU. However, the reverse is not true: changing the IP MTU value has no effect on the value for the **mtu** interface configuration command.

Example

The following example sets the maximum IP packet size for the first serial interface to 300 bytes:

```
interface serial 0
ip mtu 300
```

Related Command

A dagger (†) indicates that the command is documented in the *Router Products Command Reference* publication.

mtu †

ip name-server

To specify the IP address of one or more name servers to use for name and address resolution, use the **ip name-server** global configuration command. To remove the addresses specified and restore the default, use the **no** form of the command.

ip name-server *server-address1* [*server-address2... server-address6*]
no ip name-server *server-address1* [*server-address2... server-address6*]

Syntax Description

server-address1...6	IP addresses of up to six name servers

Default

None

Command Mode

Global configuration

Example

The following example specifies host 131.108.1.111 as the primary name server and host 131.108.1.2 as the secondary server:

```
ip name-server 131.108.1.111 131.108.1.2
```

Related Commands

ip domain-lookup
ip domain-name

ip redirects

To enable the sending of redirect messages if the protocol translator is forced to resend a packet through the same interface on which it was received, use the **ip redirects** interface configuration command. To disable the sending of redirect messages, use the **no** form of this command.

ip redirects
no ip redirects

Syntax Description

This command has no arguments or keywords.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

The protocol translator sends an ICMP Redirect message to the originator of any packet that it is on a subnet directly connected to the protocol translator when it would otherwise forward the packet to another system on the same subnet. It does so because the originating host presumably could have sent that packet to the next hop without involving the protocol translator at all.

Example

The following example disables the sending of IP redirects on Ethernet interface 0:

```
interface ethernet 0
no ip redirects
```

Related Command

show ip redirects

ip security add

To add a basic security option to all outgoing packets, use the **ip security add** interface configuration command. To disable the adding of a basic security option to all outgoing packets use the **no** form of this command.

ip security add
no ip security add

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

If an outgoing packet does not have a security option present, the **ip security add** command will add one as the first IP option. The security label added to the option field is the label that was computed for this packet when it first entered the protocol translator. Because this action is performed after all the security tests have been passed, this label will either be the same as or will fall within the range of the interface. This action is always enforced on multilevel interfaces.

Example

The following example adds a basic security option to each packet leaving Ethernet interface 0:

```
interface ethernet 0
ip security add
```

Related Commands

ip security dedicated
ip security extended-allowed
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed
ip security strip

ip security dedicated

To set the requested level of classification and authority, use the **ip security dedicated** interface configuration command. To reset the interface to the default classification and authorities, use the **no** form of this command.

ip security dedicated *level authority* [*authority...*]
no ip security dedicated *level authority* [*authority...*]

Syntax Description

level	Degree of sensitivity of information. The possible values of *level* are listed in Table 1-1.
authority	Organization that defines the set of security levels that will be used in a network. The possible values of *authority* are listed in Table 1-2.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

All traffic entering the protocol translator on this interface must have a security option that exactly matches this label. Any outgoing traffic on this interface will have this label attached to it. A label is a combination of a security level and one or more authorities.

Table 1-1 explains the values of the argument *level*. Table 1-2 explains the values of the argument *authority.* In both tables, the values are listed in order from highest degree of sensitivity or agency, to lowest. These definitions apply to all the other **ip security** commands that have these arguments.

Table 1-1 IPSO Level Keywords and Bit Patterns

Level Keyword	Bit Pattern
Reserved4	0000 0001
TopSecret	0011 1101
Secret	0101 1010
Confidential	1001 0110
Reserved3	0110 0110
Reserved2	1100 1100
Unclassified	1010 1011
Reserved1	1111 0001

Table 1-2 IPSO Authority Keywords and Bit Patterns

Authority Keyword	Bit Pattern
Genser	1000 0000
Siop-Esi	0100 0000
DIA	0010 0000
NSA	0001 0000
DOE	0000 1000

Example

The following example sets a confidential level with Genser authority:

```
ip security dedicated confidential Genser
```

Related Commands

ip security add
ip security extended-allowed
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed
ip security strip

ip security extended-allowed

To accept packets on an interface that has an extended security option, use the **ip security extended-allowed** interface configuration command. To reject packets immediately, use the **no** form of this command.

ip security extended-allowed
no ip security extended-allowed

Syntax Description

This command has no arguments or keywords.

Default

Reject the packet immediately

Command Mode

Interface configuration

Example

The following example allows Ethernet interface 0 to accept packets that have an extended security option present:

```
interface ethernet 0
ip security extended-allowed
```

Related Commands

ip security add
ip security dedicated
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed
ip security strip

ip security first

To prioritize the presence of security options on a packet, use the **ip security first** interface configuration command. To disable this function, use the **no** form of this command.

ip security first
no ip security first

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

If a basic security option is present on an outgoing packet, but it is not the first IP option, then it is moved to the front of the options field when this interface configuration command is used.

Example

The following example ensures that, if a basic security option is present in the options field of a packet exiting Ethernet interface 0, it is moved to the front of the options field:

```
interface ethernet 0
ip security first
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed
ip security strip

ip security ignore-authorities

To configure the protocol translator to ignore the authorities field of all incoming packets, use the **ip security ignore-authorities** interface configuration command. To disable this function, use the **no** form of this command.

ip security ignore-authorities
no ip security ignore-authorities

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

The value used in place of the authorities field is the authority value declared for the specified interface. This action is only allowed for single-level interfaces.

Example

The following example causes Ethernet interface 0 to ignore the authorities field on all incoming packets:

```
interface ethernet 0
ip security ignore-authorities
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security first
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed
ip security strip

ip security implicit-labelling

To force the protocol translator to accept packets on the interface, even if the packets do not include a security option, use the **ip security implicit-labelling** interface configuration command. To disable this function, use the **no** form of this command.

ip security implicit-labelling [*level authority* [*authority...*]]
no ip security implicit-labelling [*level authority* [*authority...*]]

Syntax Description

level	(Optional.) Degree of sensitivity of information. If your interface has multilevel security set, you must specify this argument. You can specify more than one. The level keywords are listed in Table 1-1 (in the discussion of the **ip security dedicated** command).
authority	(Optional.) Organization that defines the set of security levels that will be used in a network. If your interface has multilevel security set, you must specify this argument. You can specify more than one. The authority keywords are listed in Table 1-2 (in the discussion of the **ip security dedicated** command).

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

If your interface has multilevel security set, you must use the expanded form of the command (with the optional arguments as noted in brackets) because the arguments are used to specify the precise level and authority to use when labeling the packet.

Example

In the following example, an interface is set for security and will accept unlabeled packets:

```
ip security dedicated confidential genser
ip security implicit-labelling
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security first
ip security ignore-authorities

ip security multilevel
ip security reserved-allowed
ip security strip

ip security multilevel

To set the interface to the requested range of classifications and authorities, use the **ip security multilevel** interface configuration command. To disable this function, use the **no** form of this command.

ip security multilevel *level1* [*authority1...*] **to** *level2 authority2* [*authority2...*]
no ip security multilevel

Syntax Description

level1	Degree of sensitivity of information. The classification level of incoming packets must be equal to or greater than this value for processing to occur. The level keywords are found in Table 1-1 (in the discussion of the **ip security dedicated** command).
authority1	Organization that defines the set of security levels that will be used in a network. The authority bits must be a superset of this value. The authority keywords are listed in Table 1-2 (in the discussion of the **ip security dedicated** command).
to	Separates the range of classifications and authorities.
level2	Degree of sensitivity of information. The classification level of incoming packets must be equal to or less than this value for processing to occur. The level keywords are found in Table 1-1 (in the discussion of the **ip security dedicated** command).
authority2	Organization that defines the set of security levels that will be used in a network. The authority bits must be a proper subset of this value. The authority keywords are listed in Table 1-2 (in the discussion of the **ip security dedicated** command).

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

All traffic entering or leaving the protocol translator must have a security option that falls within the range you define with the **ip security multilevel** command.

Being within range requires that the following two conditions be met:

- The classification level must be greater than or equal to *level1* and less than or equal to *level2*.
- The authority bits must be a superset of *authority1* and a proper subset of *authority2*. That is, *authority1* specifies those authority bits that are required on a packet, while *authority2* specifies the required bits plus any optional authorities that also can be included. If the *authority1* field is the empty set, then a packet is required to specify any one or more of the authority bits in *authority2*.

Example

The following example specifies levels Unclassified to Secret and NSA authority:

```
ip security multilevel unclassified to secret nsa
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security reserved-allowed
ip security strip

ip security reserved-allowed

To treat as valid any packets that have Reserved1 to Reserved4 security levels, use the **ip security reserved-allowed** interface configuration command. To disable this feature, use the **no** form of this command.

ip security reserved-allowed
no ip security reserved-allowed

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

When you set multilevel security on an interface, and indicate, for example, that the highest range allowed is Confidential and the lowest is Unclassified, the protocol translator neither allows nor operates on packets that have security levels of Reserved3 and Reserved2 because they are undefined.

If you use the IP Security Option (IPSO) to block transmission out of unclassified interfaces, and you use one of the Reserved security levels, you enable this feature to preserve network security.

Example

The following example allows a security level of Reserved through Ethernet interface 0:

```
interface ethernet 0
ip security reserved-allowed
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security strip

ip security strip

To remove any basic security option on outgoing packets on an interface, use the **ip security strip** interface configuration command. To disable this function, use the **no** form of this command.

ip security strip
no ip security strip

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This procedure is performed after all security tests in the protocol translator have been passed. This command is not allowed for multilevel interfaces.

Example

The following example removes any basic security options on outgoing packets on Ethernet interface 0:

```
interface ethernet 0
ip security strip
```

Related Commands

ip security add
ip security dedicated
ip security extended-allowed
ip security first
ip security ignore-authorities
ip security implicit-labelling
ip security multilevel
ip security reserved-allowed

ip source-route

To allow the protocol translator to handle IP datagrams with source routing header options, use the **ip source-route** global configuration command. To have the protocol translator discard any IP datagram containing a source-route option, use the **no** form of this command.

ip source-route
no ip source-route

Syntax Description

This command has no arguments or keywords.

Default

Enabled

Command Mode

Global configuration

Example

The following example enables the handling of IP datagrams with source routing header options:

```
ip source-route
```

ip tcp chunk-size

To optimize response to Telnet user interrupt characters, use the **ip tcp chunk-size** global configuration command.

ip tcp chunk-size *number*

Syntax Description

number	Number of characters output before the interrupt executes. The suggested value of *number* is 80, which will typically abort output within a line or two of where the user types the interrupt character. Values of less than 50 are not recommended for efficiency reasons.

Default

None

Command Mode

Global configuration

Usage Guidelines

When used with a correctly operating host, protocol translators implement the Telnet Synchronize and Abort Output signals, which can stop output within one packet's worth of data from the time the user types the interrupt character. The **ip tcp chunk-size** command allows you to configure a faster response to user interrupt characters.

Changing the chunk size affects neither the size of the packet used nor the TCP window size, either of which would cause serious efficiency problems for the remote host as well as for the protocol translator. Instead, the Telnet status is checked after the number of characters specified, causing only a relatively minor performance loss.

Example

The following example allows the protocol translator to react more quickly when the user types an interrupt character or sequence (such as Ctrl-C):

```
ip tcp chunk-size 100
```

ip tcp synwait-time

To set the time the protocol translator will wait to attempt to establish a TCP connection before it times out, use the **ip tcp synwait-time** global configuration command. To restore the default time, use the **no** form of this command.

ip tcp synwait-time *seconds*
no ip tcp synwait-time *seconds*

Syntax Description

seconds	Number of seconds the protocol translator will wait when attempting to establish a TCP connection. It can be a value in the range 5 to 300 seconds.

Default

30 seconds

Command Mode

Global configuration

Usage Guidelines

In previous versions of protocol translator software, the system would wait a fixed 30 seconds when attempting to establish a TCP connection. If your network contains Public Switched Telephone Network Dial on Demand Routing (PSTN DDR), it is possible that the call setup time will exceed 30 seconds. This amount of time is not sufficient in networks that have dial-up asynchronous connections because it will affect your ability to Telnet over the link (from the protocol translator) if the link must be brought up. If you have this type of network, you might want to set this value to the UNIX value of 75.

Because this is a host parameter, it does not pertain to traffic going through the protocol translator, just for traffic originating at the protocol translator. Because UNIX has a fixed 75-second timeout, hosts are unlikely to see this problem.

Example

The following example configures the protocol translator to continue attempting to establish a TCP connection for 180 seconds:

```
ip tcp synwait-time 180
```

ip unreachables

To enable the generation of ICMP Unreachable messages, use the **ip unreachables** interface configuration command. To disable this function, use the **no ip** form of this command.

ip unreachables
no ip unreachables

Syntax Description

This command has no arguments or keywords.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

If the protocol translator receives a nonbroadcast packet destined for itself that uses a protocol it does not recognize, it sends an ICMP Protocol Unreachable message to the source.

If the protocol translator receives a datagram that it cannot deliver to its ultimate destination because it knows of no route to the destination address, it replies to the originator of that datagram with an ICMP Host Unreachable message.

Example

The following example disables the generation of ICMP Unreachable messages:

```
interface ethernet 0
no ip unreachables
```

ping (user level)

To check host reachability and network connectivity, use the **ping** (IP packet internet groper function) user-level EXEC command.

ping [*protocol*] {*host* | *address*}

Syntax Description

protocol	(Optional.) Protocol keyword. IP is the default.
host	Host name of the system to ping.
address	IP address of the system to ping.

Command Mode

User-level EXEC

Usage Guidelines

The **ping** command sends ICMP Echo messages. If the protocol translator receives an ICMP Echo message, it sends an ICMP Echo Reply message to the source of the ICMP Echo message.

The user-level **ping** command provides a basic ping facility for IP users who do not have system privileges. This feature allows the protocol translator to perform the simple default ping functionality for the IP protocol. Only the nonverbose form of the **ping** command is supported for user-level pings.

If the system cannot map an address for a host name, it will return an "%Unrecognized host or address" error message.

Multicast and broadcast pings are fully supported. When you ping the broadcast address of 255.255.255.255, the system will send out pings and print a list of all stations responding. You can also ping a local network to get a list of all systems that respond, as in the following example, where 128.111.3 is a local network:

```
ping 128.111.3.255
```

As a side-effect, you also can get a list of all multicast-capable hosts that are connected directly to the protocol translator from which you are pinging, as in the following example:

```
ping 224.0.0.1
```

To abort a ping session, type the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key).

Table 1-3 describes the test characters that the ping facility sends.

Table 1-3 Ping Test Characters

Char	Description
!	Each exclamation point indicates receipt of a reply.
.	Each period indicates the network server timed out while waiting for a reply.
U	Destination unreachable.
N	Network unreachable.
P	Protocol unreachable.
Q	Source quench.
M	Could not fragment.
?	Unknown packet type.

Sample Display Using an IP Host Name

The following display shows sample ping output when you ping a host named fred:

```
pt> ping fred
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.31.7.27, timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/3/4 ms
```

Sample Display Using the Broadcast Address

The following display shows sample ping output when you ping the broadcast address of 255.255.255.255:

```
pt> ping 255.255.255.255
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 255.255.255.255, timeout is 2 seconds:

Reply to request 0 from 160.89.48.15 (4 ms)
Reply to request 0 from 160.89.48.10 (4 ms)
Reply to request 0 from 160.89.48.19 (4 ms)
Reply to request 0 from 160.89.49.15 (4 ms)
Reply to request 1 from 160.89.48.15 (4 ms)
Reply to request 1 from 160.89.48.10 (4 ms)
Reply to request 1 from 160.89.48.19 (4 ms)
Reply to request 1 from 160.89.49.15 (4 ms)
Reply to request 2 from 160.89.48.15 (4 ms)
Reply to request 2 from 160.89.48.10 (4 ms)
Reply to request 2 from 160.89.48.19 (4 ms)
Reply to request 2 from 160.89.49.15 (4 ms)
Reply to request 3 from 160.89.48.15 (4 ms)
Reply to request 3 from 160.89.48.10 (4 ms)
Reply to request 3 from 160.89.48.19 (4 ms)
Reply to request 3 from 160.89.49.15 (4 ms)
Reply to request 4 from 160.89.48.15 (4 ms)
Reply to request 4 from 160.89.48.10 (4 ms)
Reply to request 4 from 160.89.48.19 (4 ms)
Reply to request 4 from 160.89.49.15 (4 ms)
```

Related Command

ping (privileged level)

ping (privileged level)

To check host reachability and network connectivity, use the **ping** (IP packet internet groper function) privileged-level EXEC command.

ping [*protocol*] {*host* | *address*}

Syntax Description

protocol	(Optional.) Protocol keyword. IP is the default.
host	Host name of the system to ping.
address	IP address of the system to ping.

Command Mode

Privileged EXEC

Usage Guidelines

The **ping** command sends ICMP Echo messages. If the protocol translator receives an ICMP Echo message, it sends an ICMP Echo Reply message to the source of the ICMP Echo message.

You can use the IP **ping** command to diagnose serial line problems. By placing the local or remote CSU/DSU into loopback mode and pinging your own interface, you can isolate the problem to the protocol translator or leased line.

To abort a ping session, type the escape sequence (by default, Ctrl-^ X, which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key).

Table 1-4 describes the test characters that the ping facility sends.

Table 1-4 Ping Test Characters

Char	Description
!	Each exclamation point indicates receipt of a reply.
.	Each period indicates the network server timed out while waiting for a reply.
U	Destination unreachable.
N	Network unreachable.
P	Protocol unreachable.
Q	Source quench.
M	Could not fragment.
?	Unknown packet type.

You can use the extended command mode of the **ping** command to specify the supported Internet header options, as shown in the following sample display.

Sample Display Showing Extended Command Sequence

To enter **ping** extended command mode, enter **yes** at the extended commands prompt of the **ping** command. The following display shows a sample **ping** extended command sequence:

```
Protocol [ip]:
Target IP address: 192.31.7.27
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address: 131.108.1.1
Type of service [0]:
Set DF bit in IP header? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.31.7.27, timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 1/3/4 ms
```

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

Table 1-5 IP Ping Internet Header Options Field Descriptions

Field	Description
Protocol [ip]:	Default is IP.
Target IP address:	Prompts for the IP address or host name of the destination node you plan to ping.
Repeat count [5]:	Number of ping packets that will be sent to the destination address. Default: 5.
Datagram size [100]:	Size of the ping packet (in bytes). Default: 100 bytes.
Timeout in seconds [2]:	Timeout interval (in seconds). Default: 2.
Extended commands [n]:	Specifies whether or not a series of additional commands appears. Many of the following displays and tables show and describe these commands. Default: no.
Source address:	IP address that appears in the ping packet as the source address.
Type of service [0]:	Internet service quality selection. See RFC 791 for more information. Default: 0.
Set DF bit in IP header? [no]:	Don't Fragment. Specifies that if the packet encounters a node in its path that is configured for a smaller MTU than the packet's MTU, that the packet is to be dropped and an error message is to be sent to the protocol translator at the packet's source address. If performance problems are encountered on the network, a node configured for a small MTU could be a contributing factor. This feature can be used to determine the smallest MTU in the path. Default: no.
Data pattern [0xABCD]:	Sets 16-bit hexadecimal data pattern. Default: 0xABCD. Varying the data pattern in this field (to all ones or all zeros for example) can be useful when debugging data sensitivity problems on CSU/DSUs, or detecting cable-related problems such as cross talk.

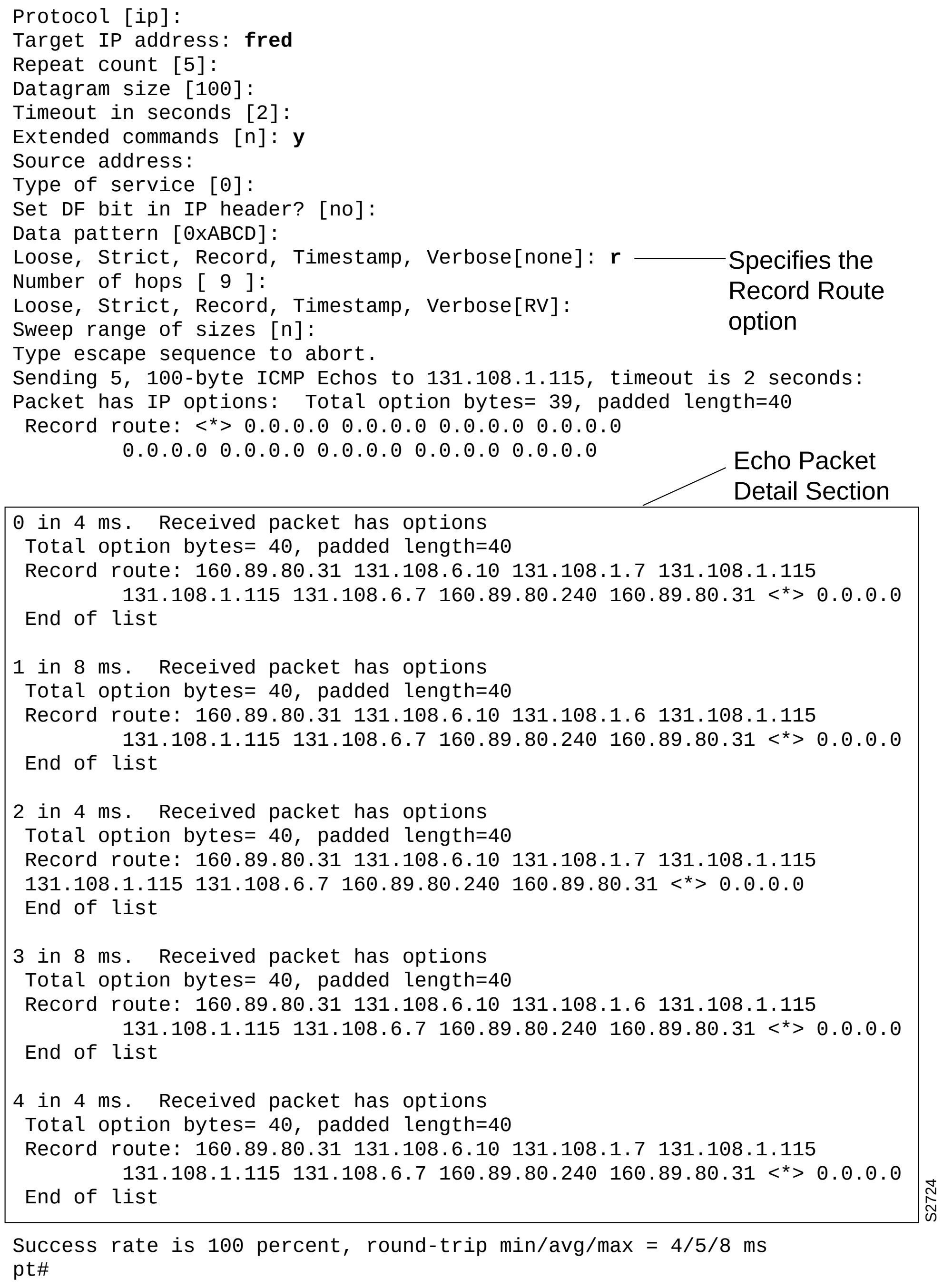
Field	Description
Loose, Strict, Record, Timestamp, Verbose [none]:	Supported IP header options. The protocol translator examines the header options to every packet that passes through it. If it finds a packet with an invalid option, the protocol translator sends an ICMP Parameter Problem message to the source of the packet and discards the packet. The IP header options follow: • Loose • Strict • Record—See the following section for more information on this helpful option. • Timestamp • Verbose Default: none. For more information on these header options, see RFC 791.
Sweep range of sizes [n]:	Allows you to vary the sizes of the echo packets being sent. This capability is useful for determining the minimum sizes of the MTUs configured on the nodes along the path to the destination address. Packet fragmentation contributing to performance problems can then be reduced.
!!!!!	Each exclamation point (!) indicates receipt of a reply. A period (.) indicates the network server timed out while waiting for a reply. Other characters may appear in the ping output display, depending on the protocol type.
Success rate is 100 percent	Percentage of packets successfully echoed back to the protocol translator. Anything less than 80 percent is usually considered problematic.
round-trip min/avg/max = 1/3/4 ms	Round-trip travel time intervals for the protocol echo packets, including minimum/average/maximum (in milliseconds).

Using the Record Route Option

Using the Record Route option to trace a path to a particular destination address. Be aware, however, that the **trace** EXEC command performs a similar function, but the latter does not have the nine-hop limitation.

Sample Display Showing the Record Route Option

The following display shows sample extended **ping** output when the Record Route option is specified.



```
Protocol [ip]:
Target IP address: fred
Repeat count [5]:
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]: y
Source address:
Type of service [0]:
Set DF bit in IP header? [no]:
Data pattern [0xABCD]:
Loose, Strict, Record, Timestamp, Verbose[none]: r
Number of hops [ 9 ]:
Loose, Strict, Record, Timestamp, Verbose[RV]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 131.108.1.115, timeout is 2 seconds:
Packet has IP options:  Total option bytes= 39, padded length=40
 Record route: <*> 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
         0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0

0 in 4 ms.  Received packet has options
 Total option bytes= 40, padded length=40
 Record route: 160.89.80.31 131.108.6.10 131.108.1.7 131.108.1.115
         131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
 End of list

1 in 8 ms.  Received packet has options
 Total option bytes= 40, padded length=40
 Record route: 160.89.80.31 131.108.6.10 131.108.1.6 131.108.1.115
         131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
 End of list

2 in 4 ms.  Received packet has options
 Total option bytes= 40, padded length=40
 Record route: 160.89.80.31 131.108.6.10 131.108.1.7 131.108.1.115
 131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
 End of list

3 in 8 ms.  Received packet has options
 Total option bytes= 40, padded length=40
 Record route: 160.89.80.31 131.108.6.10 131.108.1.6 131.108.1.115
         131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
 End of list

4 in 4 ms.  Received packet has options
 Total option bytes= 40, padded length=40
 Record route: 160.89.80.31 131.108.6.10 131.108.1.7 131.108.1.115
         131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
 End of list

Success rate is 100 percent, round-trip min/avg/max = 4/5/8 ms
pt#
```

In this display, five ping echo packets are sent to the destination address 131.108.1.115. The echo packet detail section includes specific information about each of these echo packets.

The lines of **ping** output that are unique when the Record Route option is specified are described as follows:

- The following line of output allows you to specify the number of hops that will be recorded in the route. Range: 1 to 9. Default: 9.

  ```
  Number of hops [ 9 ]:
  ```

- The following line of output indicates that IP header options have been enabled on the outgoing echo packets and shows the number of option bytes and padded bytes in the headers of these packets:

  ```
  Packet has IP options: Total option bytes= 39, padded length=40
  ```

- The following lines of output indicate that the fields that will contain the IP addresses of the nodes in the routes have been zeroed out in the outgoing packets.

  ```
  Record route: <*> 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
           0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0 0.0.0.0
  ```

- The following lines of output display statistics for the first of the five echo packets sent. 0 is the number assigned to this packet to indicate that it is the first in the series. 4 ms indicates the round trip travel time for the packet.

  ```
  0 in 4 ms. Received packet has options
   Total option bytes= 40, padded length=40
   Record route: 160.89.80.31 131.108.6.10 131.108.1.7 131.108.1.115
       131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
  ```

- The following line of output indicates that four nodes were included in the packet’s route, including the protocol translator at source address 160.89.80.31, two intermediate nodes at addresses 131.108.6.10 and 131.108.1.7, and the destination node at address 131.108.1.115. The underlined address shows where the original route differs from the return route in the line that follows this line.

  ```
   Record route: 160.89.80.31 131.108.6.10 131.108.1.7 131.108.1.115
  ```

- The following line of output includes the addresses of the four nodes in the return path of the echo packet. The underlined address shows where the return route differs from the original route shown in the previous line of output.

  ```
           131.108.1.115 131.108.6.7 160.89.80.240 160.89.80.31 <*> 0.0.0.0
  ```

Related Command

ping (user level)

show access-lists

To display the contents of all current access lists, use the **show access-lists** EXEC command.

show access-lists

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show access-lists** command:

```
Standard IP access list 19
    permit 131.108.19.0
    deny   0.0.0.0, wildcard bits 255.255.255.255
Standard IP access list 49
    permit 131.108.31.0, wildcard bits 0.0.0.255
    permit 131.108.194.0, wildcard bits 0.0.0.255
    permit 131.108.195.0, wildcard bits 0.0.0.255
    permit 131.108.196.0, wildcard bits 0.0.0.255
    permit 131.108.197.0, wildcard bits 0.0.0.255
Extended IP access list 101
    permit tcp 0.0.0.0 255.255.255.255 0.0.0.0 255.255.255.255 eq 23
Type code access list 201
    permit 0x6001 0x0000
Type code access list 202
    permit 0x6004 0x0000
    deny   0x0000 0xFFFF
```

Related Command

access-list (standard)
access-list (extended)

show hosts

To display the default domain name, the style of name lookup service, a list of name server hosts, and the cached list of host names and addresses, use the **show hosts** EXEC command.

show hosts

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show hosts** command:

```
Default domain is CISCO.COM
Name/address lookup uses domain service
Name servers are 255.255.255.255
Host              Flag        Age   Type       Address(es)
SLAG.CISCO.COM    (temp, OK)  1     IP         131.108.4.10
CHAR.CISCO.COM    (temp, OK)  8     IP         192.31.7.50
CHAOS.CISCO.COM   (temp, OK)  8     IP         131.108.1.115
DIRT.CISCO.COM    (temp, EX)  8     IP         131.108.1.111
DUSTBIN.CISCO.COM (temp, EX)  0     IP         131.108.1.27
DREGS.CISCO.COM   (temp, EX)  24    IP         131.108.1.30
```

Table 1-6 describes the fields shown in the display.

Table 1-6 Show Hosts Field Descriptions

Field	Description
Flag	A temp entry is entered by a name server; the protocol translator removes the entry after 72 hours of inactivity. A perm entry is entered by a configuration command and is not timed out. Entries marked OK are believed to be valid. Entries marked ?? are considered suspect and subject to revalidation. Entries marked EX are expired.
Age	Indicates the number of hours since the protocol translator last referred to the cache entry.
Type	Identifies the type of address, for example, IP, CLNS, or X.121.
Address(es)	Shows the address of the host. One host can have up to eight addresses.

Related Command

clear host

show ip aliases

To display the protocol translator's IP addresses mapped to TCP ports (*aliases*) and SLIP addresses, which are treated similarly to aliases, use the **show ip aliases** EXEC command.

show ip aliases

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

To distinguish a SLIP address from a normal alias address, the command output uses the form SLIP TTY1 for the "port" number, where 1 is the auxiliary port.

Sample Display

The following is sample output from the **show ip aliases** command:

```
  IP Address    Port
131.108.29.245  SLIP TTY1
```

The display lists the IP address and corresponding port number.

Related Command

A dagger (†) indicates that the command is documented in the *Router Products Command Reference* publication.

show line †

show ip arp

To display the Address Resolution Protocol (ARP) cache, where SLIP addresses appear as permanent TRP table entries, use the **show ip arp** EXEC command.

show ip arp

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

ARP establishes correspondences between network addresses (an IP address, for example) and LAN hardware addresses (Ethernet addresses). A record of each correspondence is kept in a cache for a predetermined amount of time and then discarded.

Sample Display

The following is sample output from the **show ip arp** command:

```
Protocol  Address          Age (min)     Hardware Addr   Type      Interface
Internet  131.108.62.192         187     0800.2010.a3b6  ARPA      Ethernet3
Internet  131.108.62.245          68     0800.200e.28f8  ARPA      Ethernet3
Internet  131.108.1.140          139     0000.0c01.2812  ARPA      Ethernet0
Internet  131.108.62.160         187     0800.200e.4dab  ARPA      Ethernet3
Internet  131.108.1.111           27     0800.2007.8866  ARPA      Ethernet0
Internet  131.108.1.117          119     0000.0c00.f346  ARPA      Ethernet0
Internet  131.108.1.115           28     0000.0c01.0509  ARPA      Ethernet0
Internet  131.108.1.77             1     0800.200e.57ce  ARPA      Ethernet0
Internet  192.31.7.29            225     aa00.0400.0234  ARPA      Ethernet2
Internet  192.31.7.17            118     2424.c01f.0711  ARPA      Ethernet2
Internet  192.31.7.18            135     0000.0c01.2817  ARPA      Ethernet2
Internet  192.31.7.21            119     2424.c01f.0715  ARPA      Ethernet2
Internet  131.108.1.33             1     0800.2008.c52e  ARPA      Ethernet0
Internet  131.108.62.1             -     0000.0c00.750f  ARPA      Ethernet3
Internet  131.108.31.35          119     0800.2010.8c5b  ARPA      Ethernet7
Internet  131.108.62.7            14     0000.0c00.33ce  ARPA      Ethernet3
Internet  131.108.1.55           155     0800.200e.e443  ARPA      Ethernet0
```

Table 1-7 describes the fields shown in the display.

Table 1-7 Show IP ARP Field Displays

Field	Description
Protocol	Protocol for network address in the Address field.
Address	The network address that corresponds to Hardware Addr.
Age (min)	Age, in minutes, of the cache entry.
Hardware Addr	LAN hardware address a MAC address that corresponds to network address.
Type	Type of encapsulation: • ARPA—Ethernet • SNAP—RFC 1042 • ISO1—IEEE 802.3
Interface	Interface to which this address mapping has been assigned.

show ip interface

To display the usability status of interfaces, use the **show ip interface** EXEC command.

show ip interface [*interface unit*]

Syntax Description

interface unit — (Optional.) Used to display information for a particular interface. For example, e 0 specifies the first Ethernet interface; e 1 specifies the second Ethernet interface. You must specify both the interface type and unit number.

Command Mode

EXEC

Usage Guidelines

A protocol translator automatically enters a directly connected route in the routing table if the interface is usable. A usable interface is one through which the protocol translator can send and receive packets. If the protocol translator determines that an interface is not usable, it removes the directly connected routing entry from the routing table. Removing the entry allows the protocol translator to use dynamic routing protocols to determine backup routes to the network (if any).

If the interface can provide two-way communication, the line protocol is marked “up.” If the interface hardware is usable, the interface is marked “up.”

If you specify an optional interface type, you will see only information on that specific interface.

If you specify no optional parameters you will see information on all the interfaces.

Sample Display

The following is sample output from the **show ip interface** command.

```
Ethernet 0 is up, line protocol is up
    Internet address is 192.54.222.2, subnet mask is 255.255.255.0
    Broadcast address is 192.54.222.0
    Address determined by non-volatile memory
    MTU is 1500 bytes
    Helper address is 192.52.71.4
    Secondary address 131.192.115.2, subnet mask 255.255.255.0
    Outgoing access list is not set
    Proxy ARP is enabled
    Security level is default
    Split horizon is enabled
    ICMP redirects are always sent
    ICMP unreachables are always sent
    ICMP mask replies are never sent
    IP fast switching is enabled
    Gateway Discovery is disabled
    IP accounting is disabled
    TCP/IP header compression is disabled
    Probe proxy name replies are disabled
```

Table 1-8 describes the fields shown in the display.

Table 1-8 Show IP Interface Field Descriptions

Field	Description
Ethernet 0 is up	If the interface hardware is usable, the interface is marked “up.” For an interface to be usable, both the interface hardware and line protocol must be up.
line protocol is up	If the interface can provide two-way communication, the line protocol is marked “up.” For an interface to be usable, both the interface hardware and line protocol must be up.
Broadcast address	Broadcast address.
Helper address	Helper address, if one has been set.
Outgoing access list	Indicates whether or not the interface has an outgoing access list set.
Proxy ARP	Indicates whether Proxy ARP is enabled for the interface.
Security level	IPSO security level set for this interface.
ICMP redirects	Indicates whether redirects will be sent on this interface.
ICMP unreachables	Indicates whether unreachable messages will be sent on this interface.
ICMP mask replies	Indicates whether mask replies will be sent on this interface.
IP fast switching	Indicates whether fast switching has been enabled for this interface. It is generally enabled on serial interfaces, such as this one.
Gateway Discovery	Indicates whether the discovery process has been enabled for this interface. It is generally disabled on serial interfaces, such as this one.
IP accounting	Indicates whether IP accounting is enabled for this interface and what the threshold (maximum number of entries) is.
TCP/IP header compression	Indicates whether compression is enabled or disabled.
Probe proxy name	Indicates whether HP Probe proxy name replies are generated.

show ip redirects

To display the address of a default gateway (protocol translator), use the **show ip redirects** EXEC command.

show ip redirects

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip redirects** command:

```
Default gateway is 160.89.80.29

Host               Gateway           Last Use    Total Uses  Interface
131.108.1.111      160.89.80.240         0:00             9  Ethernet0
128.95.1.4         160.89.80.240         0:00             4  Ethernet0
```

Related Command

ip default-gateway

show ip traffic

To display IP protocol statistics, use the **show ip traffic** EXEC command.

show ip traffic

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

The following is sample output from the **show ip traffic** command:

```
IP statistics:
  Rcvd: 98 total, 98 local destination
        0 format errors, 0 checksum errors, 0 bad hop count
        0 unknown protocol, 0 not a gateway
        0 security failures, 0 bad options
  Frags:0 reassembled, 0 timeouts, 0 too big
        0 fragmented, 0 couldn't fragment
  Bcast:38 received, 52 sent
  Sent: 44 generated, 0 forwarded
        0 encapsulation failed, 0 no route
ICMP statistics:
  Rcvd: 0 checksum errors, 0 redirects, 0 unreachable, 0 echo
        0 echo reply, 0 mask requests, 0 mask replies, 0 quench
        0 parameter, 0 timestamp, 0 info request, 0 other
  Sent: 0 redirects, 3 unreachable, 0 echo, 0 echo reply
        0 mask requests, 0 mask replies, 0 quench, 0 timestamp
        0 info reply, 0 time exceeded, 0 parameter problem
UDP statistics:
  Rcvd: 56 total, 0 checksum errors, 55 no port
  Sent: 18 total, 0 forwarded broadcasts
TCP statistics:
  Rcvd: 0 total, 0 checksum errors, 0 no port
  Sent: 0 total
EGP statistics:
  Rcvd: 0 total, 0 format errors, 0 checksum errors, 0 no listener
  Sent: 0 total
IGRP statistics:
  Rcvd: 73 total, 0 checksum errors
  Sent: 26 total
HELLO statistics:
  Rcvd: 0 total, 0 checksum errors
  Sent: 0 total
ARP statistics:
  Rcvd: 20 requests, 17 replies, 0 reverse, 0 other
  Sent: 0 requests, 9 replies (0 proxy), 0 reverse
Probe statistics:
  Rcvd: 6 address requests, 0 address replies
0 proxy name requests, 0 other
  Sent: 0 address requests, 4 address replies (0 proxy)
        0 proxy name replies
```

Table 1-9 describes the fields shown in the display.

Table 1-9 Show IP Traffic Field Descriptions

Field	Description
format errors	A gross error in the packet format, such as an impossible IP header length.
bad hop count	Occurs when a packet is discarded because its time-to-live (TTL) field was decremented to zero.
encapsulation failed	Usually indicates that the protocol translator had no ARP request entry and therefore did not send a datagram.
no route	Counted when the protocol translator discards a datagram it did not know how to route.
proxy name reply	Counted when the protocol translator sends an ARP or Probe Reply on behalf of another host. The display shows the number of Probe Proxy requests that have been received and the number of responses that have been sent.

trace (user level)

To discover the IP routes the protocol translator's packets will actually take when traveling to their destination, use the **trace** EXEC command.

trace ip *[destination*]

Syntax Description

destination	(Optional.) Destination address or host name on the command line. The default parameters for the appropriate protocol are assumed and the tracing action begins.

Command Mode

User-level EXEC

Usage Guidelines

The **trace** command works by taking advantage of the error messages generated by protocol translators when a datagram exceeds its time-to-live (TTL) value.

The **trace** command starts by sending probe datagrams with a TTL value of one. This causes the first protocol translator to discard the probe datagram and send back an error message. The **trace** command sends several probes at each TTL level and displays the round-trip time for each.

The **trace** command sends out one probe at a time. Each outgoing packet may result in one or two error messages. A time exceeded error message indicates that an intermediate protocol translator has seen and discarded the probe. A destination unreachable error message indicates that the destination node has received the probe and discarded it because it could not deliver the packet. If the timer goes off before a response comes in, **trace** prints an asterisk (*).

The **trace** command terminates when the destination responds, when the maximum TTL is exceeded, or when the user interrupts the trace with the escape sequence. By default, to invoke the escape sequence, press Ctrl-^ X—which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key.

Common Trace Problems

Due to bugs in the IP implementation of various hosts and protocol translators, the IP **trace** command might behave in odd ways.

Not all destinations will respond correctly to a *probe* message by sending back an ICMP port unreachable message. A long sequence of TTL levels with only asterisks, terminating only when the maximum TTL has been reached, might indicate this problem.

There is a known problem with the way some hosts handle an ICMP TTL exceeded message. Some hosts generate an ICMP message but they reuse the TTL of the incoming packet. Since this is zero, the ICMP packets do not make it back. When you trace the path to such a host, you might see a set of TTL values with asterisks (*). Eventually the TTL gets high enough that the ICMP message can get back. For example, if the host is six hops away, **trace** will time out on responses 6 through 11.

Sample Display Showing Trace IP Routes

The following display shows sample IP **trace** output when a destination host name (ABA.NYC. mil) has been specified:

```
Type escape sequence to abort.
Tracing the route to ABA.NYC.mil (26.0.0.73)
  1 DEBRIS.CISCO.COM (131.108.1.6) 1000 msec 8 msec 4 msec
  2 BARRNET-GW.CISCO.COM (131.108.16.2) 8 msec 8 msec 8 msec
  3 EXTERNAL-A-GATEWAY.STANFORD.EDU (192.42.110.225) 8 msec 4 msec 4 msec
  4 BB2.SU.BARRNET.NET (131.119.254.6) 8 msec 8 msec 8 msec
  5 SU.ARC.BARRNET.NET (131.119.3.8) 12 msec 12 msec 8 msec
  6 MOFFETT-FLD-MB.in.MIL (192.52.195.1) 216 msec 120 msec 132 msec
  7 ABA.NYC.mil (26.0.0.73) 412 msec 628 msec 664 msec
```

Table 1-10 describes the fields shown in the display.

Table 1-10 Trace Field Descriptions

Field	Description
1	Indicates the sequence number of the protocol translator in the path to the host.
DEBRIS.CISCO.COM	Host name of this protocol translator.
131.108.1.6	IP address of this protocol translator.
1000 msec 8 msec 4 msec	Round-trip time for each of the three probes that are sent.

Table 1-11 describes the characters that can appear in **trace** output.

Table 1-11 IP Trace Text Characters

Char	Description
nn msec	For each node, the round-trip time in milliseconds for the specified number of probes.
*	The probe timed out.
?	Unknown packet type.
Q	Source quench.
P	Protocol unreachable.
N	Network unreachable.
U	Port unreachable.
H	Host unreachable.

Related Command

trace (privileged level)

trace (privileged level)

To discover the routes the protocol translator's packets will actually take when traveling to their destination, use the **trace** EXEC command.

trace [*destination*]

Syntax Description

destination	(Optional.) Destination address or host name. The default parameters for the appropriate protocol are assumed and the tracing action begins.

Command Mode

Privileged EXEC

Usage Guidelines

The **trace** command works by taking advantage of the error messages generated by protocol translators when a datagram exceeds its time-to-live (TTL) value.

The **trace** command starts by sending probe datagrams with a TTL value of one. This causes the first protocol translator to discard the probe datagram and send back an error message. The **trace** command sends several probes at each TTL level and displays the round-trip time for each.

The **trace** command sends out one probe at a time. Each outgoing packet may result in one or two error messages. A time exceeded error message indicates that an intermediate protocol translator has seen and discarded the probe. A destination unreachable error message indicates that the destination node has received the probe and discarded it because it could not deliver the packet. If the timer goes off before a response comes in, **trace** prints an asterisk (*).

The **trace** command terminates when the destination responds, when the maximum TTL is exceeded, or when the user interrupts the trace with the escape sequence. By default, to invoke the escape sequence, press Ctrl-^ X—which is done by simultaneously pressing the Ctrl, Shift, and 6 keys, letting go, then pressing the X key.

To use nondefault parameters and invoke an extended **trace** test, enter the command without a destination argument. You will be stepped through a dialog to select the desired parameters.

Common Trace Problems

Due to bugs in the IP implementation of various hosts and protocol translators, the IP **trace** command may behave in odd ways.

Not all destinations will respond correctly to a probe message by sending back an ICMP port unreachable message. A long sequence of TTL levels with only asterisks, terminating only when the maximum TTL has been reached, might indicate this problem.

There is a known problem with the way some hosts handle an ICMP TTL exceeded message. Some hosts generate an ICMP message but they reuse the TTL of the incoming packet. Since this is zero, the ICMP packets do not make it back. When you trace the path to such a host, you might see a set of TTL values with asterisks (*). Eventually the TTL gets high enough that the ICMP message can get back. For example, if the host is six hops away, **trace** will time out on responses 6 through 11.

Sample Display Showing Trace IP Routes

The following display shows sample IP **trace** output when a destination host name (ABA.NYC.mil) has been specified:

```
Type escape sequence to abort.
Tracing the route to ABA.NYC.mil (26.0.0.73)
  1 DEBRIS.CISCO.COM (131.108.1.6) 1000 msec 8 msec 4 msec
  2 BARRNET-GW.CISCO.COM (131.108.16.2) 8 msec 8 msec 8 msec
  3 EXTERNAL-A-GATEWAY.STANFORD.EDU (192.42.110.225) 8 msec 4 msec 4 msec
  4 BB2.SU.BARRNET.NET (131.119.254.6) 8 msec 8 msec 8 msec
  5 SU.ARC.BARRNET.NET (131.119.3.8) 12 msec 12 msec 8 msec
  6 MOFFETT-FLD-MB.in.MIL (192.52.195.1) 216 msec 120 msec 132 msec
  7 ABA.NYC.mil (26.0.0.73) 412 msec 628 msec 664 msec
```

Table 1-12 describes the fields shown in the display.

Table 1-12 Trace Field Descriptions

Field	Description
1	Indicates the sequence number of the protocol translator in the path to the host.
DEBRIS.CISCO.COM	Host name of this protocol translator.
131.108.1.6	IP address of this protocol translator.
1000 msec 8 msec 4 msec	Round-trip time for each of the three probes that are sent.

Sample Display Showing Extended IP Trace Dialog

The following display shows a sample **trace** session involving the extended dialog of the **trace** command:

```
Protocol [ip]:
Target IP address: mit.edu
Source address:
Numeric display [n]:
Timeout in seconds [3]:
Probe count [3]:
Minimum Time to Live [1]:
Maximum Time to Live [30]:
Port Number [33434]:
Loose, Strict, Record, Timestamp, Verbose[none]:
Type escape sequence to abort.
Tracing the route to MIT.EDU (18.72.2.1)
  1 ICM-DC-2-V1.ICP.NET (192.108.209.17) 72 msec 72 msec 88 msec
  2 ICM-FIX-E-H0-T3.ICP.NET (192.157.65.122) 80 msec 128 msec 80 msec
  3 192.203.229.246 540 msec 88 msec 84 msec
  4 T3-2.WASHINGTON-DC-CNSS58.T3.ANS.NET (140.222.58.3) 84 msec 116 msec 88 msec
  5 T3-3.WASHINGTON-DC-CNSS56.T3.ANS.NET (140.222.56.4) 80 msec 132 msec 88 msec
  6 T3-0.NEW-YORK-CNSS32.T3.ANS.NET (140.222.32.1) 92 msec 132 msec 88 msec
  7 T3-0.HARTFORD-CNSS48.T3.ANS.NET (140.222.48.1) 88 msec 88 msec 88 msec
  8 T3-0.HARTFORD-CNSS49.T3.ANS.NET (140.222.49.1) 96 msec 104 msec 96 msec
  9 T3-0.ENSS134.T3.ANS.NET (140.222.134.1) 92 msec 128 msec 92 msec
 10 W91-CISCO-EXTERNAL-FDDI.MIT.EDU (192.233.33.1) 92 msec 92 msec 112 msec
 11 E40-RTR-FDDI.MIT.EDU (18.168.0.2) 92 msec 120 msec 96 msec
 12 MIT.EDU (18.72.2.1) 96 msec 92 msec 96 msec
```

Table 1-13 describes the fields that are unique to the extended trace sequence, as shown in the display.

Table 1-13 Trace Field Descriptions

Field	Description
Target IP address	You must enter a host name or an IP address. There is no default.
Source address	One of the interface addresses of the protocol translator to use as a source address for the probes. The protocol translator normally selects the best source address to use.
Numeric display	The default is to have both a symbolic and numeric display; however, you can suppress the symbolic display.
Timeout in seconds	The number of seconds to wait for a response to a probe packet. The default is 3 seconds.
Probe count	The number of probes to be sent at each TTL level. The default count is 3.
Minimum Time to Live [1]	The TTL value for the first probes. The default is 1, but it can be set to a higher value to suppress the display of known hops.
Maximum Time to Live [30]	The largest TTL value that can be used. The default is 30. The **trace** command terminates when the destination is reached or when this value is reached.
Port Number	The destination port used by the UDP probe messages. The default is 33434.
Loose, Strict, Record, Timestamp, Verbose	IP header options. You can specify any combination. The **trace** command issues prompts for the required fields. Note that **trace** places the requested options in each probe; however, there is no guarantee that all protocol translators (or end nodes) will process the options.
Loose Source Routing	Allows you to specify a list of nodes that must be traversed when going to the destination.
Strict Source Routing	Allows you to specify a list of nodes that must be the only nodes traversed when going to the destination.
Record	Allows you to specify the number of hops to leave room for.
Timestamp	Allows you to specify the number of time stamps to leave room for.
Verbose	If you select any option, the verbose mode is automatically selected and **trace** prints the contents of the option field in any incoming packets. You can prevent verbose mode by selecting it again, toggling its current setting.

Table 1-14 describes the characters that can appear in **trace** output.

Table 1-14 IP Trace Text Characters

Char	Description
nn msec	For each node, the round-trip time in milliseconds for the specified number of probes.
*	The probe timed out.
?	Unknown packet type.
Q	Source quench.
P	Protocol unreachable.
N	Network unreachable.
U	Port unreachable.
H	Host unreachable.

Related Command

trace (user level)