Granular Protocol Inspection

Last Updated: January 19, 2012

The Granular Protocol Inspection feature adds flexibility to the Cisco IOS Firewall by allowing it to perform a higher degree of inspection of TCP and User Data Protocol (UDP) traffic for most RFC 1700 application types.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Granular Inspection Protocol

- Cisco IOS Firewall software must be installed in your network.
- Access control lists (ACLs) must be applied to specified interfaces to enable the existing firewall software to function properly.

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Restrictions for Granular Inspection Protocol

Port ranges cannot be specified directly in the **ip inspect name** command; use the port-to-application mapping (PAM) table.

Information About Granular Protocol Inspection

Cisco IOS Firewall

The Cisco IOS Firewall is a security-specific option that provides inspection firewall functionality and intrusion detection for every network perimeter. By delivering state-of-the-art security features such as stateful, application-based filtering; dynamic per-user authentication and authorization; and URL filtering, the Cisco IOS Firewall adds greater depth and flexibility to existing Cisco IOS security solutions including authentication, encryption, and failover.

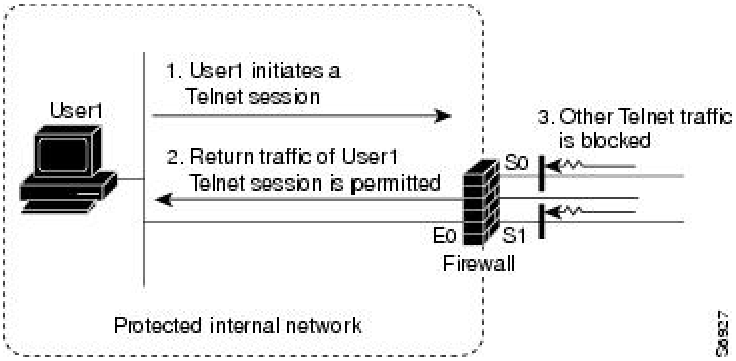
A firewall is a physical software or hardware barrier between one part of an internal network used to control access to and from external networks. This barrier is unique because it allows predefined traffic to pass through the firewall while being monitored for protocol anomalies. The difficult part is determining the criteria by which the packets are granted or denied access through the device.

As mentioned, a firewall blocks traffic and permits other types of traffic to traverse. Firewalls are not just access control lists (ACLs); rather, they are a stateful inspection application.

Granular Protocol Inspection

The Cisco IOS Firewall performs inspections for TCP and UDP traffic. For example, TCP inspections include Telnet traffic (port 23, by default) as well as all other applications on TCP such as Hypertext Transfer Protocol (HTTP), e-mail, instant message (IM) chatter, and so on. Therefore, there is no easy way to inspect Telnet traffic alone and deny all other TCP traffic.

The Granular Protocol Inspection feature allows you to specify TCP or UDP ports using the PAM table. As a result, the Cisco IOS Firewall can restrict traffic inspections to specific applications, thereby permitting a higher degree of granularity in selecting which protocols are to be permitted and denied as shown in the figure below.


User1
1. User1 initiates a Telnet session
2. Return traffic of User1 Telnet session is permitted
3. Other Telnet traffic is blocked
S0
S1
E0
Firewall
Protected internal network
S6927

Benefits

- Greater flexibility by allowing more granularity in the selection of protocols to be inspected
- Ease of use by providing for group inspection of multiple ports into a single, user-defined application keyword
- Enhanced functionality with the addition of more well-known ports, user-defined applications, and user-defined port ranges
- Improved performance and reduced CPU load resulting from focused inspection selections

How to Configure Granular Protocol Inspection

Defining Applications

Perform the following task to define your applications in the PAM table by using the **ip port-map** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip port-map** *appl-name* **port** [**tcp** | **udp**] [*port_num* | **from** *begin_port_num* **to** *end_port_num*] [**list** *acl-num*] [**description** *description_string*]
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**ip port-map** *appl-name* **port** [**tcp** | **udp**] [*port_num* | **from** *begin_port_num* **to** *end_port_num*] [**list** *acl-num*] [**description** *description_string*] **Example:** `Router(config)# ip port-map user-10 port udp from 3400 to 3433 list 22 description “test application”`	Establishes PAM entries. **Note** When defining a user application in the PAM table, you must enter the prefix user-; otherwise, the following error message appears: “Unable to add port-map entry. Names for user-defined applications must start with 'user-'.” **Note** Write the text string in the following format: “C *description_string* C,” where “C” is a delimiting character.
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode.

Setting Up Inspection Rules

Perform the following task to set up your inspection rules by using the **ip inspect name** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip inspect name** *inspection-name protocol* [**alert** {**on** | **off**}] [**audit-trail** {**on** | **off**}] [**timeout** *seconds*]
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**ip inspect name** *inspection-name protocol* [**alert** {**on** | **off**}] [**audit-trail** {**on** | **off**}] [**timeout** *seconds*] **Example:** `Router(config)# ip inspect name abc user-10`	Defines inspection rules. **Note** Replace the *protocol* argument with the application (PAM entry) that you just defined in the previous step. In this example, it is *user-10*.
Step 4	**exit** **Example:** `Router(config)# exit`	Exits global configuration mode.

Verifying the Configuration

Perform the following task to verify your applications and inspection rules.

SUMMARY STEPS

1. **enable**
2. **show ip port-map** [*appl-name* | **port** *port-num* [**detail**]]
3. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip port-map** [*appl-name* | **port** *port-num* [**detail**]] **Example:** `Router# show ip port-map port 70 detail`	Establishes PAM entries.
Step 3	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuration Examples for Granular Protocol Inspection

Example Defining an Application for the PAM Table

In the following example from the **ip port-map** command, a user-defined application named user-10 is defined in the PAM table for five ports using the TCP protocol. Standard access list 77 is applied to define host-specific port mapping and “TEST STRING” is the description.

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip port-map user-10 port tcp 4000 5000 6000 7000 8000 list 77 description
"TEST STRING"
Router(config)# end
```

Example Setting Up an Inspection Rule

The following example from the **ip inspect name** command, lists user-10 as an application with the description “TEST STRING.”

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip inspect name abc ?
  bootpc        Bootstrap Protocol Client
  bootps        Bootstrap Protocol Server
  cisco-fna     Cisco FNATIVE
  cisco-sys     Cisco SYSMAINT
  cisco-tna     Cisco TNATIVE
  cuseeme       CUSeeMe Protocol
  echo          Echo port
  esmtp         Extended SMTP
  finger        Finger
  fragment      IP fragment inspection
  ftp           File Transfer Protocol
  gopher        Gopher
  gtpv0         GPRS Tunneling Protocol Version 0
  gtpv1         GPRS Tunneling Protocol Version 1
  h323          H.323 Protocol (e.g, MS NetMeeting, Intel Video Phone)
  http          HTTP Protocol
  icmp          ICMP Protocol
  imap          IMAP Protocol
  imap3         Interactive Mail Access Protocol 3
  kerberos      Kerberos
  ldap          Lightweight Directory Access Protocol
  netbios-dgm   NETBIOS Datagram Service
  netshow       Microsoft NetShow Protocol
  nntp          Network News Transport Protocol
  parameter     Specify inspection parameters
  pop3          POP3 Protocol
  pwdgen        Password  Generator Protocol
  rcmd          R commands (r-exec, r-login, r-sh)
  realaudio     Real Audio Protocol
  rpc           Remote Prodedure Call Protocol
  rtsp          Real Time Streaming Protocol
  secure-http   Secure Hypertext Transfer Protocol
  sip           SIP Protocol
  skinny        Skinny Client Control Protocol
  smtp          Simple Mail Transfer Protocol
  snmp          Simple Network Management Protocol
  snmptrap     SNMP Trap
  sqlnet       SQL Net Protocol
  sqlsrv       SQL Service
  streamworks  StreamWorks Protocol
  tacacs       Login Host Protocol (TACACS)
  tacacs-ds    TACACS-Database Service
  tcp          Transmission Control Protocol
  telnet       Telnet
  tftp         TFTP Protocol
  udp          User Datagram Protocol
  vdolive      VDOLive Protocol
  user-10      TEST STRING       <----- !user-defined application!
```

In the following example from the **ip inspect name** command, an inspection rule is established for user-10:

```
Router# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# ip inspect name abc user-10
Router(config)# end
```

Example Verifying the Configuration

The following example verifies your port-map configuration:

```
Router# show running-config

|
include port-map
ip port-map user-10 port tcp 4000 5000 6000 7000 8000 list 77 description "TEST STRING"
```

The following example verifies your inspection rule configuration:

```
Router# show running-config

|
include inspect
ip inspect name abc user-10
```

The following example displays information about the user-defined application called user-10.

```
Router# show ip port-map user-10
Host specific:    user-10              tcp port 4000...8000    in list 77    user defined
```

The following example displays detailed information about the user-defined application called user-10.

```
Router# show ip port-map user-10 detail
IP port-map entry for application 'user-10':
     tcp 4000...8000                   list 77 "TEST STRING"                  user defined
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

Related Topic	Document Title
Security commands: complete command syntax, command mode, defaults, usage guidelines, and examples	*Cisco IOS Security Command Reference*

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	--

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Granular Protocol Inspection

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1 *Feature Information for Granular Protocol Inspection*

Feature Name	Releases	Feature Information
Granular Protocol Inspection	12.3(14)T	The Granular Protocol Inspection feature adds flexibility to the Cisco IOS Firewall by allowing it to perform a higher degree of inspection of TCP and User Data Protocol (UDP) traffic for most RFC 1700 application types. The following commands were introduced or modified: **ip inspect name**, **ip port-map**, **show ip port-map**.

Glossary

firewall --A router or access server, or several routers or access servers, designated as a buffer between any connected public networks and a private network. A firewall router uses access lists and other methods to ensure the security of the private network.

granular--Degree of componentization. Small, fine-grained components provide greater flexibility in assembling the right combination of functionality, but can be difficult to manage.

inspection rule --A rule that specifies what IP traffic (which application-layer protocols) will be inspected by CBAC at an interface.

PAM --port-to-application mapping. A flexible, per-application port mapping capability that allows the Cisco IOS Firewall to support applications running on nonstandard ports. This feature allows network administrators to customize access control for specific applications and services, in order to meet their distinct network needs.

traffic inspection --A way that CBAC inspects traffic that travels through the firewall to discover and manage state information for TCP and UDP sessions. This state information is used to create temporary openings in the firewall's access lists to allow return traffic and additional data connections for permissible sessions (sessions that originated from within the protected internal network).

UDP --User Data Protocol. A connectionless service--there are no actual sessions, so the software approximates sessions by examining the information in the packet and determining if the packet is similar to other UDP packets (for example, similar source/destination addresses and port numbers) and if the packet was detected soon after another similar UDP packet. “Soon” means within the configurable UDP idle timeout period.

and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.