Creating a Custom Protocol

Network-Based Application Recognition (NBAR) recognizes and classifies network traffic on the basis of a set of protocols and application types. You can add to the set of protocols and application types that NBAR recognizes by creating custom protocols.

Creating custom protocols is an optional process. However, custom protocols extend the capability of NBAR to classify and monitor additional static port applications and allow NBAR to classify nonsupported static port traffic.

This module contains concepts and tasks for creating a custom protocol.

Prerequisites for Creating a Custom Protocol

Before creating a custom protocol, read the information in the "Classifying Network Traffic Using NBAR" module.

Information About Creating a Custom Protocol

NBAR and Custom Protocols

NBAR supports the use of custom protocols to identify custom applications. Custom protocols support static port-based protocols and applications that NBAR does not currently support.

Note For a list of NBAR-supported protocols, see the "Classifying Network Traffic Using NBAR" module.

With NBAR supporting the use of custom protocols, NBAR can map static TCP and UDP port numbers to the custom protocols.

Initially, NBAR included the following features related to custom protocols and applications:

- Custom protocols had to be named custom-xx, with xx being a number.
- Ten custom applications can be assigned using NBAR, and each custom application can have up to 16 TCP and 16 UDP ports each mapped to the individual custom protocol. The real-time statistics of each custom protocol can be monitored using Protocol Discovery.

NBAR includes the following characteristics related to user-defined custom protocols and applications:

- The ability to inspect the payload for certain matching string patterns at a specific offset.
- The ability to allow users to define the names of their custom protocol applications. The user-named protocol can then be used by Protocol Discovery, the Protocol Discovery MIB, the **match protocol** command, and the **ip nbar port-map** command as an NBAR-supported protocol.
- The ability of NBAR to inspect the custom protocols specified by traffic direction (that is, traffic heading toward a source or a destination rather than traffic in both directions).
- CLI support that allows a user configuring a custom application to specify a range of ports rather than specify each port individually.
- The **http**/**dns**/**ssl** keyword group that lets you add custom host and URL signatures.

Note Defining a user-defined custom protocol restarts the NBAR feature, whereas defining predefined custom protocol does not restart the NBAR feature.

MQC and NBAR Custom Protocols

NBAR recognizes and classifies network traffic by protocol or application. You can extend the set of protocols and applications that NBAR recognizes by creating a custom protocol. Custom protocols extend the capability of NBAR Protocol Discovery to classify and monitor additional static port applications and allow NBAR to classify nonsupported static port traffic. You define a custom protocol by using the keywords and arguments of the **ip nbar custom** command. However, after you define the custom protocol, you must create a traffic class and configure a traffic policy (policy map) to use the custom protocol when NBAR classifies traffic. To create traffic classes and configure traffic polices, use the functionality of the Modular Quality of Service (QoS) Command-Line Interface (CLI) (MQC). The MQC is a command-line interface that allows you to define traffic classes, create and configure traffic policies (policy maps), and then attach these traffic policies to interfaces. For more information about NBAR and the functionality of the MQC, see the "Configuring NBAR Using the MQC" module.

Limitations of Custom Protocols

The following limitations apply to custom protocols:

- NBAR supports a maximum of 120 custom protocols. All custom protocols are included in this maximum, including single-signature and composite protocols.
- Cannot define two custom protocols for the same target regular expression.

For example, after configuring **ip nbar custom 1abcd http url www.abcdef.com**, cannot then configure:

```
ip nbar custom 2abcd http url www.abcdef.com
```

Attempting to do so results in an error.

- Maximum length for the regular expression that defines the custom protocol: 30 characters

How to Create a Custom Protocol

Defining a Custom NBAR Protocol Based on a Single Network Protocol

Custom protocols extend the capability of NBAR Protocol Discovery to classify and monitor additional static port applications and allow NBAR to classify non-supported static port traffic.

This procedure creates a custom NBAR protocol based on a single network protocol (HTTP, SSL, and so on).

Note NBAR supports a maximum of 120 custom protocols. All custom protocols are included in this maximum, including single-signature and composite protocols.

To define a custom protocol, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nbar custom** *protocol-name* [*offset* [*format value*]] [**variable** *field-name field-length*] [*source* | *destination*] [**tcp** | **udp**] [**range** *start end* | *port-number*]
4. **end**

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.
Step 3	**ip nbar custom** *protocol-name* [*offset* [*format value*]] [**variable** *field-name field-length*] [*source*	*destination*] [**tcp**	**udp**] [**range** *start end*	*port-number*]	Extends the capability of NBAR Protocol Discovery to classify and monitor additional static port applications or allows NBAR to classify non-supported static port traffic.

	Command or Action	Purpose
	Example: `Router(config)# ip nbar custom app_sales1 5 ascii SALES source tcp 4567`	• Creates a custom NBAR protocol that identifies traffic based on a single network protocol. • Useful for identifying a single type of traffic (HTTP, SSL, and so on) according to a specified pattern. • Enter the custom protocol name and any other optional keywords and arguments.
Step 4	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode.

Examples

In the following example, the custom protocol LAYER4CUSTOM will look for TCP packets that have a destination or source port of 6700:

```
Device# configure terminal
Device(config)# ip nbar custom LAYER4CUSTOM  transport tcp id 14
Device(config-custom)# port 6700
```

To display other options besides port:

```
Device# configure terminal
Device(config)# ip nbar custom LAYER4CUSTOM  transport tcp id 14
Device(config-custom)# ?
Custom protocol commands:
  direction  Flow direction
  dscp       DSCP in IPv4 and IPv6 packets
  exit       Exit from custom configuration mode
  ip         ip address
  ipv6       ipv6 address
  no         Negate a command or set its defaults
  port       ports
```

Defining a Custom NBAR Protocol Based on Multiple Network Protocols

Custom protocols extend the capability of NBAR Protocol Discovery to classify and monitor additional static port applications and allow NBAR to classify non-supported static port traffic.

This procedure creates a custom NBAR protocol based on multiple network protocols.

Note In this description, the term "protocol" is used in two ways: as an NBAR protocol used for identifying traffic, and as a network protocol (HTTP, SSL, and so on).

Note NBAR supports a maximum of 120 custom protocols. All custom protocols are included in this maximum, including single-signature and composite protocols.

To define a composite-signature custom protocol, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip nbar custom** *protocol-name* **composite server-name** *server-name*
4. **end**

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.
Step 3	**ip nbar custom** *protocol-name* **composite server-name** *server-name* **Example:** `Router(config)# ip nbar custom abc_example_custom composite server-name *abc_example`	Extends the capability of NBAR Protocol Discovery to classify and monitor additional static port applications or allows NBAR to classify non-supported static port traffic. • Creates a custom NBAR protocol that identifies traffic using signatures for multiple network protocols. Currently, the only option for *composite-option* is **server-name**, which identifies all HTTP, SSL, and DNS traffic associated with a specific server. • Useful for identifying multiple types of traffic (HTTP, SSL, and so on) according to a specified pattern, using a single protocol. In the example, the objective is to identify all HTTP, SSL, and DNS traffic associated with the **abc_example.com** server.
Step 4	**end** **Example:** `Router(config)# end`	(Optional) Exits global configuration mode.

Configuring a Traffic Class to Use the Custom Protocol

Traffic classes can be used to organize packets into groups on the basis of a user-specified criterion. For example, traffic classes can be configured to match packets on the basis of the protocol type or application recognized by NBAR. In this case, the traffic class is configured to match on the basis of the custom protocol.

To configure a traffic class to use the custom protocol, perform the following steps.

Note The **match protocol**command is shown at Step 4. For the *protocol-name* argument, enter the protocol name used as the match criteria. For a custom protocol, use the protocol specified by the *name* argument of the **ip nbar custom**command. (See Step 3 of the Defining a Custom Protocol task.)

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** [**match-all** | **match-any**] *class-map-name*
4. **match protocol** *protocol-name*
5. **end**

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.
Step 3	**class-map** [**match-all**	**match-any**] *class-map-name* **Example:** `Router(config)# class-map cmap1`	Creates a class map to be used for matching packets to a specified class and enters class-map configuration mode. • Enter the name of the class map.
Step 4	**match protocol** *protocol-name* **Example:** `Router(config-cmap)# match protocol app_sales1`	Configures NBAR to match traffic on the basis of the specified protocol. • For the *protocol-name* argument, enter the protocol name used as the match criterion. For a custom protocol, use the protocol specified by the *name* argument of the **ip nbar custom**command. (See Step 3 of the "Defining a Custom Protocol" task.)

	Command or Action	Purpose
Step 5	**end** **Example:** `Router(config-cmap)# end`	(Optional) Exits class-map configuration mode.

Examples

In the following example, the **variable** keyword is used while creating a custom protocol, and class maps are configured to classify different values within the variable field into different traffic classes. Specifically, in the example below, variable scid values 0x15, 0x21, and 0x27 will be classified into class map active-craft, while scid values 0x11, 0x22, and 0x25 will be classified into class map passive-craft.

```
Router(config)#
 ip nbar custom ftdd 23 variable scid 1 tcp range 5001 5005

Router(config)#
class-map active-craft
Router(config-cmap)# match protocol ftdd scid 0x15
Router(config-cmap)# match protocol ftdd scid 0x21
Router(config-cmap)# match protocol ftdd scid 0x27

Router(config)#
class-map passive-craft
Router(config-cmap)# match protocol ftdd scid 0x11
Router(config-cmap)# match protocol ftdd scid 0x22
Router(config-cmap)# match protocol ftdd scid 0x25
```

Configuring a Traffic Policy

Traffic that matches a user-specified criterion can be organized into specific classes. The traffic in those classes can, in turn, receive specific QoS treatment when that class is included in a policy map.

To configure a traffic policy, perform the following steps.

Note The **bandwidth** command is shown at Step 5. The **bandwidth** command configures the QoS feature class-based weighted fair queuing (CBWFQ). CBWFQ is just an example of a QoS feature that can be configured. Use the appropriate command for the QoS feature that you want to use.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map-name*
4. **class** {*class-name* | **class-default**}
5. **bandwidth** {*bandwidth-kbps*| **remaining percent** *percentage*| **percent** *percentage*}
6. **end**

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.
Step 3	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map policy1`	Creates or modifies a policy map that can be attached to one or more interfaces and enters policy-map configuration mode. • Enter the name of the policy map.
Step 4	**class** {*class-name* | **class-default**} **Example:** `Router(config-pmap)# class class1`	Specifies the name of the class whose policy you want to create or change and enters policy-map class configuration mode. • Enter the specific class name or enter the **class-default**keyword.
Step 5	**bandwidth** {*bandwidth-kbps*| **remaining percent** *percentage*| **percent** *percentage*} **Example:** `Router(config-pmap-c)# bandwidth percent 50`	(Optional) Specifies or modifies the bandwidth allocated for a class belonging to a policy map. • Enter the amount of bandwidth as a number of kbps, a relative percentage of bandwidth, or an absolute amount of bandwidth. **Note** The **bandwidth** command configures the QoS feature class-based weighted fair queuing (CBWFQ). CBWFQ is just an example of a QoS feature that can be configured. Use the appropriate command for the QoS feature that you want to use.
Step 6	**end** **Example:** `Router(config-pmap-c)# end`	(Optional) Exits policy-map class configuration mode.

Attaching the Traffic Policy to an Interface

After a traffic policy (policy map) is created, the next step is to attach the policy map to an interface. Policy maps can be attached to either the input or output direction of the interface.

Note Depending on the needs of your network, you may need to attach the policy map to a subinterface, an ATM PVC, a Frame Relay DLCI, or other type of interface.

To attach the traffic policy to an interface, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number* [*name-tag*]
4. **pvc** [*name*] *vpi* / *vci* [**ilmi**| **qsaal**| **smds**| **l2transport**]
5. **exit**
6. **service-policy** {**input** | **output**} *policy-map-name*
7. **end**

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.
Step 3	**interface** *type number* [*name-tag*] **Example:** `Router(config)# interface ethernet 2/4`	Configures an interface type and enters interface configuration mode. • Enter the interface type and the interface number.
Step 4	**pvc** [*name*] *vpi* / *vci* [**ilmi**| **qsaal**| **smds**| **l2transport**] **Example:** `Router(config-if)# pvc cisco 0/16`	(Optional) Creates or assigns a name to an ATM permanent virtual circuit (PVC), specifies the encapsulation type on an ATM PVC, and enters ATM virtual circuit configuration mode. • Enter the PVC name, the ATM network virtual path identifier, and the network virtual channel identifier. **Note** This step is required only if you are attaching the policy map to an ATM PVC. If you are not attaching the policy map to an ATM PVC, advance to Step 6.
Step 5	**exit**	(Optional) Returns to interface configuration mode.

	Command or Action	Purpose
	Example: `Router(config-atm-vc)# exit`	**Note** This step is required only if you are attaching the policy map to an ATM PVC and you completed Step 4. If you are not attaching the policy map to an ATM PVC, advance to Step 6.
Step 6	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy input policy1`	Attaches a policy map to an input or output interface. • Enter the name of the policy map. **Note** Policy maps can be configured on ingress or egress routers. They can also be attached in the input or output direction of an interface. The direction (input or output) and the router (ingress or egress) to which the policy map should be attached vary according to your network configuration. When using the **service-policy** command to attach the policy map to an interface, be sure to choose the router and the interface direction that are appropriate for your network configuration.
Step 7	**end** **Example:** `Router(config-if)# end`	(Optional) Returns to privileged EXEC mode.

Displaying Custom Protocol Information

After you create a custom protocol and match traffic on the basis of that custom protocol, you can use the **show ip nbar port-map** command to display information about that custom protocol.

To display custom protocol information, complete the following steps.

SUMMARY STEPS

1. **enable**
2. **show ip nbar port-map** [*protocol-name*]
3. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**show ip nbar port-map** [*protocol-name*] **Example:** `Router# show ip nbar port-map`	Displays the current protocol-to-port mappings in use by NBAR. • (Optional) Enter a specific protocol name.
Step 3	**exit** **Example:** `Router# exit`	(Optional) Exits privileged EXEC mode.

Configuration Examples for Creating a Custom Protocol

Example Creating a Custom Protocol

In the following example, the custom protocol called app_sales1 identifies TCP packets that have a source port of 4567 and that contain the term SALES in the first payload packet:

```
Router> enable
Router# configure terminal
Router(config)# ip nbar custom app_sales1 5 ascii SALES source tcp 4567
Router(config)# end
```

Example Configuring a Traffic Class to Use the Custom Protocol

In the following example, a class called cmap1 has been configured. All traffic that matches the custom app_sales1 protocol will be placed in the cmap1 class.

```
Router> enable
Router# configure terminal
Router(config)# class-map cmap1
Router(config-cmap)# match protocol app_sales1
Router(config-cmap)# end
```

Example Configuring a Traffic Policy

In the following example, a traffic policy (policy map) called policy1 has been configured. Policy1 contains a class called class1, within which CBWFQ has been enabled.

```
Router> enable

Router# configure terminal

Router(config)# policy-map policy1

Router(config-pmap)# class class1

Router(config-pmap-c)# bandwidth percent 50

Router(config-pmap-c)# end
```

Note In the above example, the **bandwidth** command is used to enable Class-Based Weighted Fair Queuing (CBWFQ). CBWFQ is only an example of one QoS feature that can be applied in a traffic policy (policy map). Use the appropriate command for the QoS feature that you want to use.

Example Attaching the Traffic Policy to an Interface

In the following example, the traffic policy (policy map) called policy1 has been attached to ethernet interface 2/4 in the input direction of the interface.

```
Router> enable

Router# configure terminal

Router(config)# interface ethernet 2/4

Router(config-if)# service-policy input policy1

Router(config-if)# end
```

Example Displaying Custom Protocol Information

The following is sample output of the **show ip nbar port-map** command. This command displays the current protocol-to-port mappings in use by NBAR. Use the display to verify that these mappings are correct.

```
Router# show ip nbar port-map
port-map bgp      udp 179
port-map bgp      tcp 179
port-map cuseeme  udp 7648 7649
```

```
port-map cuseeme  tcp 7648 7649
port-map dhcp     udp 67 68
port-map dhcp     tcp 67 68
```

If the **ip nbar port-map** command has been used, the **show ip nbar port-map** command displays the ports assigned to the protocol.

If the **no ip nbar port-map**command has been used, the **show ip nbar port-map** command displays the default ports. To limit the display to a specific protocol, use the *protocol-name* argument of the **show ip nbar port-map** command.

Additional References

The following sections provide references related to creating a custom protocol.

Related Documents

Related Topic	Document Title
QoS commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	*Cisco IOS Quality of Service Solutions Command Reference*
MQC, traffic policies (policy maps), and traffic classes	"Applying QoS Features Using the MQC" module
Concepts and information about NBAR	"Classifying Network Traffic Using NBAR" module
Information about enabling Protocol Discovery	"Enabling Protocol Discovery" module
Configuring NBAR using the MQC	"Configuring NBAR Using the MQC" module
Adding application recognition modules (also known as PDLMs)	"Adding Application Recognition Modules" module

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 Creating a Custom Protocol

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 Creating a Custom Protocol

Feature Name	Releases	Feature Information
NBAR - Multiple Matches Per Port	12.4(2)T	Provides the ability for NBAR to distinguish between values of an attribute within the traffic stream of a particular application on a TCP or UDP port. The following sections provide information about the NBAR - Multiple Matches Per Port feature:
NBAR User-Defined Custom Application Classification	12.3(4)T	Provides ability to identify TCP- or UDP-based applications by using a character string or value. The character string or value is used to match traffic within the packet payload. The following sections provide information about the NBAR User-Defined Custom Application Classification feature: