RADIUS Attributes Configuration Guide, Cisco IOS XE Gibraltar 16.11.x

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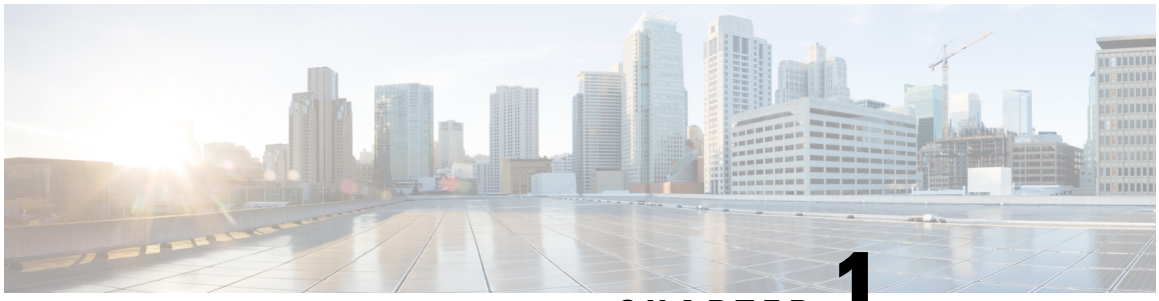
CONTENTS



CHAPTER 1

Read Me First

Important Information about Cisco IOS XE 16

Effective Cisco IOS XE Release 3.7.0E for Catalyst Switching and Cisco IOS XE Release 3.17S (for Access and Edge Routing) the two releases evolve (merge) into a single version of converged release—the Cisco IOS XE 16—providing one release covering the extensive range of access and edge products in the Switching and Routing portfolio.

Feature Information

Use Cisco Feature Navigator to find information about feature support, platform support, and Cisco software image support. An account on Cisco.com is not required.

Related References

- Cisco IOS Command References, All Releases

Obtaining Documentation and Submitting a Service Request

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
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- To obtain general networking, training, and certification titles, visit Cisco Press.
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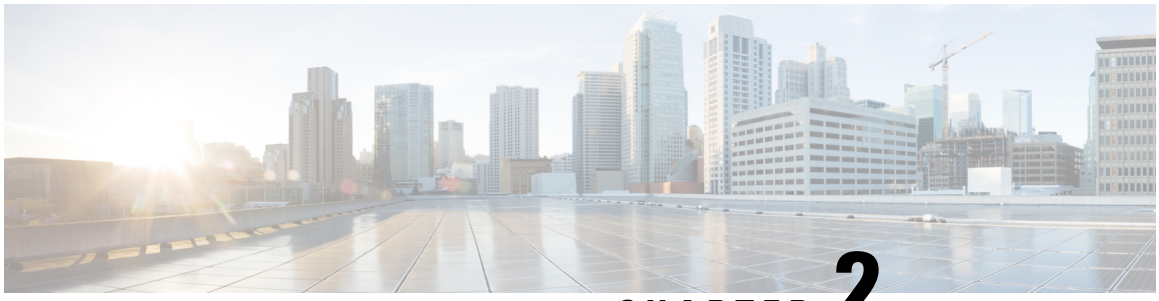


CHAPTER 2

RADIUS Attributes Overview and RADIUS IETF Attributes

Remote Authentication Dial-In User Service (RADIUS) attributes are used to define specific authentication, authorization, and accounting (AAA) elements in a user profile, which are stored on the RADIUS program. This chapter lists the RADIUS attributes that are supported.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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.

RADIUS Attributes Overview

IETF Attributes Versus VSAs

RADIUS Internet Engineering Task Force (IETF) attributes are the original set of 255 standard attributes that are used to communicate AAA information between a client and a server. The IETF attributes are standard and the attribute data is predefined. All clients and servers that exchange AAA information using IETF attributes must agree on attribute data such as the exact meaning of the attributes and the general bounds of the values for each attribute.

RADIUS vendor-specific attributes (VSAs) are derived from a vendor-specific IETF attribute (attribute 26). Attribute 26 allows a vendor to create an additional 255 attributes; that is, a vendor can create an attribute that

does not match the data of any IETF attribute and encapsulate it behind attribute 26. The newly created attribute is accepted if the user accepts attribute 26.

For more information on VSAs, refer to the chapter "RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values."

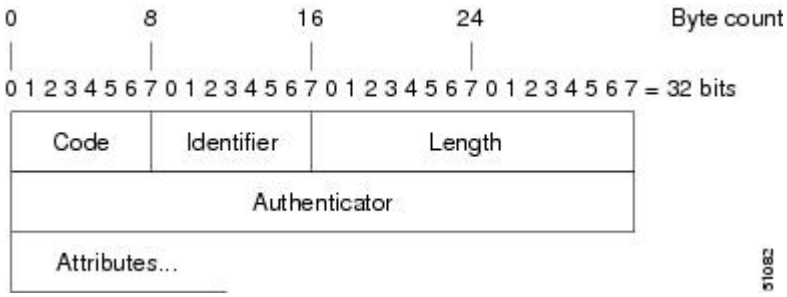
RADIUS Packet Format

The data between a RADIUS server and a RADIUS client is exchanged in RADIUS packets. The data fields are transmitted from left to right.

The figure below shows the fields within a RADIUS packet.

Note For a diagram of VSAs, refer to Figure 1 in the chapter "RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values."

Figure 1: RADIUS Packet Diagram



Each RADIUS packet contains the following information:

- Code—The code field is one octet; it identifies one of the following types of RADIUS packets:
  - Access-Request (1)
  - Access-Accept (2)
  - Access-Reject (3)
  - Accounting-Request (4)
  - Accounting-Response (5)
- Identifier—The identifier field is one octet; it helps the RADIUS server match requests and responses and detect duplicate requests.
- Length—The length field is two octets; it specifies the length of the entire packet.
- Authenticator—The authenticator field is 16 octets. The most significant octet is transmitted first; it is used to authenticate the reply from the RADIUS server. The two types of authenticators are:
  - Request-Authentication: Available in Access-Request and Accounting-Request packets.
  - Response-Authenticator: Available in Access-Accept, Access-Reject, Access-Challenge, and Accounting-Response packets.

RADIUS Packet Types

The following list defines the various types of RADIUS packet types that contain attribute information:

Access-Request—Sent from a client to a RADIUS server. The packet contains information that allows the RADIUS server to determine whether to allow access to a specific network access server (NAS), which will allow access to the user. A user performing authentication must submit an Access-Request packet. After the Access-Request packet is received, the RADIUS server must forward a reply.

Access-Accept—After a RADIUS server receives an Access-Request packet, it must send an Access-Accept packet if all attribute values in the Access-Request packet are acceptable. Access-Accept packets provide the configuration information necessary for the client to provide service to the user.

Access-Reject—After a RADIUS server receives an Access-Request packet, it must send an Access-Reject packet if any of the attribute values are not acceptable.

Access-Challenge—After the RADIUS server receives an Access-Accept packet, it can send the client an Access-Challenge packet, which requires a response. If the client does not know how to respond or if the packets are invalid, the RADIUS server discards the packets. If the client responds to the packet, a new Access-Request packet must be sent with the original Access-Request packet.

Accounting-Request—Sent from a client to a RADIUS accounting server, which provides accounting information. If the RADIUS server successfully records the Accounting-Request packet, it must submit an Accounting Response packet.

Accounting-Response—Sent by the RADIUS accounting server to the client to acknowledge that the Accounting-Request has been received and recorded successfully.

RADIUS Files

Understanding the types of files used by RADIUS is important for communicating AAA information from a client to a server. Each file defines a level of authentication or authorization for the user. The dictionary file defines which attributes the user's NAS can implement, the clients file defines which users are allowed to make requests to the RADIUS server, and the users file defines which user requests the RADIUS server will authenticate based on security and configuration data.

Dictionary File

A dictionary file provides a list of attributes that are dependent on which attributes your NAS supports. However, you can add your own set of attributes to your dictionary for custom solutions. It defines attribute values, so you can interpret attribute output such as parsing requests. A dictionary file contains the following information:

- Name—The ASCII string "name" of the attribute, such as User-Name.
- ID—The numerical "name" of the attribute; for example, User-Name attribute is attribute 1.
- Value type—Each attribute can be specified as one of the following five value types:
  - abinary—0 to 254 octets.
  - date—32-bit value in big-endian order. For example, seconds since 00:00:00 GMT, JAN. 1, 1970.
  - ipaddr—4 octets in network byte order.
  - integer—32-bit value in big-endian order (high byte first).
  - string—0 to 253 octets.

When the data type for a particular attribute is an integer, you can optionally expand the integer to equate to some string. The following sample dictionary includes an integer-based attribute and its corresponding values.

```
# dictionary sample of integer entry
#
ATTRIBUTE       Service-Type            6                     integer
VALUE           Service-Type            Login                    1
VALUE           Service-Type            Framed                   2
VALUE           Service-Type            Callback-Login           3
VALUE           Service-Type            Callback-Framed          4
VALUE           Service-Type            Outbound                 5
VALUE           Service-Type            Administrative           6
VALUE           Service-Type            NAS-Prompt               7
VALUE           Service-Type            Authenticate-Only        8
VALUE           Service-Type            Callback-NAS-Prompt      9
VALUE           Service-Type            Call-Check               10
VALUE           Service-Type            Callback-Administrative  11
```

Clients File

A clients file contains a list of RADIUS clients that are allowed to send authentication and accounting requests to the RADIUS server. To receive authentication, the name and authentication key that the client sends to the server must be an exact match with the data contained in the clients file.

The following is an example of a clients file. The key, as shown in this example, must be the same as the **radius-server key***SomeSecret* command.

```
#Client Name        Key
#----------------  ---------------
10.1.2.3:256        test
nas01               bananas
nas02               MoNkEys
nas07.foo.com       SomeSecret
```

Users File

A RADIUS users file contains an entry for each user that the RADIUS server will authenticate; each entry, which is also known as a user profile, establishes an attribute the user can access.

The first line in any user profile is always a “user access” line; that is, the server must check the attributes on the first line before it can grant access to the user. The first line contains the name of the user, which can be up to 252 characters, followed by authentication information such as the password of the user.

Additional lines, which are associated with the user access line, indicate the attribute reply that is sent to the requesting client or server. The attributes sent in the reply must be defined in the dictionary file. When looking at a user file, note that the data to the left of the equal (=) character is an attribute defined in the dictionary file, and the data to the right of the equal character is the configuration data.

Note A blank line cannot appear anywhere within a user profile.

The following is an example of a RADIUS user profile (Merit Daemon format). In this example, the user name is company.com, the password is user1, and the user can access five tunnel attributes.

```
# This user profile includes RADIUS tunneling attributes
company.com  Password="user1" Service-Type=Outbound
```

```
Tunnel-Type = :1:L2TP
Tunnel-Medium-Type = :1:IP
Tunnel-Server-Endpoint = :1:10.0.0.1
Tunnel-Password = :1:"welcome"
Tunnel-Assignment-ID = :1:"nas"
```

RADIUS IETF Attributes

Note For RADIUS tunnel attributes, 32 tagged tunnel sets are supported for L2TP.

Supported RADIUS IETF Attributes

Table 1 lists Cisco-supported IETF RADIUS attributes and the Cisco IOS release in which they are implemented. In cases where the attribute has a security server-specific format, the format is specified.

Refer to Table 2 for a description of each listed attribute.

Note Attributes implemented in special (AA) or early development (T) releases are added to the next mainline image.

Table 1: Supported RADIUS IETF Attributes

Number	IETF Attribute	11.1	11.2	11.3	11.3 AA	11.3T	12.0	12.1	12.2
1	User-Name	yes	yes	yes	yes	yes	yes	yes	yes
2	User-Password	yes	yes	yes	yes	yes	yes	yes	yes
3	CHAP-Password	yes	yes	yes	yes	yes	yes	yes	yes
4	NAS-IP Address	yes	yes	yes	yes	yes	yes	yes	yes
5	NAS-Port	yes	yes	yes	yes	yes	yes	yes	yes
6	Service-Type	yes	yes	yes	yes	yes	yes	yes	yes
7	Framed-Protocol	yes	yes	yes	yes	yes	yes	yes	yes
8	Framed-IP-Address	yes	yes	yes	yes	yes	yes	yes	yes
9	Framed-IP-Netmask	yes	yes	yes	yes	yes	yes	yes	yes
10	Framed-Routing	yes	yes	yes	yes	yes	yes	yes	yes
11	Filter-Id	yes	yes	yes	yes	yes	yes	yes	yes
12	Framed-MTU	yes	yes	yes	yes	yes	yes	yes	yes

Number	IETF Attribute	11.1	11.2	11.3	11.3 AA	11.3T	12.0	12.1	12.2
13	Framed-Compression	yes	yes	yes	yes	yes	yes	yes	yes
14	Login-IP-Host	yes	yes	yes	yes	yes	yes	yes	yes
15	Login-Service	yes	yes	yes	yes	yes	yes	yes	yes
16	Login-TCP-Port	yes	yes	yes	yes	yes	yes	yes	yes
18	Reply-Message	yes	yes	yes	yes	yes	yes	yes	yes
19	Callback-Number	no	no	no	no	no	no	yes	yes
20	Callback-ID	no	no	no	no	no	no	no	no
22	Framed-Route	yes	yes	yes	yes	yes	yes	yes	yes
23	Framed-IPX-Network	no	no	no	no	no	no	no	no
24	State	yes	yes	yes	yes	yes	yes	yes	yes
25	Class	yes	yes	yes	yes	yes	yes	yes	yes
26	Vendor-Specific	yes	yes	yes	yes	yes	yes	yes	yes
27	Session-Timeout	yes	yes	yes	yes	yes	yes	yes	yes
28	Idle-Timeout	yes	yes	yes	yes	yes	yes	yes	yes
29	Termination-Action	no	no	no	no	no	no	no	no
30	Called-Station-Id	yes	yes	yes	yes	yes	yes	yes	yes
31	Calling-Station-Id	yes	yes	yes	yes	yes	yes	yes	yes
32	NAS-Identifier	no	no	no	no	no	no	no	yes
33	Proxy-State	no	no	no	no	no	no	no	no
34	Login-LAT-Service	yes	yes	yes	yes	yes	yes	yes	yes
35	Login-LAT-Node	no	no	no	no	no	no	no	yes
36	Login-LAT-Group	no	no	no	no	no	no	no	no
37	Framed-AppleTalk-Link	no	no	no	no	no	no	no	no
38	Framed-AppleTalk-Network	no	no	no	no	no	no	no	no
39	Framed-AppleTalk-Zone	no	no	no	no	no	no	no	no
40	Acct-Status-Type	yes	yes	yes	yes	yes	yes	yes	yes
41	Acct-Delay-Time	yes	yes	yes	yes	yes	yes	yes	yes

Number	IETF Attribute	11.1	11.2	11.3	11.3 AA	11.3T	12.0	12.1	12.2
42	Acct-Input-Octets	yes	yes	yes	yes	yes	yes	yes	yes
43	Acct-Output-Octets	yes	yes	yes	yes	yes	yes	yes	yes
44	Acct-Session-Id	yes	yes	yes	yes	yes	yes	yes	yes
45	Acct-Authentic	yes	yes	yes	yes	yes	yes	yes	yes
46	Acct-Session-Time	yes	yes	yes	yes	yes	yes	yes	yes
47	Acct-Input-Packets	yes	yes	yes	yes	yes	yes	yes	yes
48	Acct-Output-Packets	yes	yes	yes	yes	yes	yes	yes	yes
49	Acct-Terminate-Cause	no	no	no	yes	yes	yes	yes	yes
50	Acct-Multi-Session-Id	no	yes	yes	yes	yes	yes	yes	yes
51	Acct-Link-Count	no	yes	yes	yes	yes	yes	yes	yes
52	Acct-Input-Gigawords	no	no	no	no	no	no	no	no
53	Acct-Output-Gigawords	no	no	no	no	no	no	no	no
55	Event-Timestamp	no	no	no	no	no	no	no	yes
60	CHAP-Challenge	yes	yes	yes	yes	yes	yes	yes	yes
61	NAS-Port-Type	yes	yes	yes	yes	yes	yes	yes	yes
62	Port-Limit	yes	yes	yes	yes	yes	yes	yes	yes
63	Login-LAT-Port	no	no	no	no	no	no	no	no
64	Tunnel-Type[1]	no	no	no	no	no	no	yes	yes
65	Tunnel-Medium-Type 1	no	no	no	no	no	no	yes	yes
66	Tunnel-Client-Endpoint	no	no	no	no	no	no	yes	yes
67	Tunnel-Server-Endpoint 1	no	no	no	no	no	no	yes	yes
68	Acct-Tunnel-Connection-ID	no	no	no	no	no	no	yes	yes
69	Tunnel-Password 1	no	no	no	no	no	no	yes	yes
70	ARAP-Password	no	no	no	no	no	no	no	no
71	ARAP-Features	no	no	no	no	no	no	no	no
72	ARAP-Zone-Access	no	no	no	no	no	no	no	no

Number	IETF Attribute	11.1	11.2	11.3	11.3 AA	11.3T	12.0	12.1	12.2
73	ARAP-Security	no	no	no	no	no	no	no	no
74	ARAP-Security-Data	no	no	no	no	no	no	no	no
75	Password-Retry	no	no	no	no	no	no	no	no
76	Prompt	no	no	no	no	no	no	yes	yes
77	Connect-Info	no	no	no	no	no	no	no	yes
78	Configuration-Token	no	no	no	no	no	no	no	no
79	EAP-Message	no	no	no	no	no	no	no	no
80	Message-Authenticator	no	no	no	no	no	no	no	no
81	Tunnel-Private-Group-ID	no	no	no	no	no	no	no	no
82	Tunnel-Assignment-ID [1]	no	no	no	no	no	no	yes	yes
83	Tunnel-Preference	no	no	no	no	no	no	no	yes
84	ARAP-Challenge-Response	no	no	no	no	no	no	no	no
85	Acct-Interim-Interval	no	no	no	no	no	no	yes	yes
86	Acct-Tunnel-Packets-Lost	no	no	no	no	no	no	no	no
87	NAS-Port-ID	no	no	no	no	no	no	no	no
88	Framed-Pool	no	no	no	no	no	no	no	no
90	Tunnel-Client-Auth-ID [2]	no	no	no	no	no	no	no	yes
91	Tunnel-Server-Auth-ID	no	no	no	no	no	no	no	yes
200	IETF-Token-Immediate	no	no	no	no	no	no	no	no

[1] This RADIUS attribute complies with the following two draft IETF documents: RFC 2868 RADIUS Attributes for Tunnel Protocol Support and RFC 2867 RADIUS Accounting Modifications for Tunnel Protocol Support.

[2] This RADIUS attribute complies with RFC 2865 and RFC 2868.

Comprehensive List of RADIUS Attribute Descriptions

The table below lists and describes IETF RADIUS attributes. In cases where the attribute has a security server-specific format, the format is specified.

Table 2: RADIUS IETF Attributes

Number	IETF Attribute	Description
1	User-Name	Indicates the name of the user being authenticated by the RADIUS server.
2	User-Password	Indicates the user's password or the user's input following an Access-Challenge. Passwords longer than 16 characters are encrypted using RFC 2865 specifications.
3	CHAP-Password	Indicates the response value provided by a PPP Challenge Handshake Authentication Protocol (CHAP) user in response to an Access-Challenge.
4	NAS-IP Address	Specifies the IP address of the network access server that is requesting authentication. The default value is 0.0.0.0/0.
5	NAS-Port	Indicates the physical port number of the network access server that is authenticating the user. The NAS-Port value (32 bits) consists of one or two 16-bit values (depending on the setting of the **radius-server extended-portnames** command). Each 16-bit number should be viewed as a 5-digit decimal integer for interpretation as follows: For asynchronous terminal lines, asynchronous network interfaces, and virtual asynchronous interfaces, the value is **00ttt**, where **ttt** is the line number or asynchronous interface unit number. • For ordinary synchronous network interface, the value is **10xxx**. • For channels on a primary rate ISDN interface, the value is **2ppcc** • For channels on a basic rate ISDN interface, the value is **3bb0c**. • For other types of interfaces, the value is **6nnss**.

Number	IETF Attribute	Description
6	Service-Type	Indicates the type of service requested or the type of service to be provided. • In a request: Framed for known PPP or Serial Line Internet Protocol (SLIP) connection. Administrative-user for **enable** command. • In response: Login—Make a connection. Framed--Start SLIP or PPP. Administrative User--Start an EXEC or **enable ok**. Exec User—Start an EXEC session. Service type is indicated by a particular numeric value as follows: • 1: Login • 2: Framed • 3: Callback-Login • 4: Callback-Framed • 5: Outbound • 6: Administrative • 7: NAS-Prompt • 8: Authenticate Only • 9: Callback-NAS-Prompt
7	Framed-Protocol	Indicates the framing to be used for framed access. No other framing is allowed. Framing is indicated by a numeric value as follows: • 1: PPP • 2: SLIP • 3: ARA • 4: Gandalf-proprietary single-link/multilink protocol • 5: Xylogics-proprietary IPX/SLIP

Number	IETF Attribute	Description
8	Framed-IP-Address	Indicates the IP address to be configured for the user, by sending the IP address of a user to the RADIUS server in the access-request. To enable this command, use the **radius-server attribute 8 include-in-access-req** command in global configuration mode.
9	Framed-IP-Netmask	Indicates the IP netmask to be configured for the user when the user is using a device on a network. This attribute value results in a static route being added for Framed-IP-Address with the mask specified.
10	Framed-Routing	Indicates the routing method for the user when the user is using a device on a network. Only "None" and "Send and Listen" values are supported for this attribute. Routing method is indicated by a numeric value as follows: • 0: None • 1: Send routing packets • 2: Listen for routing packets • 3: Send routing packets and listen for routing packets
11	Filter-Id	Indicates the name of the filter list for the user and is formatted as follows: %d, %d.in, or %d.out. This attribute is associated with the most recent service-type command. For login and EXEC, use %d or %d.out as the line access list value from 0 to 199. For Framed service, use %d or %d.out as interface output access list, and %d.in for input access list. The numbers are self-encoding to the protocol to which they refer.
12	Framed-MTU	Indicates the maximum transmission unit (MTU) that can be configured for the user when the MTU is not negotiated by PPP.

Number	IETF Attribute	Description
13	Framed-Compression	Indicates a compression protocol used for the link. This attribute results in a "/compress" being added to the PPP or SLIP autocommand generated during EXEC authorization. This is not implemented for non-EXEC authorization. Compression protocol is indicated by a numeric value as follows: • 0: None • 1: VJ-TCP/IP header compression • 2: IPX header compression
14	Login-IP-Host	Indicates the host to which the user will connect when the Login-Service attribute is included. This begins immediately after login.
15	Login-Service	Indicates the service that should be used to connect the user to the login host. Service is indicated by a numeric value as follows: • 0: Telnet • 1: Rlogin • 2: TCP-Clear • 3: PortMaster • 4: LAT
16	Login-TCP-Port	Defines the TCP port with which the user is to be connected when the Login-Service attribute is also present.
18	Reply-Message	Indicates text that might be displayed to the user using the RADIUS server. You can include this attribute in user files; however, you cannot exceed a maximum of 16 Reply-Message entries per profile.
19	Callback-Number	Defines a dialing string to be used for callback.
20	Callback-ID	Defines the name (consisting of one or more octets) of a place to be called, to be interpreted by the network access server.

Number	IETF Attribute	Description
22	Framed-Route	Provides routing information to be configured for the user on this network access server. The RADIUS RFC format (net/bits [router [metric]]) and the old style dotted mask (net mask [router [metric]]) are supported. If the device field is omitted or 0, the peer IP address is used. Metrics are currently ignored. This attribute is access-request packets.
23	Framed-IPX-Network	Defines the IPX network number configured for the user.
24	State	Allows state information to be maintained between the network access server and the RADIUS server. This attribute is applicable only to CHAP challenges.
25	Class	(Accounting) Arbitrary value that the network access server includes in all accounting packets for this user if supplied by the RADIUS server.

Number	IETF Attribute	Description

26	Vendor-Specific	Allows vendors to support their own extended attributes not suitable for general use. The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. Cisco's vendor-ID is 9, and the supported option has vendor-type 1, which is named "cisco-avpair." The value is a string of the format:
		
		`protocol : attribute sep value`
		
		"Protocol" is a value of the Cisco "protocol" attribute for a particular type of authorization. "Attribute" and "value" are an appropriate AV pair defined in the Cisco TACACS+ specification, and "sep" is "=" for mandatory attributes and "*" for optional attributes. This allows the full set of features available for TACACS+ authorization to also be used for RADIUS. For example:
		
		`cisco-avpair= "ip:addr-pool=first"`
		`cisco-avpair= "shell:priv-lvl=15"`
		
		The first example causes Cisco's Multiple Named ip address Pools" feature to be activated during IP authorization (during PPP's IPCP address assignment). The second example causes a user logging in from a network access server to have immediate access to EXEC commands.
		
		Table 1 lists supported vendor-specific RADIUS attributes (IETF attribute 26).

27	Session-Timeout	Sets the maximum number of seconds of service to be provided to the user before the session terminates. This attribute value becomes the per-user absolute timeout.
28	Idle-Timeout	Sets the maximum number of consecutive seconds of idle connection allowed to the user before the session terminates. This attribute value becomes the per-user session-timeout.

Number	IETF Attribute	Description
29	Termination-Action	Termination is indicated by a numeric value as follows: • 0: Default • 1: RADIUS request
30	Called-Station-Id	(Accounting) Allows the network access server to send the telephone number the user called as part of the Access-Request packet (using Dialed Number Identification Service [DNIS] or a similar technology). This attribute is only supported on ISDN and modem calls on the Cisco AS5200 if used with PRI.
31	Calling-Station-Id	(Accounting) Allows the network access server to send the telephone number the call came from as part of the Access-Request packet (using Automatic Number Identification or a similar technology). This attribute has the same value as "remote-addr" from TACACS+. This attribute is only supported on ISDN and modem calls on the Cisco AS5200 if used with PRI.
32	NAS-Identifier	String identifying the network access server originating the Access-Request. Use the **radius-server attribute 32 include-in-access-req** global configuration command to send RADIUS attribute 32 in an Access-Request or Accounting-Request. By default, the Fully Qualified Domain Name (FQDN) is sent in the attribute when the format is not specified.
33	Proxy-State	Attribute that can be sent by a proxy server to another server when forwarding Access-Requests; this must be returned unmodified in the Access-Accept, Access-Reject or Access-Challenge and removed by the proxy server before sending the response to the network access server.
34	Login-LAT-Service	Indicates the system with which the user is to be connected by local area transport (LAT). This attribute is only available in the EXEC mode.
35	Login-LAT-Node	Indicates the node with which the user is automatically connected by LAT.

Number	IETF Attribute	Description
36	Login-LAT-Group	Identifies the LAT group codes that the user is authorized to use.
37	Framed-AppleTalk-Link	Indicates the AppleTalk network number that should be used for serial links, which is another AppleTalk device.
38	Framed-AppleTalk- Network	Indicates the AppleTalk network number that the network access server uses to allocate an AppleTalk node for the user.
39	Framed-AppleTalk-Zone	Indicates the AppleTalk Default Zone to be used for the user.
40	Acct-Status-Type	(Accounting) Indicates whether this Accounting-Request marks the beginning of the user service (start) or the end (stop).
41	Acct-Delay-Time	(Accounting) Indicates how many seconds the client has been trying to send a particular record.
42	Acct-Input-Octets	(Accounting) Indicates how many octets have been received from the port over the course of this service being provided.
43	Acct-Output-Octets	(Accounting) Indicates how many octets have been sent to the port in the course of delivering this service.
44	Acct-Session-Id	(Accounting) A unique accounting identifier that makes it easy to match start and stop records in a log file. Acct-Session ID numbers restart at 1 each time the device is power-cycled or the software is reloaded. To send this attribute in access-request packets, use the **radius-server attribute 44 include-in-access-req** command in global configuration mode.
45	Acct-Authentic	(Accounting) Indicates how the user was authenticated, whether by RADIUS, the network access server itself, or another remote authentication protocol. This attribute is set to “radius” for users authenticated by RADIUS; “remote” for TACACS+ and Kerberos; or “local” for local, enable, line, and if-needed methods. For all other methods, the attribute is omitted.

Number	IETF Attribute	Description
46	Acct-Session-Time	(Accounting) Indicates how long (in seconds) the user has received service.
47	Acct-Input-Packets	(Accounting) Indicates how many packets have been received from the port over the course of this service being provided to a framed user.
48	Acct-Output-Packets	(Accounting) Indicates how many packets have been sent to the port in the course of delivering this service to a framed user.
49	Acct-Terminate-Cause	(Accounting) Reports details on why the connection was terminated. Termination causes are indicated by a numeric value as follows: **1.** User request **2.** Lost carrier **3.** Lost service **4.** Idle timeout **5.** Session timeout **6.** Admin reset **7.** Admin reboot **8.** Port error **9.** NAS error **10.** NAS request **11.** NAS reboot **12.** Port unneeded **13.** Port pre-empted **14.** Port suspended **15.** Service unavailable **16.** Callback **17.** User error **18.** Host request **Note** For attribute 49, Cisco supports values 1 to 6, 8, 9, 12, and 15 to 18.

Number	IETF Attribute	Description
50	Acct-Multi-Session-Id	(Accounting) A unique accounting identifier used to link multiple related sessions in a log file. Each linked session in a multilink session has a unique Acct-Session-Id value, but shares the same Acct-Multi-Session-Id.
51	Acct-Link-Count	(Accounting) Indicates the number of links known in a given multilink session at the time an accounting record is generated. The network access server can include this attribute in any accounting request that might have multiple links.
52	Acct-Input-Gigawords	Indicates how many times the Acct-Input-Octets counter has wrapped around 2^32 over the course of the provided service.
53	Acct-Output-Gigawords	Indicates how many times the Acct-Output-Octets counter has wrapped around 2^32 while delivering service.

Number	IETF Attribute	Description
55	Event-Timestamp	Records the time that the event occurred on the NAS, the timestamp sent in attribute 55 is in seconds since January 1, 1970 00:00 UTC. To send RADIUS attribute 55 in accounting packets, use the **radius-server attribute 55 include-in-acct-req** command. **Note** Before the Event-Timestamp attribute can be sent in accounting packets, you must configure the clock on the network device. (For information on setting the clock on your network device, see the "Performing Basic System Management" section in the "Basic System Management" chapter of *Network Management Configuration Guide*.) To avoid configuring the clock on the network device every time the network device is reloaded, you can enable the **clock calendar-valid** command. (For more information about this command, see the"Setting Time and Calendar Services" section in the "Basic System Management" chapter of *Network Management Configuration Guide*.
60	CHAP-Challenge	Contains the Challenge Handshake Authentication Protocol challenge sent by the network access server to a PPP CHAP user.
61	NAS-Port-Type	Indicates the type of physical port the network access server is using to authenticate the user. Physical ports are indicated by a numeric value as follows: • 0: Asynchronous • 1: Synchronous • 2: ISDN-Synchronous • 3: ISDN-Asynchronous (V.120) • 4: ISDN-Asynchronous (V.110) • 5: Virtual

Number	IETF Attribute	Description
62	Port-Limit	Sets the maximum number of ports provided to the user by the NAS.
63	Login-LAT-Port	Defines the port with which the user is to be connected by LAT.
64	Tunnel-Type[3]	Indicates the tunneling protocol(s) used. Cisco software supports one possible value for this attribute: L2TP.
65	Tunnel-Medium-Type1	Indicates the transport medium type used to create a tunnel. This attribute has only one available value for this release: IP. If no value is set for this attribute, IP is used as the default.
66	Tunnel-Client-Endpoint	Contains the address of the initiator end of the tunnel. It may be included in both Access-Request and Access-Accept packets to indicate the address from which a new tunnel is to be initiated. If the Tunnel-Client-Endpoint attribute is included in an Access-Request packet, the RADIUS server should take the value as a hint. This attribute should be included in Accounting-Request packets that contain Acct-Status-Type attributes with values of either Start or Stop, in which case it indicates the address from which the tunnel was initiated. This attribute, along with the Tunnel-Server-Endpoint and Acct-Tunnel-Connection-ID attributes, may be used to provide a globally unique method to identify a tunnel for accounting and auditing purposes. An enhancement has been added for the network access server to accept a value of 127.0.0.X for this attribute such that: 127.0.0.0 would indicate that loopback0 IP address has to be used, 127.0.0.1 would indicate that loopback1 IP address has to be used. 127.0.0.X would indicate that loopbackX IP address has to be used for the actual tunnel client endpoint IP address. This enhancement adds scalability across multiple network access servers.

Number	IETF Attribute	Description
67	Tunnel-Server-Endpoint1	Indicates the address of the server end of the tunnel. The format of this attribute varies depending on the value of Tunnel-Medium-Type. Depending on your release only IP as a tunnel medium type may be supported and the IP address or the host name of LNS is valid for this attribute.
68	Acct-Tunnel-Connection-ID	Indicates the identifier assigned to the tunnel session. This attribute should be included in Accounting-Request packets that contain an Acct-Status-Type attribute having the value Start, Stop, or any of the values described above. This attribute, along with the Tunnel-Client-Endpoint and Tunnel-Server-Endpoint attributes, may be used to provide a method to uniquely identify a tunnel session for auditing purposes.
69	Tunnel-Password1	Defines the password to be used to authenticate to a remote server. This attribute is converted into different AAA attributes based on the value of Tunnel-Type: AAA_ATTR_l2tp_tunnel_pw (L2TP), AAA_ATTR_nas_password (L2F), and AAA_ATTR_gw_password (L2F). By default, all passwords received are encrypted, which can cause authorization failures when a NAS attempts to decrypt a non-encrypted password. To enable attribute 69 to receive non-encrypted passwords, use the **radius-server attribute 69 clear** command in global configuration mode.
70	ARAP-Password	Identifies an Access-Request packet containing a Framed-Protocol of AppleTalk Remote Access Control (ARAP).
71	ARAP-Features	Includes password information that the NAS should send to the user in an ARAP feature flags packet.
72	ARAP-Zone-Access	Indicates how the ARAP zone list for the user should be used.
73	ARAP-Security	Identifies the ARAP Security Module to be used in an Access-Challenge packet.

Number	IETF Attribute	Description
74	ARAP-Security-Data	Contains the actual security module challenge or response in Access-Challenge and Access-Request packets.
75	Password-Retry	Indicates the number of times a user may attempt authentication before being disconnected.
76	Prompt	Indicates to the NAS whether it should echo the user's response as it is entered or not echo it. (0 = no echo, 1 = echo)
77	Connect-Info	Provides additional call information for modem calls. This attribute is generated in start and stop accounting records.
78	Configuration-Token	Indicates the type of user profile to be used. This attribute should be used in large distributed authentication networks based on proxy. It is sent from a RADIUS Proxy Server to a RADIUS Proxy Client in an Access-Accept; it should not be sent to a NAS.
79	EAP-Message	Encapsulates Extended Access Protocol (EAP) packets that allow the NAS to authenticate dial-in users using EAP without having to understand the EAP protocol.
80	Message-Authenticator	Prevents spoofing Access-Requests using CHAP, ARAP, or EAP authentication methods.
81	Tunnel-Private-Group-ID	Indicates the group ID for a particular tunneled session.
82	Tunnel-Assignment-ID1	Indicates to the tunnel initiator the particular tunnel to which a session is assigned.
83	Tunnel-Preference	Indicates the relative preference assigned to each tunnel. This attribute should be included if more than one set of tunneling attributes is returned by the RADIUS server to the tunnel initiator.
84	ARAP-Challenge-Response	Contains the response to the challenge of the dial-in client.

Number	IETF Attribute	Description
85	Acct-Interim-Interval	Indicates the number of seconds between each interim update in seconds for this specific session. This value can only appear in the Access-Accept message.
86	Acct-Tunnel-Packets-Lost	Indicates the number of packets lost on a given link. This attribute should be included in Accounting-Request packets that contain an Acct-Status-Type attribute having the value Tunnel-Link-Stop.
87	NAS-Port-ID	Contains a text string which identifies the port of the NAS that is authenticating the user.
88	Framed-Pool	Contains the name of an assigned address pool that should be used to assign an address for the user. If a NAS does not support multiple address pools, the NAS should ignore this attribute.
90	Tunnel-Client-Auth-ID	Specifies the name used by the tunnel initiator (also known as the NAS) when authenticating tunnel setup with the tunnel terminator. Supports L2F and L2TP protocols.
91	Tunnel-Server-Auth-ID	Specifies the name used by the tunnel terminator (also known as the Home Gateway) when authenticating tunnel setup with the tunnel initiator. Supports L2F and L2TP protocols.
200	IETF-Token-Immediate	Determines how RADIUS treats passwords received from login-users when their file entry specifies a hand-held security card server. The value for this attribute is indicated by a numeric value as follows: • 0: No—the password is ignored. • 1: Yes—the password is used for authentication.

[3] This RADIUS attribute complies with the following two IETF documents: RFC 2868, RADIUS Attributes for Tunnel Protocol Support and RFC 2867, RADIUS Accounting Modifications for Tunnel Protocol Support .

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Master Commands List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z

RFCs

RFC	Title
RFC 2865	Remote Authentication Dial In User Service (RADIUS)
RFC 2866	RADIUS Accounting
RFC 2867	RADIUS Accounting Modifications for Tunnel Protocol Support
RFC 2868	RADIUS Attributes for Tunnel Protocol Support
RFC 2869	RADIUS Extensions

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

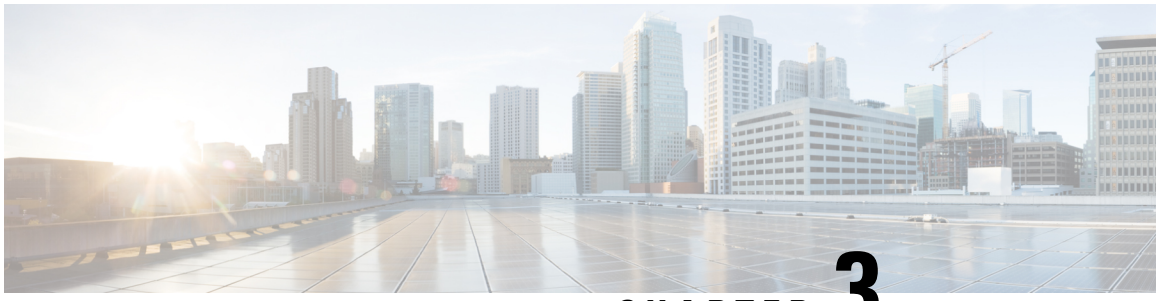
Feature Information for RADIUS Attributes Overview and RADIUS IETF Attributes

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 3: Feature Information for RADIUS Attributes Overview and RADIUS IETF Attributes

Feature Name	Releases	Feature Information
RADIUS IETF Attributes	Cisco IOS Release 11.1	This feature was introduced in Cisco IOS Release 11.1.



CHAPTER 3

RADIUS Vendor-Proprietary Attributes

The IETF draft standard for RADIUS specifies a method for communicating vendor-proprietary information between the network access server and the RADIUS server. However, some vendors have extended the RADIUS attribute set for specific applications. This document provides Cisco IOS XE support information for these vendor-proprietary RADIUS attrubutes.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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.

Supported Vendor-Proprietary RADIUS Attributes

The table below lists Cisco-supported vendor-proprietary RADIUS attributes and the Cisco IOS XE release in which they are implemented. In cases where the attribute has a security server-specific format, the format is specified. Refer to Refer to Vendor-Proprietary RADIUS Attributes table for a list of descriptions.

Table 4: Supported Vendor-Proprietary RADIUS Attributes

Number	Vendor-Proprietary Attribute	IOS XE 2.1
17	Change-Password	yes
21	Password-Expiration	yes
68	Tunnel-ID	yes

Number	Vendor-Proprietary Attribute	IOS XE 2.1
108	My-Endpoint-Disc-Alias	no
109	My-Name-Alias	no
110	Remote-FW	no
111	Multicast-GLeave-Delay	no
112	CBCP-Enable	no
113	CBCP-Mode	no
114	CBCP-Delay	no
115	CBCP-Trunk-Group	no
116	Appletalk-Route	no
117	Appletalk-Peer-Mode	no
118	Route-Appletalk	no
119	FCP-Parameter	no
120	Modem-PortNo	no
121	Modem-SlotNo	no
122	Modem-ShelfNo	no
123	Call-Attempt-Limit	no
124	Call-Block-Duration	no
125	Maximum-Call-Duration	no
126	Router-Preference	no
127	Tunneling-Protocol	no
128	Shared-Profile-Enable	no
129	Primary-Home-Agent	no
130	Secondary-Home-Agent	no
131	Dialout-Allowed	no
133	BACP-Enable	no
134	DHCP-Maximum-Leases	no
135	Primary-DNS-Server	yes
136	Secondary-DNS-Server	yes

Number	Vendor-Proprietary Attribute	IOS XE 2.1
137	Ascend-Client-Assign-DNS	no
138	User-Acct-Type	no
139	User-Acct-Host	no
140	User-Acct-Port	no
141	User-Acct-Key	no
142	User-Acct-Base	no
143	User-Acct-Time	no
144	Assign-IP-Client	no
145	Assign-IP-Server	no
146	Assign-IP-Global-Pool	no
147	DHCP-Reply	no
148	DHCP-Pool-Number	no
149	Expect-Callback	no
150	Event-Type	no
151	Ascend-Session-Svr-Key	yes
152	Ascend-Multicast-Rate-Limit	yes
153	IF-Netmask	no
154	h323-Remote-Address	no
155	Ascend-Multicast-Client	yes
156	FR-Circuit-Name	no
157	FR-LinkUp	no
158	FR-Nailed-Grp	no
159	FR-Type	no
160	FR-Link-Mgt	no
161	FR-N391	no
162	FR-DCE-N392	no
163	FR-DTE-N392	no
164	FR-DCE-N393	no

Number	Vendor-Proprietary Attribute	IOS XE 2.1
165	FR-DTE-N393	no
166	FR-T391	no
167	FR-T392	no
168	Bridge-Address	no
169	TS-Idle-Limit	no
170	TS-Idle-Mode	no
171	DBA-Monitor	no
172	Base-Channel-Count	no
173	Minimum-Channels	no
174	IPX-Route	no
175	FT1-Caller	no
176	Ipsec-Backup-Gateway	yes
177	rm-Call-Type	yes
178	Group	no
179	FR-DLCI	no
180	FR-Profile-Name	no
181	Ara-PW	no
182	IPX-Node-Addr	no
183	Home-Agent-IP-Addr	no
184	Home-Agent-Password	no
185	Home-Network-Name	no
186	Home-Agent-UDP-Port	no
187	Multilink-ID	yes
188	Ascend-Num-In-Multilink	yes
189	First-Dest	no
190	Pre-Bytes-In	yes
191	Pre-Bytes-Out	yes
192	Pre-Paks-In	yes

Number	Vendor-Proprietary Attribute	IOS XE 2.1
193	Pre-Paks-Out	yes
194	Maximum-Time	yes
195	Disconnect-Cause	yes
196	Connect-Progress	yes
197	Data-Rate	yes
198	PreSession-Time	yes
199	Token-Idle	no
201	Require-Auth	no
202	Number-Sessions	no
203	Authen-Alias	no
204	Token-Expiry	no
205	Menu-Selector	no
206	Menu-Item	no
207	PW-Warntime	no
208	PW-Lifetime	yes
209	IP-Direct	yes
210	PPP-VJ-Slot-Compression	yes
211	PPP-VJ-1172	no
212	PPP-Async-Map	no
213	Third-Prompt	no
214	Send-Secret	yes
215	Receive-Secret	no
216	IPX-Peer-Mode	no
217	IP-Pool	yes
218	Static-Addr-Pool	yes
219	FR-Direct	no
220	FR-Direct-Profile	no
221	FR-Direct-DLCI	no

Number	Vendor-Proprietary Attribute	IOS XE 2.1
222	Handle-IPX	no
223	Netware-Timeout	no
224	IPX-Alias	no
225	Metric	no
226	PRI-Number-Type	no
227	Dial-Number	yes
228	Route-IP	yes
229	Route-IPX	no
230	Bridge	no
231	Send-Auth	yes
232	Send-Passwd	no
233	Link-Compression	yes
234	Target-Util	yes
235	Maximum-Channels	yes
236	Inc-Channel-Count	no
237	Dec-Channel-Count	no
238	Seconds-of-History	no
239	History-Weigh-Type	no
240	Add-Seconds	no
241	Remove-Seconds	no
242	Data-Filter	yes
243	Call-Filter	no
244	Idle-Limit	yes
245	Preempt-Limit	no
246	Callback	no
247	Data-Service	yes
248	Force-56	yes
249	Billing Number	no

Number	Vendor-Proprietary Attribute	IOS XE 2.1
250	Call-By-Call	no
251	Transit-Number	no
252	Host-Info	no
253	PPP-Address	no
254	MPP-Idle-Percent	no
255	Xmit-Rate	yes

Comprehensive List of Vendor-Proprietary RADIUS Attribute Descriptions

The table below lists and describes the known vendor-proprietary RADIUS attributes:

Table 5: Vendor-Proprietary RADIUS Attributes

Number	Vendor-Proprietary Attribute	Description
17	Change-Password	Specifies a request to change the password of a user.
21	Password-Expiration	Specifies an expiration date for a user's password in the user's file entry.
68	Tunnel-ID	(Ascend 5) Specifies the string assigned by RADIUS for each session using CLID or DNIS tunneling. When accounting is implemented, this value is used for accoutning.
108	My-Endpoint-Disc-Alias	(Ascend 5) No description available.
109	My-Name-Alias	(Ascend 5) No description available.
110	Remote-FW	(Ascend 5) No description available.
111	Multicast-GLeave-Delay	(Ascend 5) No description available.
112	CBCP-Enable	(Ascend 5) No description available.
113	CBCP-Mode	(Ascend 5) No description available.
114	CBCP-Delay	(Ascend 5) No description available.
115	CBCP-Trunk-Group	(Ascend 5) No description available.
116	Appletalk-Route	(Ascend 5) No description available.
117	Appletalk-Peer-Mode	(Ascend 5) No description available.

Number	Vendor-Proprietary Attribute	Description
118	Route-Appletalk	(Ascend 5) No description available.
119	FCP-Parameter	(Ascend 5) No description available.
120	Modem-PortNo	(Ascend 5) No description available.
121	Modem-SlotNo	(Ascend 5) No description available.
122	Modem-ShelfNo	(Ascend 5) No description available.
123	Call-Attempt-Limit	(Ascend 5) No description available.
124	Call-Block-Duration	(Ascend 5) No description available.
125	Maximum-Call-Duration	(Ascend 5) No description available.
126	Router-Preference	(Ascend 5) No description available.
127	Tunneling-Protocol	(Ascend 5) No description available.
128	Shared-Profile-Enable	(Ascend 5) No description available.
129	Primary-Home-Agent	(Ascend 5) No description available.
130	Secondary-Home-Agent	(Ascend 5) No description available.
131	Dialout-Allowed	(Ascend 5) No description available.
133	BACP-Enable	(Ascend 5) No description available.
134	DHCP-Maximum-Leases	(Ascend 5) No description available.
135	Primary-DNS-Server	Identifies a primary DNS server that can be requested by Microsoft PPP clients from the network access server during IPCP negotiation.
136	Secondary-DNS-Server	Identifies a secondary DNS server that can be requested by Microsoft PPP clients from the network access server during IPCP negotiation.
137	Client-Assign-DNS	No description available.
138	User-Acct-Type	No description available.
139	User-Acct-Host	No description available.
140	User-Acct-Port	No description available.
141	User-Acct-Key	No description available.
142	User-Acct-Base	No description available.
143	User-Acct-Time	No description available.
144	Assign-IP-Client	No description available.
145	Assign-IP-Server	No description available.

Number	Vendor-Proprietary Attribute	Description
146	Assign-IP-Global-Pool	No description available.
147	DHCP-Reply	No description available.
148	DHCP-Pool-Number	No description available.
149	Expect-Callback	No description available.
150	Event-Type	No description available.
151	Session-Svr-Key	No description available.
152	Multicast-Rate-Limit	No description available.
153	IF-Netmask	No description available.
154	Remote-Addr	No description available.
155	Multicast-Client	No description available.
156	FR-Circuit-Name	No description available.
157	FR-LinkUp	No description available.
158	FR-Nailed-Grp	No description available.
159	FR-Type	No description available.
160	FR-Link-Mgt	No description available.
161	FR-N391	No description available.
162	FR-DCE-N392	No description available.
163	FR-DTE-N392	No description available.
164	FR-DCE-N393	No description available.
165	FR-DTE-N393	No description available.
166	FR-T391	No description available.
167	FR-T392	No description available.
168	Bridge-Address	No description available.
169	TS-Idle-Limit	No description available.
170	TS-Idle-Mode	No description available.
171	DBA-Monitor	No description available.
172	Base-Channel-Count	No description available.
173	Minimum-Channels	No description available.

Number	Vendor-Proprietary Attribute	Description
174	IPX-Route	No description available.
175	FT1-Caller	No description available.
176	Backup	No description available.
177	Call-Type	No description available.
178	Group	No description available.
179	FR-DLCI	No description available.
180	FR-Profile-Name	No description available.
181	Ara-PW	No description available.
182	IPX-Node-Addr	No description available.
183	Home-Agent-IP-Addr	Indicates the home agent's IP address (in dotted decimal format) when using Ascend Tunnel Management Protocol (ATMP).
184	Home-Agent-Password	With ATMP, specifies the password that the foreign agent uses to authenticate itself.
185	Home-Network-Name	With ATMP, indicates the name of the connection profile to which the home agent sends all packets.
186	Home-Agent-UDP-Port	Indicates the UDP port number the foreign agent uses to send ATMP messages to the home agent.
187	Multilink-ID	Reports the identification number of the multilink bundle when the session closes. This attribute applies to sessions that are part of a multilink bundle. The Multilink-ID attribute is sent in authentication-response packets.
188	Num-In-Multilink	Reports the number of sessions remaining in a multilink bundle when the session reported in an accounting-stop packet closes. This attribute applies to sessions that are part of a multilink bundle. The Num-In-Multilink attribute is sent in authentication-response packets and in some accounting-request packets.
189	First-Dest	Records the destination IP address of the first packet received after authentication.
190	Pre-Bytes-In	Records the number of input bytes before authentication. The Pre-Bytes-In attribute is sent in accounting-stop records.
191	Pre-Bytes-Out	Records the number of output bytes before authentication. The Pre-Bytes-Out attribute is sent in accounting-stop records.
192	Pre-Paks-In	Records the number of input packets before authentication. The Pre-Paks-In attribute is sent in accounting-stop records.

Number	Vendor-Proprietary Attribute	Description
193	Pre-Paks-Out	Records the number of output packets before authentication. The Pre-Paks-Out attribute is sent in accounting-stop records.
194	Maximum-Time	Specifies the maximum length of time (in seconds) allowed for any session. After the session reaches the time limit, its connection is dropped.
195	Disconnect-Cause	Specifies the reason a connection was taken offline. The Disconnect-Cause attribute is sent in accounting-stop records. This attribute also causes stop records to be generated without first generating start records if disconnection occurs before authentication is performed. See the Vendor-Specific Attributes (VSA) and RADIUS Disconnect-Cause Attribute Values for more information on their meanings.
196	Connect-Progress	Indicates the connection state before the connection is disconnected.
197	Data-Rate	Specifies the average number of bits per second over the course of the connection's lifetime. The Data-Rate attribute is sent in accounting-stop records.
198	PreSession-Time	Specifies the length of time, in seconds, from when a call first connects to when it completes authentication. The PreSession-Time attribute is sent in accounting-stop records.
199	Token-Idle	Indicates the maximum amount of time (in minutes) a cached token can remain alive between authentications.
201	Require-Auth	Defines whether additional authentication is required for class that has been CLID authenticated.
202	Number-Sessions	Specifies the number of active sessions (per class) reported to the RADIUS accounting server.
203	Authen-Alias	Defines the RADIUS server's login name during PPP authentication.
204	Token-Expiry	Defines the lifetime of a cached token.
205	Menu-Selector	Defines a string to be used to cue a user to input data.
206	Menu-Item	Specifies a single menu-item for a user-profile. Up to 20 menu items can be assigned per profile.
207	PW-Warntime	(Ascend 5) No description available.
208	PW-Lifetime	Enables you to specify on a per-user basis the number of days that a password is valid.

Number	Vendor-Proprietary Attribute	Description
209	IP-Direct	When you include this attribute in a user's file entry, a framed route is installed to the routing and bridging tables. **Note** Packet routing is dependent upon the entire table, not just this newly installed entry. The inclusion of this attribute does not guarantee that all packets should be sent to the specified IP address; thus, this attribute is not fully supported. These attribute limitations occur because the Cisco router cannot bypass all internal routing and bridging tables and send packets to a specified IP address.
210	PPP-VJ-Slot-Comp	Instructs the Cisco router not to use slot compression when sending VJ-compressed packets over a PPP link.
211	PPP-VJ-1172	Instructs PPP to use the 0x0037 value for VJ compression.
212	PPP-Async-Map	Gives the Cisco router the asynchronous control character map for the PPP session. The specified control characters are passed through the PPP link as data and used by applications running over the link.
213	Third-Prompt	Defines a third prompt (after username and password) for additional user input.
214	Send-Secret	Enables an encrypted password to be used in place of a regular password in outdial profiles.
215	Receive-Secret	Enables an encrypted password to be verified by the RADIUS server.
216	IPX-Peer-Mode	(Ascend 5) No description available.
217	IP-Pool-Definition	Defines a pool of addresses using the following format: X a.b.c Z; where X is the pool index number, a.b.c is the pool's starting IP address, and Z is the number of IP addresses in the pool. For example, 3 10.0.0.1 5 allocates 10.0.0.1 through 10.0.0.5 for dynamic assignment.
218	Assign-IP-Pool	Tells the router to assign the user and IP address from the IP pool.
219	FR-Direct	Defines whether the connection profile operates in Frame Relay redirect mode.
220	FR-Direct-Profile	Defines the name of the Frame Relay profile carrying this connection to the Frame Relay switch.
221	FR-Direct-DLCI	Indicates the DLCI carrying this connection to the Frame Relay switch.
222	Handle-IPX	Indicates how NCP watchdog requests will be handled.
223	Netware-Timeout	Defines, in minutes, how long the RADIUS server responds to NCP watchdog packets.

Number	Vendor-Proprietary Attribute	Description
224	IPX-Alias	Allows you to define an alias for IPX routers requiring numbered interfaces.
225	Metric	No description available.
226	PRI-Number-Type	No description available.
227	Dial-Number	Defines the number to dial.
228	Route-IP	Indicates whether IP routing is allowed for the user's file entry.
229	Route-IPX	Allows you to enable IPX routing.
230	Bridge	No description available.
231	Send-Auth	Defines the protocol to use (PAP or CHAP) for username-password authentication following CLID authentication.
232	Send-Passwd	Enables the RADIUS server to specify the password that is sent to the remote end of a connection on outgoing calls.
233	Link-Compression	Defines whether to turn on or turn off "stac" compression over a PPP link. Link compression is defined as a numeric value as follows: • 0: None • 1: Stac • 2: Stac-Draft-9 • 3: MS-Stac
234	Target-Util	Specifies the load-threshold percentage value for bringing up an additional channel when PPP multilink is defined.
235	Maximum-Channels	Specifies allowed/allocatable maximum number of channels.
236	Inc-Channel-Count	No description available.
237	Dec-Channel-Count	No description available.
238	Seconds-of-History	No description available.
239	History-Weigh-Type	No description available.
240	Add-Seconds	No description available.
241	Remove-Seconds	No description available.

Number	Vendor-Proprietary Attribute	Description
242	Data-Filter	Defines per-user IP data filters. These filters are retrieved only when a call is placed using a RADIUS outgoing profile or answered using a RADIUS incoming profile. Filter entries are applied on a first-match basis; therefore, the order in which filter entries are entered is important.
243	Call-Filter	Defines per-user IP data filters. On a Cisco router, this attribute is identical to the Data-Filter attribute.
244	Idle-Limit	Specifies the maximum time (in seconds) that any session can be idle. When the session reaches the idle time limit, its connection is dropped.
245	Preempt-Limit	No description available.
246	Callback	Allows you to enable or disable callback.
247	Data-Svc	No description available.
248	Force-56	Determines whether the network access server uses only the 56 K portion of a channel, even when all 64 K appear to be available.
249	Billing Number	No description available.
250	Call-By-Call	No description available.
251	Transit-Number	No description available.
252	Host-Info	No description available.
253	PPP-Address	Indicates the IP address reported to the calling unit during PPP IPCP negotiations.
254	MPP-Idle-Percent	No description available.
255	Xmit-Rate	(Ascend 5) No description available.

See the Configuring RADIUS feature module for more information on vendor-propritary RADIUS attributes.

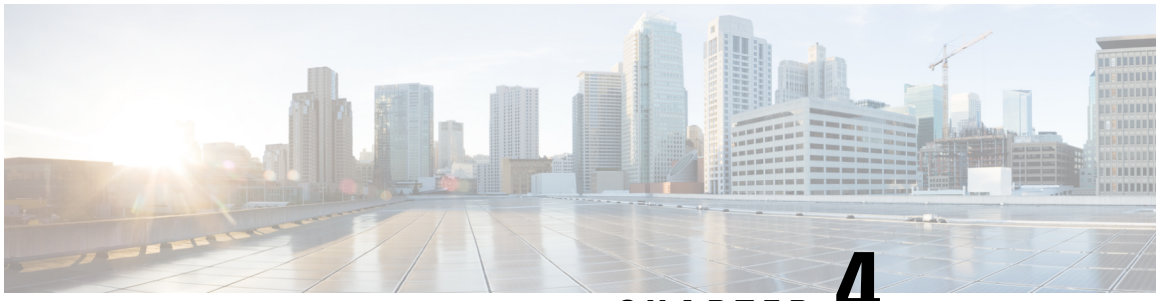
Feature Information for RADIUS Vendor-Proprietary Attributes

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 6: Feature Information for RADIUS Vendor-Proprietary Attributes

Feature Name	Releases	Feature Information
RADIUS Vendor-Proprietary Attributes	Cisco IOS XE Release 2.1	The IETF draft standard for RADIUS specifies a method for communicating vendor-proprietary information between the network access server and the RADIUS server. However, some vendors have extended the RADIUS attribute set for specific applications. This document provides Cisco IOS XE support information for these vendor-proprietary RADIUS attrubutes. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.



CHAPTER 4

RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values

The Internet Engineering Task Force (IETF) draft standard specifies a method for communicating vendor-specific information between the network access server and the RADIUS server by using the vendor-specific attribute (attribute 26). Attribute 26 encapsulates vendor specific attributes, thereby, allowing vendors to support their own extended attributes otherwise not suitable for general use.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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.

Information About RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values

The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. Cisco's vendor-ID is 9, and the supported option has vendor-type 1, which is named "cisco-avpair." The value is a string of the following format:

```
protocol : attribute sep value *
```

"Protocol" is a value of the Cisco "protocol" attribute for a particular type of authorization; protocols that can be used include IP, IPX, VPDN, VOIP, SHELL, RSVP, SIP, AIRNET, OUTBOUND. "Attribute" and "value" are an appropriate attribute-value (AV) pair defined in the Cisco TACACS+ specification, and "sep" is "=" for mandatory attributes and "*" for optional attributes. This allows the full set of features available for TACACS+ authorization to also be used for RADIUS.

For example, the following AV pair causes Cisco's "multiple named ip address pools" feature to be activated during IP authorization (during PPP's IPCP address assignment):

```
cisco-avpair= ″ip:addr-pool=first″
```

If you insert an "*", the AV pair "ip:addr-pool=first" becomes optional. Note that any AV pair can be made optional.

```
cisco-avpair= ″ip:addr-pool*first″
```

The following example shows how to cause a user logging in from a network access server to have immediate access to EXEC commands:

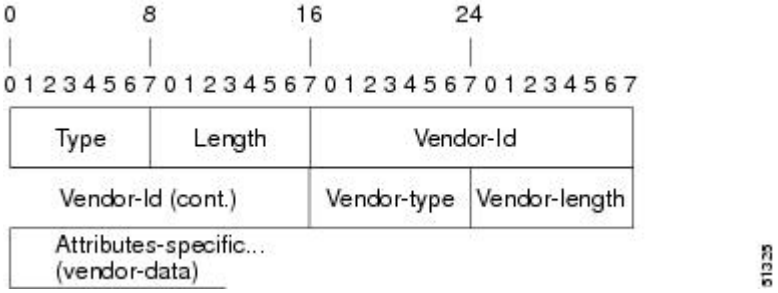
```
cisco-avpair= ″shell:priv-lvl=15″
```

Attribute 26 contains the following three elements:

- Type
- Length
- String (also known as data)
  - Vendor-Id
  - Vendor-Type
  - Vendor-Length
  - Vendor-Data

The figure below shows the packet format for a VSA encapsulated "behind" attribute 26.

Figure 2: VSA Encapsulated Behind Attribute 26



Note It is up to the vendor to specify the format of their VSA. The Attribute-Specific field (also known as Vendor-Data) is dependent on the vendor's definition of that attribute.

The table below describes significant fields listed in the Vendor-Specific RADIUS IETF Attributes table (second table below), which lists supported vendor-specific RADIUS attributes (IETF attribute 26).

Table 7: Vendor-Specific Attributes Table Field Descriptions

Field	Description
Number	All attributes listed in the following table are extensions of IETF attribute 26.
Vendor-Specific Command Codes	A defined code used to identify a particular vendor. Code 9 defines Cisco VSAs, 311 defines Microsoft VSAs, and 529 defines Ascend VSAs.
Sub-Type Number	The attribute ID number. This number is much like the ID numbers of IETF attributes, except it is a "second layer" ID number encapsulated behind attribute 26.
Attribute	The ASCII string name of the attribute.
Description	Description of the attribute.

Table 8: Vendor-Specific RADIUS IETF Attributes

Number	Vendor-Specific Company Code	Sub-Type Number	Attribute	Description
MS-CHAP Attributes				
26	311	1	MSCHAP-Response	Contains the response value provided by a PPP MS-CHAP user in response to the challenge. It is only used in Access-Request packets. This attribute is identical to the PPP CHAP Identifier. (RFC 2548)
26	311	11	MSCHAP-Challenge	Contains the challenge sent by a network access server to an MS-CHAP user. It can be used in both Access-Request and Access-Challenge packets. (RFC 2548)
VPDN Attributes				
26	9	1	l2tp-busy-disconnect	If a vpdn-group on an LNS uses a virtual-template that is configured to be pre-cloned, this attribute will control the disposition of a new L2TP session that finds no pre-cloned interface to which to connect. If the attribute is true (the default), the session will be disconnected by the LNS. Otherwise, a new interface will be cloned from the virtual-template.
26	9	1	l2tp-cm-local-window-size	Specifies the maximum receive window size for L2TP control messages. This value is advertised to the peer during tunnel establishment.
26	9	1	l2tp-drop-out-of-order	Respects sequence numbers on data packets by dropping those that are received out of order. This does not ensure that sequence numbers will be sent on data packets, just how to handle them if they are received.

Number	Vendor-Specific Company Code	Sub-Type Number	Attribute	Description
26	9	1	l2tp-hello-interval	Specifies the number of seconds for the hello keepalive interval. Hello packets are sent when no data has been sent on a tunnel for the number of seconds configured here.
26	9	1	l2tp-hidden-avp	When enabled, sensitive AVPs in L2TP control messages are scrambled or hidden.
26	9	1	l2tp-nosession-timeout	Specifies the number of seconds that a tunnel will stay active with no sessions before timing out and shutting down.
26	9	1	tunnel-tos-reflect	Copies the IP ToS field from the IP header of each payload packet to the IP header of the tunnel packet for packets entering the tunnel at the LNS.
26	9	1	l2tp-tunnel-authen	If this attribute is set, it performs L2TP tunnel authentication.
26	9	1	l2tp-tunnel-password	Shared secret used for L2TP tunnel authentication and AVP hiding.
26	9	1	l2tp-udp-checksum	This is an authorization attribute and defines whether L2TP should perform UDP checksums for data packets. Valid values are “yes” and “no.” The default is no.
H323 Attributes				
26	9	23	Remote-Gateway-ID (h323-remote-address)	Indicates the IP address of the remote gateway.
26	9	24	Connection-ID (h323-conf-id)	Identifies the conference ID.
26	9	25	Setup-Time (h323-setup-time)	Indicates the setup time for this connection in Coordinated Universal Time (UTC) formerly known as Greenwich Mean Time (GMT) and Zulu time.
26	9	26	Call-Origin (h323-call-origin)	Indicates the origin of the call relative to the gateway. Possible values are originating and terminating (answer).
26	9	27	Call-Type (h323-call-type)	Indicates call leg type. Possible values are **telephony** and **VoIP**.
26	9	28	Connect-Time (h323-connect-time)	Indicates the connection time for this call leg in UTC.
26	9	29	Disconnect-Time (h323-disconnect-time)	Indicates the time this call leg was disconnected in UTC.

Number	Vendor-Specific Company Code	Sub-Type Number	Attribute	Description
26	9	30	Disconnect-Cause (h323-disconnect-caus)e	Specifies the reason a connection was taken offline per Q.931 specification.
26	9	31	Voice-Quality (h323-voice-quality)	Specifies the impairment factor (ICPIF) affecting voice quality for a call.
26	9	33	Gateway-ID (h323-gw-id)	Indicates the name of the underlying gateway.
Large Scale Dialout Attributes				
26	9	1	callback-dialstring	Defines a dialing string to be used for callback.
26	9	1	data-service	No description available.
26	9	1	dial-number	Defines the number to dial.
26	9	1	force-56	Determines whether the network access server uses only the 56 K portion of a channel, even when all 64 K appear to be available.
26	9	1	map-class	Allows the user profile to reference information configured in a map class of the same name on the network access server that dials out.
26	9	1	send-auth	Defines the protocol to use (PAP or CHAP) for username-password authentication following CLID authentication.
Miscellaneous Attributes				
26	9	2	Cisco-NAS-Port	Specifies additional vendor specific attribute (VSA) information for NAS-Port accounting. To specify additional NAS-Port information in the form an Attribute-Value Pair (AVPair) string, use the radius-server vsa send global configuration command. **Note** This VSA is typically used in Accounting, but may also be used in Authentication (Access-Request) packets.
26	9	1	min-links	Sets the minimum number of links for MLP.

Number	Vendor-Specific Company Code	Sub-Type Number	Attribute	Description
26	9	1	proxyacl#<n>	Allows users to configure the downloadable user profiles (dynamic ACLs) by using the authentication proxy feature so that users can have the configured authorization to permit traffic going through the configured interfaces.
26	9	1	spi	Carries the authentication information needed by the home agent to authenticate a mobile node during registration. The information is in the same syntax as the **ip mobile secure host <addr>** configuration command. Basically it contains the rest of the configuration command that follows that string, verbatim. It provides the Security Parameter Index (SPI), key, authentication algorithm, authentication mode, and replay protection timestamp range.
26	9	1	client-mac-address	Contains the MAC address of the PPPoE client. **Note** This attribute is applicable only to PPP over Ethernet (PPPoE) or to PPP over ATM (PPPoA).

See “Configuring Router to Use Vendor-Specific RADIUS Attributes” section of t he Configuring RADIUS feature module for more information on configuring your NAS to recognize and use VSAs.

RADIUS Disconnect-Cause Attribute Values

Disconnect-cause attribute values specify the reason a connection was taken offline. The attribute values are sent in Accounting request packets. These values are sent at the end of a session, even if the session fails to be authenticated. If the session is not authenticated, the attribute can cause stop records to be generated without first generating start records.

The table below lists the cause codes, values, and descriptions for the Disconnect-Cause (195) attribute.

Note The Disconnect-Cause is incremented by 1000 when it is used in RADIUS AVPairs; for example, disc-cause 4 becomes 1004.

Table 9: Disconnect-Cause Attribute Values

Cause Code	Value	Description
2	Unknown	Reason unknown.
4	CLID-Authentication-Failure	Failure to authenticate number of the calling-party.
10	No-Carrier	No carrier detected. **Note** Codes 10, 11, and 12 can be sent if there is a disconnection during initial modem connection.

Cause Code	Value	Description
11	Lost-Carrier	Loss of carrier.
12	No-Detected-Result-Codes	Failure to detect modem result codes.
20	User-Ends-Session	User terminates a session. **Note** Codes 20, 22, 23, 24, 25, 26, 27, and 28 apply to EXEC sessions.
21	Idle-Timeout	Timeout waiting for user input. Codes 21, 100, 101, 102, and 120 apply to all session types.
22	Exit-Telnet-Session	Disconnect due to exiting Telnet session.
23	No-Remote-IP-Addr	Could not switch to SLIP/PPP; the remote end has no IP address.
24	Exit-Raw-TCP	Disconnect due to exiting raw TCP.
25	Password-Fail	Bad passwords.
26	Raw-TCP-Disabled	Raw TCP disabled.
27	Control-C-Detected	Control-C detected.
28	EXEC-Process-Destroyed	EXEC process destroyed.
40	Timeout-PPP-LCP	PPP LCP negotiation timed out. **Note** Codes 40, 41, 42, 43, 44, 45, and 46 apply to PPP sessions.
41	Failed-PPP-LCP-Negotiation	PPP LCP negotiation failed.
42	Failed-PPP-PAP-Auth-Fail	PPP PAP authentication failed.
43	Failed-PPP-CHAP-Auth	PPP CHAP authentication failed.
44	Failed-PPP-Remote-Auth	PPP remote authentication failed.
45	PPP-Remote-Terminate	PPP received a Terminate Request from remote end.
46	PPP-Closed-Event	Upper layer requested that the session be closed.
63	PPP-Echo-Replies	TCP connection has been closed.
100	Session-Timeout	Session timed out.
101	Session-Failed-Security	Session failed for security reasons.
102	Session-End-Callback	Session terminated due to callback.
120	Invalid-Protocol	Call refused because the detected protocol is disabled.
600	VPN-User-Disconnect	Call disconnected by client (through PPP). Code is sent if the LNS receives a PPP terminate request from the client.

Cause Code	Value	Description
601	VPN-Carrier-Loss	Loss of carrier. This can be the result of a physical line going dead. Code is sent when a client is unable to dial out using a dialer.
602	VPN-No-Resources	No resources available to handle the call. Code is sent when the client is unable to allocate memory (running low on memory).
603	VPN-Bad-Control-Packet	Bad L2TP or L2F control packets. This code is sent when an invalid control packet, such as missing mandatory Attribute-Value pairs (AVP), from the peer is received. When using L2TP, the code will be sent after six retransmits; when using L2F, the number of retransmits is user configurable. **Note** VPN-Tunnel-Shut will be sent if there are active sessions in the tunnel.
604	VPN-Admin-Disconnect	Administrative disconnect. This can be the result of a VPN soft shutdown, which is when a client reaches maximum session limit or exceeds maximum hopcount. Code is sent when a tunnel is brought down by issuing the **clear vpdn tunnel** command.
605	VPN-Tunnel-Shut	Tunnel teardown or tunnel setup has failed. Code is sent when there are active sessions in a tunnel and the tunnel goes down. **Note** This code is not sent when tunnel authentication fails.
606	VPN-Local-Disconnect	Call is disconnected by LNS PPP module. Code is sent when the LNS sends a PPP terminate request to the client. It indicates a normal PPP disconnection initiated by the LNS.
607	VPN-Session-Limit	VPN soft shutdown is enabled. Code is sent when a call has been refused due to any of the soft shutdown restrictions previously mentioned.
611	VPDN-Tunnel-In-Resync	VPDN tunnel is in HA resync.

Additional References

The following sections provide references related to RADIUS Vendor-Specific Attributes (VSA) and RADIUS Disconnect-Cause Attribute Values.

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Security commands	*Cisco IOS Security Command Reference*

Related Topic	Document Title
Security Features	*Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
Security Server Protocols	Security Server Protocols section of the *Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
RADIUS Configuration	Configuring RADIUS feature module.

Standards

Standard	Title
Internet Engineering Task Force (IETF) Internet Draft: Network Access Servers Requirements	Network Access Servers Requirements: Extended RADIUS Practices

MIBs

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

RFCs

RFC	Title
RFC 2865	Remote Authentication Dial In User Service (RADIUS)

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

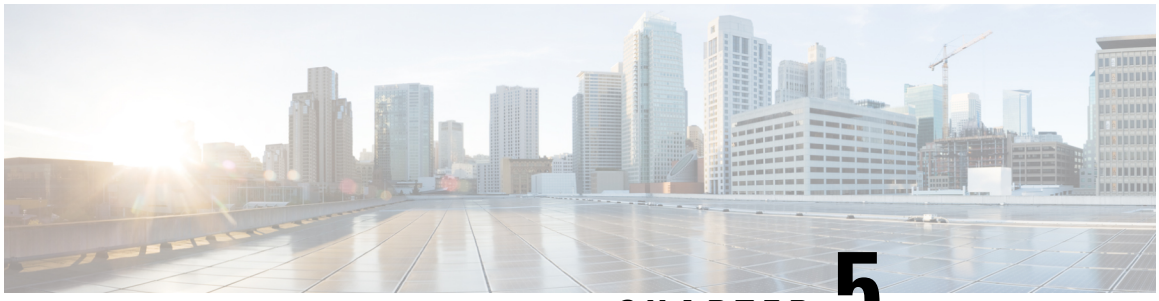
Feature Information for RADIUS Vendor-Specific Attributes and RADIUS Disconnect-Cause Attribute Values

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 10: Feature Information for RADIUS Vendor-Specific Attributes (VSA) and RADIUS Disconnect-Cause Attribute Values

Feature Name	Releases	Feature Information
Accounting of VPDN Disconnect Cause	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 Series Routers.
Vendor-Specific RADIUS Attributes	Cisco IOS XE Release 2.1	This document discusses the Internet Engineering Task Force (IETF) draft standard, which specifies a method for communicating vendor-specific information between the network access server and the RADIUS server by using the vendor-specific attribute (attribute 26). Attribute 26 encapsulates vendor specific attributes, thereby, allowing vendors to support their own extended attributes otherwise not suitable for general use. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.



CHAPTER 5

Connect-Info RADIUS Attribute 77

The Connect-Info RADIUS Attribute 77 feature enables the Network Access Server (NAS) to report Connect-Info (attribute 77) in RADIUS accounting "start" and "stop" records that are sent to the RADIUS client (dial-in modem). These records allow the transmit and receive connection speeds, modulation, and compression to be compared in order to analyze a user session over a dial-in modem where speeds are often different at the end of the connection (after negotiation).

When the network access server (NAS) sends attribute 77 in accounting "start" and "stop" records, the connect rates can be measured across the platform. The "transmit" speed (the speed at which the NAS modem sends information) and "receive" speed (the speed at which the NAS receives information) can be recorded to determine whether user modem connections renegotiate to lower speeds shortly into a session. If the transmit and receive speeds are different from each other, attribute 77 reports both speeds, which allows the modem connection speeds that each customer gets from their session.

Attribute 77 is also used to send the Class string for broadband connections such as PPPoX, physical connection speeds for dial access, and the VRF string for any sessions on router interfaces defined with **ip vrf forwarding** command.

Note This feature requires no configuration.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 Connect-Info RADIUS Attribute 77

For information about release and platform support, see the Feature Information for Connect-Info RADIUS Attribute 77, on page 60.

Before the NAS can send attribute 77 in accounting "start" and "stop" records, you must perform the following tasks:

- Configure your NAS for authentication, authorization, and accounting (AAA) and to accept incoming modem calls.
- Enable AAA accounting by using the **aaa accounting network default start-stop group radius** command in global configuration mode.
- Change the modem poll timer by using the **modem link-info poll time** command in global configuration mode.

Note Changing the modem poll timer is required on the Cisco ASR 1000 Series Aggregation Services Routers.

Information About Connect-Info RADIUS Attribute 77

The Configurable Connect-Info Attributes feature introduces support for RADIUS attribute 77 (Connect-Info), which provides information about connection speeds, modulation, and compression for modem dial-in connections via RADIUS accounting "start" and "stop" records.

Customizing Attribute 77 for Ethernet Connections

To customize Attribute 77 for Ethernet connections, enter the connection information as the name of the service policy attached to the Ethernet subinterface. The router takes the policy name and copies it to Attribute 77.

For example, in the following configuration the outbound service policy named speed:eth:25100:5100:19/0 is attached to the QinQ Gigabit Ethernet subinterface 1/0/0.2696. The router copies the policy name to Attribute 77 and sends it to the RADIUS server in an Access-Request or Accounting-Start or Stop message.

```
interface GigabitEthernet1/0/0.2696
encapsulation dot1q 2696 second-dot1q 256
pppoe enable group global
no snmp trap link-status
service-policy input set_precedence_to_0
```

service-policy output speed:eth:25100:5100:19/0

Customizing Attribute 77 for ATM Connections

To customize Attribute 77 for ATM connections, configure the **aaa connect-info** *string* command in the following configuration modes:

- PVC (for a specific PVC)
- PVC range (for a range of PVCs)
- PVC-in-range (for a specific PVC in a range of PVCs)
- VC class (under a specific **class-vc** command)

The router takes the name of the VC class you specify under the **class-vc** command or the string you specify in the **aaa connect-info** *string* command and copies it to Attribute 77.

For example, in the following configuration the **class-vc** command is configured on both ATM PVCs 10/42 and 10/43 and the **aaa connect-info** command is configured on PVC 10/42:

```
interface ATM1/0/0.1 multipoint
description TDSL clients - default TDSL 1024 no ip mroute-cache
class-int speed:ubr:1184:160:10
range pvc 10/41 10/160
!
pvc-in-range 10/42
class-vc speed:ubr:2303:224:10
aaa connect-info speed:ubr:2303:224:10:isp-specific-descr
!
pvc-in-range 10/43
class-vc speed:ubr:2303:224:10
```

For PVC 10/42, the router takes the string (speed:ubr:2303:224:10:isp-specific-descr) specified in the **aaa connect-info** command and copies it to Attribute 77. If the **aaa connect-info** command is not configured on the subinterface, the router takes the class name (speed:ubr:2303:224:10) specified in the **class-vc** command and copies it to Attribute 77.

For PVC 10/43, the router takes the class name (speed:ubr:2303:224:10) specified in the **class-vc** command and copies it to Attribute 77.

How to Verify the Connect-Info RADIUS Attribute 77

Verifying the Connect-Info RADIUS Attribute 77

To verify attribute 77 in your accounting “start” and “stop” records, use the **debug radius** command in privileged EXEC mode.

SUMMARY STEPS

1. **enable**
2. **debug radius**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug radius** **Example:** `Router# debug radius`	Displays information associated with RADIUS.

Example

The following example shows the Connect-Info [77] accounting attributes:

```
Router# debug radius
Sep 8 21:53:05.242: RADIUS/ENCODE(00007D34):Orig. component type = PPPoE
Sep 8 21:53:05.242: RADIUS: AAA Unsupported Attr: interface [208] 10
Sep 8 21:53:05.242: RADIUS: 30 2F 31 2F 30 2F 39 2E [ 0/1/0/9.]
Sep 8 21:53:05.242: RADIUS: AAA Unsupported Attr: client-mac-address[45] 14
Sep 8 21:53:05.242: RADIUS: 30 30 30 30 2E 63 30 30 31 2E 30 31 [ 0000.c001.01]
Sep 8 21:53:05.242: RADIUS(00007D34): Config NAS IP: 0.0.0.0
Sep 8 21:53:05.242: RADIUS/ENCODE(00007D34): acct_session_id: 32042
Sep 8 21:53:05.242: RADIUS(00007D34): sending
Sep 8 21:53:05.242: RADIUS/ENCODE: Best Local IP-Address 10.3.8.2 for Radius-Server 10.3.1.107

Sep 8 21:53:05.242: RADIUS(00007D34): Send Access-Request to 10.3.1.107:1645 id 1645/1, len
 116
Sep 8 21:53:05.242: RADIUS: authenticator FC 82 50 DB 65 8F 21 A9 - F3 0A A8 09 29 E5 56
65
Sep 8 21:53:05.242: RADIUS: Framed-Protocol [7] 6 PPP [1]
Sep 8 21:53:05.242: RADIUS: User-Name [1] 8 ''user1''
Sep 8 21:53:05.242: RADIUS: User-Password [2] 18 *
Sep 8 21:53:05.242: RADIUS: NAS-Port-Type [61] 6 Virtual [5]
Sep 8 21:53:05.242: RADIUS: NAS-Port [5] 6 0
Sep 8 21:53:05.242: RADIUS: NAS-Port-Id [87] 12 ''0/1/0/9.32''
Sep 8 21:53:05.242: RADIUS: Connect-Info [77] 28 ''speed:ubr:3456:448:10/0000''
Sep 8 21:53:05.242: RADIUS: Service-Type [6] 6 Framed [2]
Sep 8 21:53:05.242: RADIUS: NAS-IP-Address [4] 6 10.3.8.2
Sep 8 21:53:05.242: RADIUS(00007D34): Started 5 sec timeout
Sep 8 21:53:05.244: RADIUS: Received from id 1645/1 10.3.1.107:1645, Access-Accept, len 32

Sep 8 21:53:05.244: RADIUS: authenticator 9A F1 29 01 66 53 17 CB - 73 FB 1B CE 7D 80 04
F2
Sep 8 21:53:05.244: RADIUS: Service-Type [6] 6 Framed [2]
Sep 8 21:53:05.244: RADIUS: Framed-Protocol [7] 6 PPP [1]
Sep 8 21:53:05.244: RADIUS(00007D34): Received from id 1645/1
Sep 8 21:53:05.248: RADIUS/ENCODE(00007D34):Orig. component type = PPPoE
Sep 8 21:53:05.248: RADIUS(00007D34): Config NAS IP: 0.0.0.0
Sep 8 21:53:05.248: RADIUS(00007D34): sending
Sep 8 21:53:05.248: RADIUS/ENCODE: Best Local IP-Address 10.3.8.2 for Radius-Server 5.3.1.107

Sep 8 21:53:05.248: RADIUS(00007D34): Send Accounting-Request to 10.3.1.107:1646 id 1646/3,
 len 126
Sep 8 21:53:05.248: RADIUS: authenticator 71 6E 73 9B FD 7E 82 81 - 10 2A CD 83 A8 BD D2
```

```
F0
Sep 8 21:53:05.248: RADIUS: Acct-Session-Id [44] 10 ''00007D2A''
Sep 8 21:53:05.248: RADIUS: Framed-Protocol [7] 6 PPP [1]
Sep 8 21:53:05.248: RADIUS: User-Name [1] 8 ''user1''
Sep 8 21:53:05.248: RADIUS: Acct-Authentic [45] 6 RADIUS [1]
Sep 8 21:53:05.248: RADIUS: Acct-Status-Type [40] 6 Start [1]
Sep 8 21:53:05.248: RADIUS: NAS-Port-Type [61] 6 Virtual [5]
Sep 8 21:53:05.248: RADIUS: NAS-Port [5] 6 0
Sep 8 21:53:05.248: RADIUS: NAS-Port-Id [87] 12 ''0/1/0/9.32''
Sep 8 21:53:05.248: RADIUS: Connect-Info [77] 28 ''speed:ubr:3456:448:10/0000
```

Configuration Example for Connect-Info RADIUS Attribute 77

Example: Configure NAS for AAA and Incoming Modem Calls

The following example is a sample NAS configuration for AAA and incoming modem calls:

```
interface Serial0:15
  no ip address
  isdn switch-type primary-net5
  isdn incoming-voice modem
!
interface Async1
  ip address 192.0.2.2 255.255.255.0
  encapsulation ppp
  async default routing
  async mode interactive
  no peer default ip address
  ppp authentication chap
!
line 1
  modem InOu
  transport preferred none
  transport input all
  autoselect ppp
!
```

Additional References

The following sections provide references related to the Connect-Info RADIUS Attribute 77 feature.

Related Documents

Related Topic	Document Title
IOS dial technologies	Cisco IOS XE Dial Technologies Configuration Guide, Release 2
	Cisco IOS Dial Technologies Command Reference
Security commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	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

RFC	Title
RFC 2869	RADIUS Extensions

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

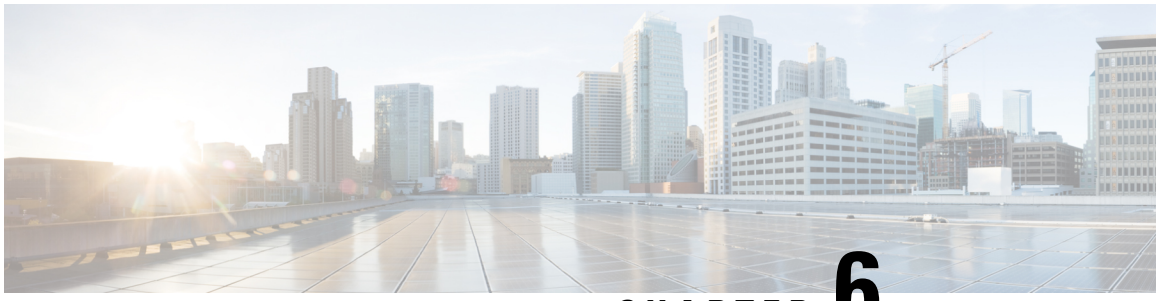
Feature Information for Connect-Info RADIUS Attribute 77

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 11: Feature Information for Connect-Info RADIUS Attribute 77

Feature Name	Releases	Feature Information
Connect-Info RADIUS Attribute 77	Cisco IOS XE Release 2.1	The Connect-Info RADIUS Attribute 77 feature enables the network access server (NAS) to report Connect-Info (attribute 77) in RADIUS accounting “start” and “stop” records that are sent to the RADIUS client (dial-in modem). These “start” and “stop” records allow the transmit and receive connection speeds, modulation, and compression to be compared in order to analyze a user session over a dial-in modem where speeds are often different at the end of the connection (after negotiation). In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 series routers.



CHAPTER 6

Encrypted Vendor-Specific Attributes

The Encrypted Vendor-Specific Attributes feature provides users with a way to centrally manage filters at a RADIUS server and supports the following types of string vendor-specific attributes (VSAs):

- Tagged String VSA, on page 64 (similar to Cisco VSA type 1 (Cisco:AVPair (1)) except that this new VSA is tagged)
- Encrypted String VSA, on page 64 (similar to Cisco VSA type 1 except that this new VSA is encrypted)
- Tagged and Encrypted String VSA, on page 64 (similar to Cisco VSA type 1 except that this new VSA is tagged and encrypted)

Cisco:AVPairs specify additional authentication and authorization information in the form an Attribute-Value Pair (AVPair) string. When Internet Engineering Task Force (IETF) RADIUS attribute 26 (Vendor-Specific) is transmitted with a vendor-Id number of "9" and a vendor-type value of "1" (which means that it is a Cisco AVPair), the RADIUS user profile format for a Cisco AVPair looks as follows: Cisco:AVPair = "protocol:attribute=value".

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 Encrypted Vendor-Specific Attributes

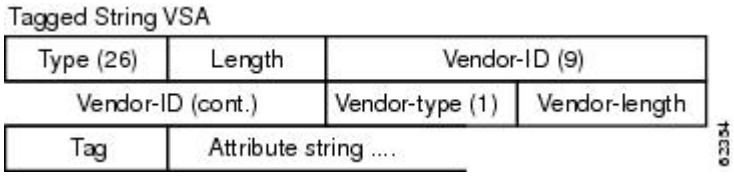
Before the RADIUS server can accept tagged and encrypted VSAs, you must configure your server for AAA authentication and authorization and to accept PPP calls.

Information About Encrypted Vendor-Specific Attributes

Tagged String VSA

The figure below displays the packet format for the Tagged String VSA:

Figure 3: Tagged String VSA Format

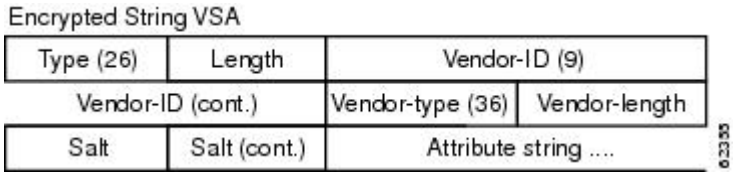


To retrieve the correct value, the Tag field must be parsed correctly. The value for this field can range only from 0x01 through 0x1F. If the value is not within the specified range, the RADIUS server ignores the value and considers the Tag field to be a part of the Attribute String field.

Encrypted String VSA

The figure below displays the packet format for the Encrypted String VSA:

Figure 4: Encrypted String VSA Format



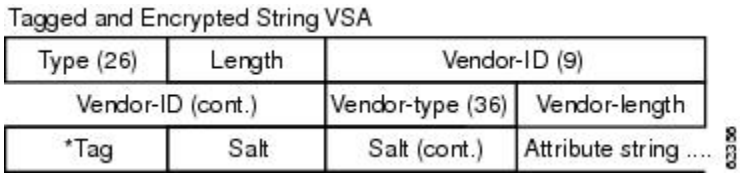
The Salt field ensures the uniqueness of the encryption key that is used to encrypt each instance of the VSA. The first and most significant bit of the Salt field must be set to 1.

Note Vendor-type (36) indicates that the attribute is an encrypted string VSA.

Tagged and Encrypted String VSA

The figure below displays the packet formats for each of the newly supported VSAs:

Figure 5: Tagged and Encrypted String VSA Format



This VSA is similar to encrypted string VSAs except this VSA has an additional Tag field. If the Tag field is not within the valid range (0x01 through 0x1F), it is considered to be part of the Salt field.

How to Verify Encrypted Vendor-Specific Attributes

The Encrypted Vendor-Specific Attributes feature requires no configuration. To verify that RADIUS-tagged and encrypted VSAs are being sent from the RADIUS server, use the following command in privileged EXEC mode:

Command	Purpose
`Router# debug radius`	Displays information associated with RADIUS. The output of this command shows whether tagged and encrypted VSAs are being sent from the RADIUS server.

Configuration Examples for Encrypted Vendor-Specific Attributes

NAS Configuration Example

The following example shows how to configure a network access server (NAS) with a basic configuration using tagged and encrypted VSAs. (This example assumes that the configuration required to make PPP calls is already enabled.)

```
aaa new-model
aaa authentication ppp default group radius
aaa authorization network default group radius
!
radius-server host 10.2.2.2 auth-port 1645 acct-port 1646
radius-server key cisco
```

RADIUS User Profile with a Tagged and Encrypted VSA Example

The following is an example of user profile on a RADIUS server that supports tagged and encrypted string VSAs:

```
mascot   Password = "password1"
         Service-Type = NAS-Prompt,
         Framed-Protocol = PPP,
```

```
Cisco:Cisco-Enc = "ip:route=10.0.0.0 255.0.0.0"
Cisco.attr Cisco-Enc 36 tag-encstr(*,*)
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
RADIUS Attributes	*Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
Media-Independent PPP and Multilink PPP	Configuring Media-Independent PPP and Multilink PPP feature module.
Authentication	Configuring Authentication feature module.
Authorization	Configuring Authorization feature module.

Standards

Standard	Title
None.	--

MIBs

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

RFCs

RFC	Title
RFC 2865	*Remote Authentication Dial In User Service (RADIUS)*
RFC 2868	*RADIUS Attributes for Tunnel Protocol Support*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

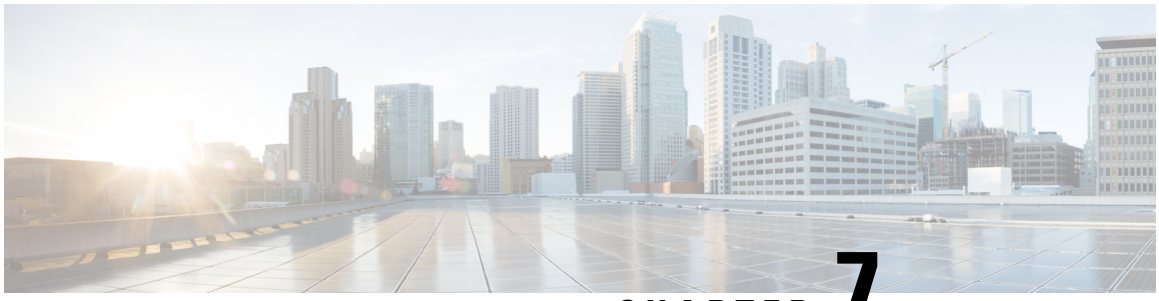
Feature Information for Encrypted Vendor-Specific Attributes

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 12: Feature Information for Encrypted Vendor-Specific Attributes

Feature Name	Releases	Feature Information
Encrypted Vendor-Specific Attributes	Cisco IOS XE Release 2.3	The Encrypted Vendor-Specific Attributes feature provides users with a way to centrally manage filters at a RADIUS server and supports the Tagged String, Encrypted String, and Tagged and Encrypted String vendor-specific attributes (VSAs). In Cisco IOS XE Release 2.3, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.



CHAPTER 7

RADIUS Attribute 8 Framed-IP-Address in Access Requests

The RADIUS Attribute 8 (Framed-IP-Address) in Access Requests feature makes it possible for a network access server (NAS) to provide the RADIUS server with a hint of the user IP address in advance of user authentication. An application can be run on the RADIUS server to use this hint and build a table (map) of user names and addresses. Using the mapping information, service applications can begin preparing user login information to have available upon successful user authentication.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 8 Framed-IP-Address in Access Requests

Sending RADIUS attribute 8 in the RADIUS access requests assumes that the login host has been configured to request its IP address from the NAS server. It also assumes that the login host has been configured to accept an IP address from the NAS.

The NAS must be configured with a pool of network addresses on the interface supporting the login hosts.

Information About RADIUS Attribute 8 Framed-IP-Address in Access Requests

How This Feature Works

When a network device dials in to a NAS that is configured for RADIUS authentication, the NAS begins the process of contacting the RADIUS server in preparation for user authentication. Typically, the IP address of the dial-in host is not communicated to the RADIUS server until after successful user authentication. Communicating the device IP address to the server in the RADIUS access request allows other applications to begin to take advantage of that information.

As the NAS is setting up communication with the RADIUS server, the NAS assigns an IP address to the dial-in host from a pool of IP addresses configured at the specific interface. The NAS sends the IP address of the dial-in host to the RADIUS server as attribute 8. At that time, the NAS sends other user information, such as the user name, to the RADIUS server.

After the RADIUS server receives the user information from the NAS, it has two options:

- If the user profile on the RADIUS server already includes attribute 8, the RADIUS server can override the IP address sent by the NAS with the IP address defined as attribute 8 in the user profile. The address defined in the user profile is returned to the NAS.
- If the user profile does not include attribute 8, the RADIUS server can accept attribute 8 from the NAS, and the same address is returned to the NAS.

The address returned by the RADIUS server is saved in memory on the NAS for the life of the session. If the NAS is configured for RADIUS accounting, the accounting start packet sent to the RADIUS server includes the same IP address as in attribute 8. All subsequent accounting packets, updates (if configured), and stop packets will also include the same IP address provided in attribute 8.

However, the RADIUS attribute 8 (Framed-IP-Address) is not included in the accounting start packets in the following two conditions:

- If the user is a dual-stack (IPv4 or IPv6) subscriber.
- If the IP address is from a local pool and not from the RADIUS server.

In both these conditions, use the **aaa accounting delay-start extended-time** *delay-value* command to delay the Internet Protocol Control Protocol version 6 (IPCPv6) address negotiation using the configured delay value. During the delay, the IPCPv4 address is posted and the framed IPv4 address is added to the accounting start packet.

Benefits

The RADIUS Attribute 8 (Framed-IP-Address) in Access Requests feature makes it possible to run applications on the RADIUS server that builds mapping tables of users and IP addresses. The server can then use the mapping table information in other applications, such as preparing customized user login pages in advance of a successful user authentication with the RADIUS server.

How to Configure RADIUS Attribute 8 Framed-IP-Address in Access Requests

Configuring RADIUS Attribute 8 in Access Requests

To send RADIUS attribute 8 in the access request, perform the following steps:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server attribute 8 include-in-access-req**

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	**radius-server attribute 8 include-in-access-req** **Example:** `Router(config)# radius-server attribute 8 include-in-access-req`	Sends RADIUS attribute 8 in access-request packets.

Verifying RADIUS Attribute 8 in Access Requests

To verify that RADIUS attribute 8 is being sent in access requests, perform the following steps. Attribute 8 should be present in all PPP access requests.

SUMMARY STEPS

1. **enable**
2. **more system:running-config**
3. **debug radius**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**more system:running-config** **Example:** `Router# more system:running-config`	Displays the contents of the current running configuration file. (Note that the **more system:running-config** command has replaced the **show running-config** command.)
Step 3	**debug radius** **Example:** `Router# debug radius`	Displays information associated with RADIUS. The output of this command shows whether attribute 8 is being sent in access requests.

Configuration Examples for RADIUS Attribute 8 Framed-IP-Address in Access Requests

NAS Configuration That Sends the IP Address of the Dial-in Host Example

The following example shows a NAS configuration that sends the IP address of the dial-in host to the RADIUS server in the RADIUS access request. The NAS is configured for RADIUS authentication, authorization, and accounting (AAA). A pool of IP addresses (async1-pool) has been configured and applied at interface virtual-template1.

```
aaa new-model
aaa authentication login default group radius
aaa authentication ppp default group radius
aaa authorization network default group radius
aaa accounting network default start-stop group radius
!
ip address-pool local
!
interface virtual-template1
 peer default ip address pool async1-pool
!
ip local pool async1-pool 209.165.200.225 209.165.200.229
!
radius-server host 172.31.71.146 auth-port 1645 acct-port 1646
radius-server retransmit 3
radius-server attribute 8 include-in-access-req
radius-server key radhost<xxx>: Example
```

Additional References

The following sections provide references related to the RADIUS Attribute 8 (Framed-IP-Address) in Access Requests feature.

Related Documents

Related Topic	Document Title
Configuring authentication and c onfiguring RADIUS	"Configuring Authentication" and "Configuring RADIUS" chapters in the *Cisco IOS XE Security Configuration Guide: Configuring User Services* , Release 2.
Security commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2138	Remote Authentication Dial In User Service (RADIUS)

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

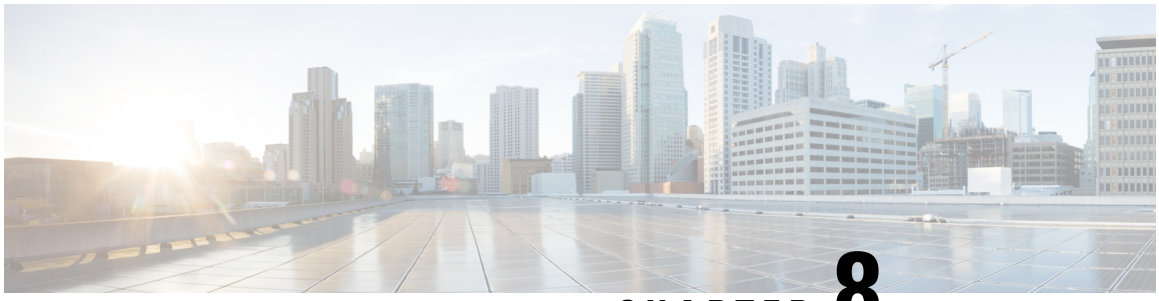
Feature Information for RADIUS Attribute 8 Framed-IP-Address in Access Requests

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 13: Feature Information for RADIUS Attribute 8 (Framed-IP-Address) in Access Requests

Feature Name	Releases	Feature Information
RADIUS Attribute 8 (Framed-IP-Address) in Access Requests (Also called Sticky IP)	Cisco IOS XE Release 2.1	The RADIUS Attribute 8 (Framed-IP-Address) in Access Requests feature makes it possible for a network access server (NAS) to provide the RADIUS server with a hint of the user IP address in advance of user authentication. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers. The following commands were introduced or modified: **radius-server attribute 8 include-in-access-req**.



CHAPTER 8

RADIUS Attribute 82 Tunnel Assignment ID

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 82 Tunnel Assignment ID

You must be using a Cisco platform that supports VPDN to use this feature.

Restrictions for Radius Attribute 82 Tunnel Assignment ID

This feature is designed only for VPDN dial-in applications. It does not support VPDN dial-out.

Information about RADIUS Attribute 82 Tunnel Assignment ID

The RADIUS Attribute 82: Tunnel Assignment ID feature allows the Layer 2 Transport Protocol access concentrator (LAC) to group users from different per-user or domain RADIUS profiles into the same active

tunnel. The RADIUS Attribute 82: Tunnel Assignment ID feature defines a new avpair, Tunnel-Assignment-ID, which allows the LAC to group users from different RADIUS profiles into the same tunnel if the chosen endpoint, tunnel type, and Tunnel-Assignment-ID are identical. This feature introduces new software functionality. No new commands are introduced with this feature.

How to Verify if RADIUS Attribute 82 is Being Used by the LAC

There are no configuration steps for the RADIUS Attribute 82: Tunnel Assignment ID feature. This task verifies the RADIUS attribute 82 used by the LAC during tunnel authorization.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Router# **debug radius**

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	Router# **debug radius** **Example:** `Router# debug radius`	Displays information associated with RADIUS. The output of this command shows whether attribute 82 is being sent in access requests.

Configuration Examples for RADIUS Attribute 82 Tunnel Assignment ID

LAC Configuration Example

The following example shows a sample LAC configuration when the VPDN group is defined on the router:

```
aaa new-model
aaa authentication ppp default local
aaa authorization network default local
!
```

```
bba-group pppoe bba_group1
virtual-template 1
!
interface Loopback1
no ip address
vpdn-group VPDN_LAC1
request-dialin
protocol l2tp
local name tb162_LAC1
domain isp1.com
initiate-to ip 10.0.0.2
source-ip 10.0.0.1
l2tp tunnel receive-window 100
l2tp tunnel nosession-timeout 30
l2tp tunnel retransmit retries 5
l2tp tunnel retransmit timeout min 2
l2tp tunnel retransmit timeout max 8
l2tp tunnel hello 60
l2tp tunnel password tunnel1
!
!
interface virtual-template 1
no snmp trap link-status
no keepalive
ip unnumbered loopback1
ppp mtu adaptive
ppp authentication pap
no logging event link-status
!
```

The following example shows a sample LAC configuration when the VPDN group is defined in RADIUS:

```
aaa authentication ppp default group radius
aaa authorization network default radius
!
bba-group pppoe bba_group1
virtual-template 1
!
interface Loopback1
no ip address
interface virtual-template 1
no snmp trap link-status
no keepalive
ip unnumbered loopback1
ppp mtu adaptive
ppp authentication pap
no logging event link-status
```

LNS Configuration Example

The following example configures VPDN on the LNS:

```
hostname lns
aaa new-model
aaa authentication ppp default group radius
aaa authorization network default group radius
vpdn enable
vpdn-group VPDN_LNS1
 accept-dialin
  protocol l2tp
  virtual-template 1
```

```
 terminate-from hostname tb162_LAC1
 local name LNS1
 l2tp tunnel hello 90
 l2tp tunnel password 0 hello1
interface Loopback0
 ip address 10.1.1.3 255.255.255.0
interface Virtual-Template1
 ip unnumbered Loopback0
 no keepalive
 peer default ip address pool mypool
 ppp authentication chap
ip local pool mypool 10.1.1.10 10.1.1.50
radius-server host lns-radiusd  auth-port 1645 acct-port 1646
radius-server retransmit 3
radius-server key cisco
```

RADIUS Configuration Example

The following examples configure the RADIUS server to group sessions in a tunnel:

Per-User Configuration

```
user@router.com Password = "cisco" Service-Type = Outbound,
       Tunnel-Type = :1:L2TP,
       Tunnel-Server-Endpoint = :1:"10.14.10.54",
       Tunnel-Assignment-Id = :1:"router"
client@router.com Password = "cisco" Service-Type = Outbound,
       Tunnel-Type = :1:L2TP,
       Tunnel-Server-Endpoint = :1:"10.14.10.54",
       Tunnel-Assignment-Id = :1:"router"
```

Domain Configuration

```
eng.router.com Password = "cisco" Service-Type = Outbound,
        Tunnel-Type = :1:L2TP,
        Tunnel-Server-Endpoint = :1:"10.14.10.54",
        Tunnel-Assignment-Id = :1:"router"
sales.router.com Password = "cisco" Service-Type = Outbound,
        Tunnel-Type = :1:L2TP,
        Tunnel-Server-Endpoint = :1:"10.14.10.54",
        Tunnel-Assignment-Id = :1:"router"
```

Additional References

The following sections provide references related to RADIUS Tunnel Attribute Extensions.

Related Documents

Related Topic	Document Title
Authentication	“ Configuring Authentication ” module.
RADIUS Attributes	“ RADIUS Attributes Overview and RADIUS IETF Attributes ” module.

Related Topic	Document Title
Virtual private dialup networks (VPDN)	*Cisco IOS VPDN Configuration Guide* , Release 15.0.

Standards

Standard	Title
None.	--

MIBs

MIB	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

RFC	Title
RFC 2868	RADIUS Attributes for Tunnel Protocol Support

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

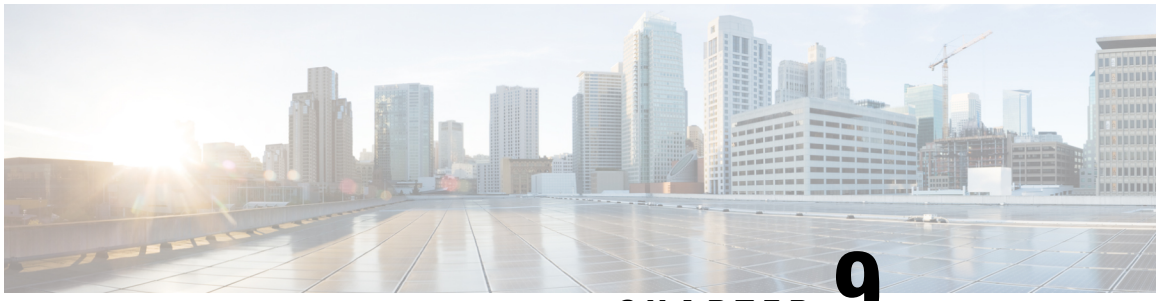
Feature Information for RADIUS Attribute 82 Tunnel Assignment ID

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 14: Feature Information for RADIUS Attribute 82: Tunnel Assignment ID

Feature Name	Releases	Feature Information
RADIUS Attribute 82: Tunnel Assignment Id	Cisco IOS XE Release 2.1	The RADIUS Attribute 82: Tunnel Assignment ID feature allows the Layer 2 Transport Protocol access concentrator (LAC) to group users from different per-user or domain RADIUS profiles into the same active tunnel. In Cisco IOS XE Release 2.1, support was added for the Cisco ASR 1000 Series Aggregation Services Routers.



CHAPTER 9

RADIUS Tunnel Attribute Extensions

The RADIUS Tunnel Attribute Extensions feature introduces RADIUS attribute 90 (Tunnel-Client-Auth-ID) and RADIUS attribute 91 (Tunnel-Server-Auth-ID). Both attributes help support the provision of compulsory tunneling in virtual private networks (VPNs) by allowing the user to specify authentication names for the network access server (NAS) and the RADIUS server.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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

To use RADIUS attributes 90 and 91, you must complete the following tasks:

- Configure your NAS to support AAA.
- Configure your NAS to support RADIUS.
- Configure your NAS to support VPN.

Restrictions

Your RADIUS server must support tagged attributes to use RADIUS tunnel attributes 90 and 91.

Information About RADIUS Tunnel Attribute Extensions

RADIUS Tunnel Attribute Extension Benefits

The RADIUS Tunnel Attribute Extensions feature allows you to specify a name (other than the default) of the tunnel initiator and the tunnel terminator. Thus, you can establish a higher level of security when setting up VPN tunneling.

RADIUS Tunnel Attribute Extension Description

Once a NAS has set up communication with a RADIUS server, you can enable a tunneling protocol. Some applications of tunneling protocols are voluntary, but others involve compulsory tunneling; that is, a tunnel is created without any action from the user and without allowing the user any choice in the matter. In those cases, new RADIUS attributes are needed to carry the tunneling information from the NAS to the RADIUS server to establish authentication. These new RADIUS attributes are listed in the table below.

Note In compulsory tunneling, any security measures in place apply only to traffic between the tunnel endpoints. Encryption or integrity protection of tunneled traffic must not be considered as a replacement for end-to-end security.

Table 15: RADIUS Tunnel Attributes

Number	IETF RADIUS Tunnel Attribute	Equivalent TACACS+ Attribute	Supported Protocols	Description
90	Tunnel-Client-Auth-ID	tunnel-id	Layer 2 Tunneling Protocol (L2TP)	Specifies the name used by the tunnel initiator (also known as the NAS[4]) when authenticating tunnel setup with the tunnel terminator.
91	Tunnel-Server-Auth-ID	gw-name	Layer 2 Tunneling Protocol (L2TP)	Specifies the name used by the tunnel terminator (also known as the Home Gateway[5]) when authenticating tunnel setup with the tunnel initiator.

[4] When L2TP is used, the NAS is referred to as an L2TP access concentrator (LAC).
[5] When L2TP is used, the Home Gateway is referred to as an L2TP network server (LNS).

RADIUS attribute 90 and RADIUS attribute 91 are included in the following situations:

- If the RADIUS server accepts the request and the desired authentication name is different from the default, they must be included it.

- If an accounting request contains Acct-Status-Type attributes with values of either start or stop and pertains to a tunneled session, they should be included in.

How to Configure RADIUS Tunnel Attribute Extensions

There are no configuration tasks associated with this feature.

Verifying RADIUS Attribute 90 and RADIUS Attribute 91

To verify that RADIUS attribute 90 and RADIUS attribute 91 are being sent in access accepts and accounting requests, use the following command in privileged EXEC mode:

Command	Purpose
`Router# debug radius`	Displays information associated with RADIUS. The output of this command shows whether attribute 90 and attribute 91 are being sent in access accepts and accounting requests.

Configuration Examples for RADIUS Tunnel Attribute Extensions

L2TP Network Server Configuration Example

The following example shows how to configure the LNS with a basic L2F and L2TP configuration using RADIUS tunneling attributes 90 and 91:

```
aaa new-model
aaa authentication login default none
aaa authentication login console none
aaa authentication ppp default local group radius
aaa authorization network default group radius if-authenticated
!
username l2tp-svr-auth-id password 0 l2tp-tnl-pass
!
vpdn enable
vpdn search-order domain
!
vpdn-group 1
accept-dialin
protocol l2tp
virtual-template 1
terminate-from hostname l2tp-cli-auth-id
local name l2tp-svr-auth-id
!
interface loopback0
ip address 10.0.0.3 255.255.255.0
no ip route-cache
no ip mroute-cache
!
interface Virtual-Template1
ip unnumbered loopback0
ppp authentication pap
```

```
!
radius-server host 1.1.1.1 auth-port 1645 acct-port 1646
radius-server key <deleted>
!
```

RADIUS User Profile with RADIUS Tunneling Attributes 90 and 91 Example

The following is an example of a RADIUS user profile that includes RADIUS tunneling attributes 90 and 91 for an L2TP tunnel.

```
cisco.com Password = "cisco", Service-Type = Outbound
Service-Type = Outbound,
Tunnel-Type = :1:L2TP,
Tunnel-Medium-Type = :1:IP,
Tunnel-Client-Endpoint = :1:"10.0.0.2",
Tunnel-Server-Endpoint = :1:"10.0.0.3",
Tunnel-Client-Auth-Id = :1:"l2tp-cli-auth-id",
Tunnel-Server-Auth-Id = :1:"l2tp-svr-auth-id",
Tunnel-Assignment-Id = :1:"l2tp-assignment-id",
Cisco-Avpair = "vpdn:l2tp-tunnel-password=l2tp-tnl-pass",
Tunnel-Preference = :1:1
```

Additional References

The following sections provide references related to the RADIUS Tunnel Attribute Extensions feature.

Related Documents

Related Topic	Document Title
Authentication configuration	"Configuring Authentication" in the *Cisco IOS XE Security Configuration Guide: Configuring User Services* , Release 2
RADIUS configuration	"Configuring RADIUS" in the *Cisco IOS XE Security Configuration Guide: Configuring User Services* , Release 2
Overview of RADIUS attributes	"RADIUS Attributes Overview and RADIUS IETF Attributes" in the *Cisco IOS XE Security Configuration Guide: Configuring User Services* , Release 2
Security commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2868	*RADIUS Attributes for Tunnel Protocol Support*

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for RADIUS Tunnel Attribute Extensions

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 16: Feature Information for RADIUS Tunnel Attribute Extensions

Feature Name	Releases	Feature Information
RADIUS Tunnel Attribute Extensions	Cisco IOS XE Release 2.1	The RADIUS Tunnel Attribute Extensions feature introduces RADIUS attribute 90 (Tunnel-Client-Auth-ID) and RADIUS attribute 91 (Tunnel-Server-Auth-ID). Both attributes help support the provision of compulsory tunneling in virtual private networks (VPNs) by allowing the user to specify authentication names for the network access server (NAS) and the RADIUS server. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.

Glossary

Layer 2 Tunnel Protocol (L2TP) -- A Layer 2 tunneling protocol that enables an ISP or other access service to create a virtual tunnel to link customer remote sites or remote users with corporate home networks. In particular, a network access server (NAS) at the ISP point of presence (POP) exchanges PPP messages with the remote users and communicates by L2F or L2TP requests and responses with the customer tunnel server to set up tunnels.

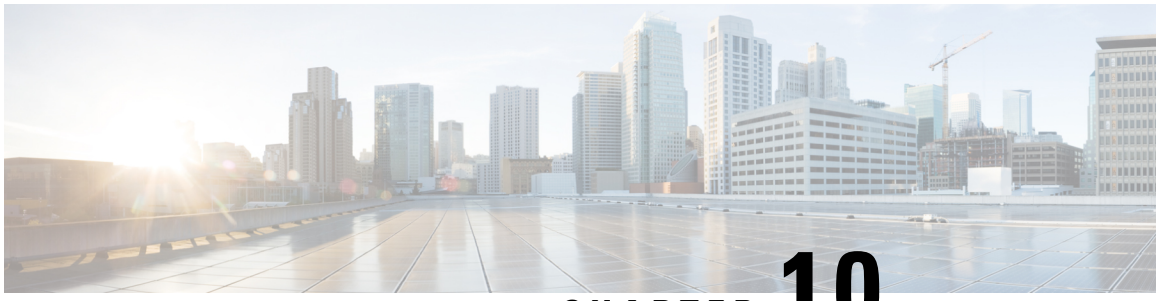
L2TP access concentrator (LAC) --A network access server (NAS) to which the client directly connects and through which PPP frames are tunneled to the L2TP network server (LNS). The LAC need only implement the media over which L2TP is to operate to pass traffic to one or more LNSs. The LAC may tunnel any protocol carried within PPP. The LAC initiates incoming calls and receives outgoing calls. A LAC is analogous to an L2F network access server.

L2TP network server (LNS) --A termination point for L2TP tunnels, and an access point where PPP frames are processed and passed to higher-layer protocols. An LNS can operate on any platform that terminates PPP. The LNS handles the server side of the L2TP protocol. L2TP relies only on the single medium over which L2TP tunnels arrive. The LNS initiates outgoing calls and receives incoming calls. An LNS is analogous to a home gateway in L2F technology.

network access server (NAS) --A Cisco platform, or collection of platforms, such as an AccessPath system, that interfaces between the packet world (such as the Internet) and the circuit-switched world (such as the PSTN).

tunnel--A virtual pipe between the L2TP access concentrator (LAC) and L2TP network server (LNS) that can carry multiple PPP sessions.

virtual private network (VPN)--A system that permits dial-in networks to exist remotely to home networks, while giving the appearance of being directly connected. VPNs use L2TP and L2F to terminate the Layer 2 and higher parts of the network connection at the L2TP network server (LNS) instead of the L2TP access concentrator (LAC).



CHAPTER 10

RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

The RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements feature allows the hostname of the network access server (NAS) to be specified--rather than the IP address of the NAS--in RADIUS attribute 66 (Tunnel-Client-Endpoint). This feature makes it easier for users to remember a hostname instead of a numerical IP address, and helps disguise the numerical IP address of the NAS.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

A Cisco platform that supports VPDN is required. See the Glossary, on page 90 for more information about VPDN.

Restrictions for RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

Your Cisco device must be running a Cisco software image that supports virtual private dialup networks (VPDNs).

Information About RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

How the RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements are Used

Virtual Private Networks (VPNs) use Layer 2 Forwarding (L2F) or Layer 2 Tunnel Protocol (L2TP) tunnels to tunnel the link layer of high-level protocols (for example, PPP or asynchronous High-Level Data Link Control (HDLC)). Internet service providers (ISPs) configure their NASs to receive calls from users and forward the calls to the customer tunnel server. Usually, the ISP maintains only information about the tunnel server--the tunnel endpoint. The customer maintains the IP addresses, routing, and other user database functions of the tunnel server users. RADIUS attribute 66 provides the customer with the ability to specify the hostname of the NAS instead of the IP address of the NAS.

Note L2F is not supported on the Cisco ASR 1000 Series Aggregation Services Routers.

How to Configure RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

There are no configuration tasks associated with support for the RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements.

Configuration Examples for RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

Setting Up the RADIUS Profile for RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements Example

The following example shows a configuration that allows the user to specify the hostname of the NAS using RADIUS attribute 66 (Tunnel-Client-Endpoint) in the RADIUS profile:

```
cisco-avpair = vpdn:l2tp-cm-local-window-size=1024
cisco-avpair = vpdn:l2tp-nosession-timeout=30
cisco-avpair = vpdn:l2tp-cm-retransmit-retries=10
cisco-avpair = vpdn:l2tp-cm-min-timeout=2
cisco-avpair = vpdn:l2tp-hello-interval=60
Service-Type = outbound
Tunnel-Assignment-Id_tag1 = ISP1
Tunnel-Client-Auth-Id_tag1 = LAC1
Tunnel-Client-Endpoint_tag1 = 10.0.0.2
Tunnel-Medium-Type_tag1 = IPv4
Tunnel-Password_tag1 = tunnel1
Tunnel-Server-Auth-Id_tag1 = LNS1
Tunnel-Server-Endpoint_tag1 = 10.0.0.1
Tunnel-Type_tag1 = l2tp
```

Additional References

The following sections provide references related to the RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements feature.

Related Documents

Related Topic	Document Title
RADIUS attribute 66	*Cisco IOS XE Security Configuration Guide: Configuring User Services* , Release 2
Security commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for RADIUS Attribute 66 Tunnel-Client-Endpoint Enhancements

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 17: Feature Information for RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements

Feature Name	Releases	Feature Information
RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements	Cisco IOS XE Release 2.1 Cisco IOS XE Release 2.3 Cisco IOS XE Release 3.9S	The RADIUS Attribute 66 (Tunnel-Client-Endpoint) Enhancements feature allows the hostname of the network access server (NAS) to be specified—rather than the IP address of the NAS—in RADIUS attribute 66 (Tunnel-Client-Endpoint). This feature makes it easier for users to remember a hostname instead of a numerical IP address, and helps disguise the numerical IP address of the NAS. In Cisco IOS XE Release 2.3, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.

Glossary

L2F--Layer 2 Forwarding Protocol. Protocol that supports the creation of secure virtual private dialup networks over the Internet.

L2TP--Layer 2 Tunnel Protocol. Protocol that is one of the key building blocks for virtual private networks in the dial access space and is endorsed by Cisco and other internetworking industry leaders. This protocol

combines the best of Cisco's Layer 2 Forwarding (L2F) protocol and Microsoft's Point-to-Point Tunneling Protocol (PPTP).

Layer 2 Forwarding Protocol--See L2F.

Layer 2 Tunnel Protocol--See L2TP.

Point-to-Point Protocol--See PPP.

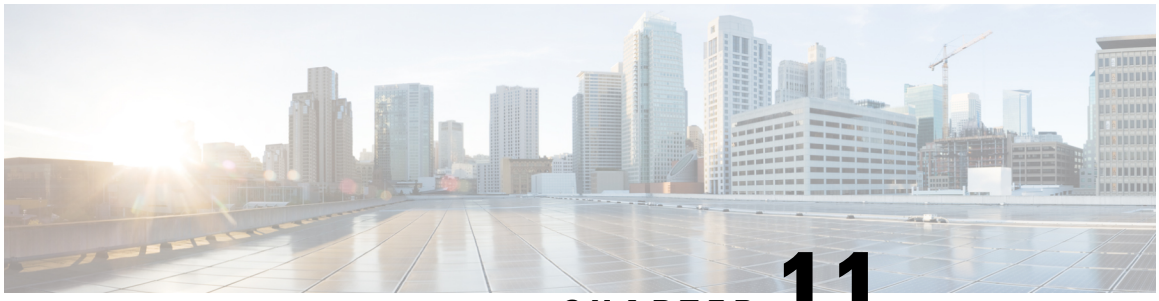
PPP--Point-to-Point Protocol. Successor to SLIP that provides router-to-router and host-to-network connections over synchronous and asynchronous circuits. Whereas SLIP was designed to work with IP, PPP was designed to work with several network layer protocols, such as IP, IPX, and ARA. PPP also has built-in security mechanisms, such as CHAP and PAP. PPP relies on two protocols: LCP and NCP.

RADIUS--Remote Authentication Dial-In User Service. Database for authenticating modem and ISDN connections and for tracking connection time.

Remote Authentication Dial-In User Service--See RADIUS.

virtual private dialup network--See VPDN.

VPDN--virtual private dialup network. A system that permits dial-in networks to exist remotely to home networks, while giving the appearance of being directly connected. VPDNs use L2TP and L2F to terminate the Layer 2 and higher parts of the network connection at the L2TP network server (LNS), instead of the L2TP access concentrator (LAC).



CHAPTER 11

RADIUS Attribute Value Screening

The RADIUS Attribute Value Screening feature allows users to configure a list of "accept" or "reject" RADIUS attributes on the network access server (NAS) for purposes such as authorization or accounting.

If a NAS accepts and processes all RADIUS attributes received in an Access-Accept packet, unwanted attributes may be processed, creating a problem for wholesale providers who do not control their customers' authentication, authorization, and accounting (AAA) servers. For example, there may be attributes that specify services to which the customer has not subscribed, or there may be attributes that may degrade service for other wholesale dial users. The ability to configure the NAS to restrict the use of specific attributes has therefore become a requirement for many users.

The RADIUS Attribute Value Screening feature should be implemented in one of the following ways:

- To allow the NAS to accept and process all standard RADIUS attributes for a particular purpose, except for those on a configured reject list
- To allow the NAS to reject (filter out) all standard RADIUS attributes for a particular purpose, except for those on a configured accept list

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute Value Screening

Before configuring a RADIUS accept or reject list, you must enable AAA.

Restrictions for RADIUS Attribute Value Screening

NAS Requirements

To enable this feature, your NAS should be configured for authorization with RADIUS groups.

Accept or Reject Lists Limitations

The two filters used to configure accept or reject lists are mutually exclusive; therefore, a user can configure only one access list or one reject list for each purpose, per server group.

Vendor-Specific Attributes

This feature does not support vendor-specific attribute (VSA) screening; however, a user can specify attribute 26 (Vendor-Specific) in an accept or reject list, which accepts or reject all VSAs.

Required Attributes Screening Recommendation

It is recommended that users do not reject the following required attributes:

- For authorization:
  - 6 (Service-Type)
  - 7 (Framed-Protocol)
- For accounting:
  - 4 (NAS-IP-Address)
  - 40 (Acct-Status-Type)
  - 41 (Acct-Delay-Time)
  - 44 (Acct-Session-ID)

If an attribute is required, the rejection is refused, and the attribute is allowed to pass through.

Note The user does not receive an error at the point of configuring a reject list for required attributes because the list does not specify a purpose--authorization or accounting. The server determines whether an attribute is required when it is known what the attribute is to be used for.

Information About RADIUS Attribute Value Screening

The RADIUS Attribute Value Screening feature provides the following benefits:

- Users can configure an accept or reject list consisting of a selection of attributes on the NAS for a specific purpose so unwanted attributes are not accepted and processed.
- Users may wish to configure an accept list that includes only relevant accounting attributes, thereby reducing unnecessary traffic and allowing users to customize their accounting data.

How to Screen RADIUS Attributes

Configuring RADIUS Attribute Value Screening

To configure a RADIUS attribute accept or reject list for authorization or accounting, use the following commands:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Router(config)# **aaa authentication ppp default**
4. Router(config)# **aaa authorization network default group** *group-name*
5. Router(config)# **aaa group server radius** *group-name*
6. Router(config-sg-radius)# **server** *ip-address*
7. Router(config-sg-radius)# **authorization** [**accept** | **reject**] *listname*
8. Router(config-sg-radius)# **exit**
9. Router(config)# **radius-server host** {*hostname* | *ip-address*} [**key** *string*
10. Router(config)# **radius-server attribute list** *listname*
11. Router(config-sg-radius)# **attribute** *value1* [*value2* [*value3...*]]

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	Router(config)# **aaa authentication ppp default** **Example:** **group** *group-name*	Specifies one or more AAA authentication methods for use on serial interfaces running PPP.

	Command or Action	Purpose
Step 4	Router(config)# **aaa authorization network default group** *group-name*	Sets parameters that restrict network access to the user.
Step 5	Router(config)# **aaa group server radius** *group-name*	Groups different RADIUS server hosts into distinct lists and distinct methods.
Step 6	Router(config-sg-radius)# **server** *ip-address*	Configures the IP address of the RADIUS server for the group server,

Step 7	Router(config-sg-radius)# **authorization** [**accept** | **reject**] *listname*
	Example:
	`and/or`
	Example:
	`Router(config-sg-radius)# accounting [accept | reject] listname`
		Specifies a filter for the attributes that are returned in an Access-Accept packet from the RADIUS server.
		and/or
		Specifies a filter for the attributes that are to be sent to the RADIUS server in an accounting request.
		Note The **accept** keyword indicates that all attributes are rejected except for the attributes specified in the *listname*. The **reject** keyword indicates that all attributes are accepted except for the attributes specified in the *listname* and all standard attributes.

Step 8	Router(config-sg-radius)# **exit**	Exits server-group configuration mode.
Step 9	Router(config)# **radius-server host** {*hostname* | *ip-address*} [**key** *string*	Specifies a RADIUS server host.
Step 10	Router(config)# **radius-server attribute list** *listname*	Defines the list name given to the set of attributes defined in the **attribute** command. **Note** The *listname* must be the same as the *listname* defined in Step 5.
Step 11	Router(config-sg-radius)# **attribute** *value1* [*value2* [*value3...*]]	Adds attributes to the configured accept or reject list. **Note** This command can be used multiple times to add attributes to an accept or reject list.

Verifying RADIUS Attribute Value Screening

To verify an accept or reject list, use one of the following commands in privileged EXEC mode:

Command	Purpose
`Router# debug aaa accounting`	Displays information on accountable events as they occur.
`Router# debug aaa authentication`	Displays information on AAA authentication.

Command	Purpose
`Router# show radius statistics`	Displays the RADIUS statistics for accounting and authentication packets.

Configuration Examples for RADIUS Attribute Value Screening

Authorization Accept Example

The following example shows how to configure an accept list for attribute 6 (Service-Type) and attribute 7 (Framed-Protocol); all other attributes (including VSAs) are rejected for RADIUS authorization.

```
aaa new-model
aaa authentication ppp default group radius-sg
aaa authorization network default group radius-sg
aaa group server radius radius-sg
server 10.1.1.1
authorization accept min-author
!
radius-server host 10.1.1.1 key mykey1
radius-server attribute list min-author
attribute 6-7
```

Accounting Reject Example

The following example shows how to configure a reject list for attribute 66 (Tunnel-Client-Endpoint) and attribute 67 (Tunnel-Server-Endpoint); all other attributes (including VSAs) are accepted for RADIUS accounting.

```
aaa new-model
aaa authentication ppp default group radius-sg
aaa authorization network default group radius-sg
aaa group server radius radius-sg
server 10.1.1.1
accounting reject tnl-x-endpoint
!
radius-server host 10.1.1.1 key mykey1
radius-server attribute list tnl-x-endpoint
attribute 66-67
```

Authorization Reject and Accounting Accept Example

The following example shows how to configure a reject list for RADIUS authorization and configure an accept list for RADIUS accounting. Although you cannot configure more than one accept or reject list per server group for authorization or accounting, you can configure one list for authorization and one list for accounting per server group.

```
aaa new-model
aaa authentication ppp default group radius-sg
aaa authorization network default group radius-sg
aaa group server radius radius-sg
```

```
server 10.1.1.1
authorization reject bad-author
accounting accept usage-only
!
radius-server host 10.1.1.1 key mykey1
radius-server attribute list usage-only
attribute 1,40,42-43,46
!
radius-server attribute list bad-author
attribute 22,27-28,56-59
```

Rejecting Required Attributes Example

The following example shows debug output for the **debug aaa accounting** command. In this example, required attributes 44, 40, and 41 have been added to the reject list "standard."

```
Router# debug aaa authorization
AAA/ACCT(6): Accounting method=radius-sg (radius)
RADIUS: attribute 44 cannot be rejected
RADIUS: attribute 61 rejected
RADIUS: attribute 31 rejected
RADIUS: attribute 40 cannot be rejected
RADIUS: attribute 41 cannot be rejected
```

Additional References

The following sections provide references related to the RADIUS Attribute Value Screening feature.

Related Documents

Related Topic	Document Title
RADIUS	" Configuring RADIUS " feature module.
Other security features	*Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
Security commands	*Cisco IOS Security Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

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

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

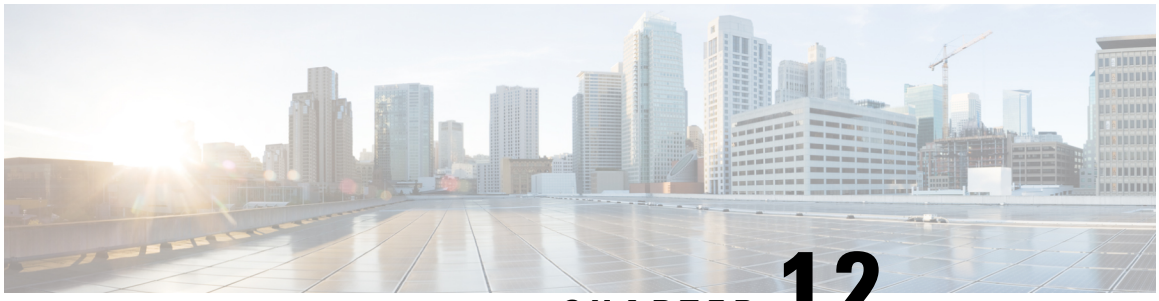
Feature Information for RADIUS Attribute Value Screening

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 18: Feature Information for RADIUS Attribute Value Screening

Feature Name	Releases	Feature Information
RADIUS Attribute Value Screening	Cisco IOS XE Release 2.1	The RADIUS Attribute Value Screening feature allows users to configure a list of “accept” or “reject” RADIUS attributes on the network access server (NAS) for purposes such as authorization or accounting. In Cisco IOS XE Release 2.1, this feature was introduced on the Cisco ASR 1000 Series Aggregation Services Routers The following commands were introduced or modified by this feature: **accounting (server-group), authorization (server-group), attribute (server-group), radius-server attribute list**



CHAPTER 12

RADIUS Attribute 55 Event-Timestamp

The RADIUS Attribute 55 Event-Timestamp feature allows a network access server (NAS) to insert an event time-stamp attribute in accounting and authentication packets that are sent to the RADIUS server with or without Network Time Protocol (NTP) synchronization.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 55 Event-Timestamp

Before the Event-Timestamp attribute can be sent in accounting and authentication request packets, you must configure the clock on the network device. For information about setting the clock on your network device, see the “Performing Basic System Management” section in the “Basic System Management” chapter of *Network Management Configuration Guide*.

To avoid configuring the clock on the network device every time the network device is reloaded, you can enable the **clock calendar-valid** command. For information about this command, see the “Setting Time and Calendar Services” section in the “Basic System Management” chapter of *Network Management Configuration Guide*.

Information About RADIUS Attribute 55 Event-Timestamp

When a network device dials in to a network access server (NAS) that is configured for RADIUS authentication, the NAS begins the process of contacting the RADIUS server in preparation for user authentication. Typically, the RADIUS attribute 55 (Event-Timestamp) is not communicated to the RADIUS server until after a successful Network Time Protocol (NTP) synchronization. This feature enables a NAS to insert the Event-Timestamp attribute in accounting and authentication request packets even if NTP synchronization does not happen.

The Event-Timestamp attribute records the time at which the event occurred on the NAS. This times tamp is sent in seconds in RADIUS attribute 55 since January 1, 1970 00:00 UTC.

The Event-Timestamp attribute is saved in memory on the NAS for the life of the session. The RADIUS accounting and authentication start packet, all subsequent accounting and authentication packets, updates (if configured), and stop packets also include the same RADIUS attribute 55 Event-Timestamp representing the time at which the original packet was sent.

How to Configure RADIUS Attribute 55 Event-Timestamp

Configuring RADIUS Attribute 55 Event-Timestamp

Perform this task to send RADIUS attribute 55 in accounting and authentication requests.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authentication ppp default group radius**
5. **aaa accounting network default start-stop group radius**
6. **radius-server host** *ip-address*
7. **radius-server attribute 55 include-in-acct-req**
8. **radius-server attribute 55 access-req include**
9. **exit**

DETAILED STEPS

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

	Command or Action	Purpose
Step 3	**aaa new-model** **Example:** `Device(config)# aaa new-model`	Enables authentication, authorization, and accounting (AAA).
Step 4	**aaa authentication ppp default group radius** **Example:** `Device(config)# aaa authentication ppp default group radius`	Specifies one or more AAA methods for use on serial interfaces that run PPP using the list of all RADIUS servers for authentication.
Step 5	**aaa accounting network default start-stop group radius** **Example:** `Device(config)# aaa accounting network default start-stop group radius`	Enables network accounting and sends start and stop accounting notices for the RADIUS accounting method list to the RADIUS server.
Step 6	**radius-server host** *ip-address* **Example:** `Device(config)# radius-server host 192.0.2.3`	Specifies the IP address of the RADIUS server host.
Step 7	**radius-server attribute 55 include-in-acct-req** **Example:** `Device(config)# radius-server attribute 55 include-in-acct-req`	Sends RADIUS attribute 55 in account-request packets.
Step 8	**radius-server attribute 55 access-req include** **Example:** `Device(config)# radius-server attribute 55 access-req include`	Sends RADIUS attribute 55 in access-request packets.
Step 9	**exit** **Example:** `Device(config)# exit`	Exits global configuration mode.

Verifying RADIUS Attribute 55 Event-Timestamp

Perform this task to verify that RADIUS attribute 55 is sent in accounting and authentication packets.

SUMMARY STEPS

1. **enable**
2. **show running-config**

3. **debug radius**

DETAILED STEPS

Step 1 **enable**

Enables privileged EXEC mode.

- Enter your password if prompted.

Example:

```
Device> enable
```

Step 2 **show running-config**

Displays the contents of the current running configuration file.

Example:

```
Device# show running-config

.
.
.
aaa group server radius sample
aaa accounting network default start-stop group radius group sample
aaa server radius dynamic-author
radius-server attribute 55 include-in-acct-req
radius-server attribute 55 access-request include
radius-server dead-criteria time 10 tries 3
radius-server host 192.0.2.3
radius-server retry method reorder
radius-server retransmit 2
radius-server deadtime 1
radius-server key rad123
radius server host
.
.
.
radius-server attribute 55 include-in-acct-req
radius-server attribute 55 access-request include
```

Step 3 **debug radius**

Displays information associated with RADIUS. The output of this command shows whether attribute 55 is being sent in accounting and authentication requests.

Example:

```
Device# debug radius

AAA/BIND(0000000D): Bind i/f Virtual-Template1
AAA/AUTHEN/PPP (0000000D): Pick method list 'default'
RADIUS/ENCODE(0000000D):Orig. component type = PPPoE
RADIUS: DSL line rate attributes successfully added
RADIUS(0000000D): Config NAS IP: 0.0.0.0
RADIUS(0000000D): Config NAS IPv6: ::
RADIUS/ENCODE(0000000D): acct_session_id: 2
RADIUS(0000000D): sending
```

```
RADIUS/ENCODE: Best Local IP-Address 192.0.2.3 for Radius-Server 192.0.2.1
RADIUS(0000000D): Sending a IPv4 Radius Packet
RADIUS(0000000D): Send Access-Request to 192.0.2.1:1645 id 1645/1,len 130
RADIUS:  authenticator 66 D8 24 42 BC 45 5B 3D - 0E DC 74 D7 E9 3D 81 85
RADIUS:  Framed-Protocol     [7]   6   PPP                       [1]
RADIUS:  User-Name           [1]   6   "test"
RADIUS:  User-Password       [2]   18  *
RADIUS:  NAS-Port-Type       [61]  6   Virtual                   [5]
RADIUS:  NAS-Port            [5]   6   0
RADIUS:  NAS-Port-Id         [87]  9   "0/0/0/0"
RADIUS:  Vendor, Cisco       [26]  41
RADIUS:   Cisco AVpair       [1]   35  "client-mac-address=aabb.cc00.6500"
RADIUS:  Service-Type        [6]   6   Framed                    [2]
RADIUS:  NAS-IP-Address      [4]   6   1.1.1.2
RADIUS:  Event-Timestamp     [55]  6   1362041578
RADIUS(0000000D): Started 5 sec timeout
RADIUS: Received from id 1645/192.0.2.1:1645, Access-Accept, len 20
.
.
.
RADIUS:  authenticator 2A 2B 24 47 06 44 23 8A - CB CC 8C 96 8D 21 76 DD
RADIUS(0000000D): Received from id 1645/1
AAA/BIND(0000000D): Bind i/f Virtual-Access2.1
RADIUS/ENCODE(0000000D):Orig. component type = PPPoE
.
.
.
RADIUS(0000000D): Config NAS IP: 0.0.0.0
RADIUS(0000000D): Config NAS IPv6: ::
RADIUS(0000000D): sending
RADIUS/ENCODE: Best Local IP-Address 192.0.2.3 for Radius-Server 192.0.2.1
RADIUS(0000000D): Sending a IPv4 Radius Packet
RADIUS(0000000D): Send Accounting-Request to 192.0.2.1:1646 id 1646/1,len 182
RADIUS:  authenticator C6 81 D0 D7 EA BA 9A A9 - 19 4B 1B 90 B8 D1 66 BF
RADIUS:  Acct-Session-Id     [44]  10  "00000002"
RADIUS:  Framed-Protocol     [7]   6   PPP                       [1]
RADIUS:  User-Name           [1]   6   "test"
RADIUS:  Vendor, Cisco       [26]  32
RADIUS:   Cisco AVpair       [1]   26  "connect-progress=Call Up"
RADIUS:  Acct-Authentic      [45]  6   RADIUS                    [1]
RADIUS:  Acct-Status-Type    [40]  6   Start                     [1]
RADIUS:  NAS-Port-Type       [61]  6   Virtual                   [5]
RADIUS:  NAS-Port            [5]   6   0
RADIUS:  NAS-Port-Id         [87]  9   "0/0/0/0"
RADIUS:  Vendor, Cisco       [26]  41
RADIUS:   Cisco AVpair       [1]   35  "client-mac-address=aabb.cc00.6500"
RADIUS:  Service-Type        [6]   6   Framed                    [2]
RADIUS:  NAS-IP-Address      [4]   6   1.1.1.2
RADIUS:  home-hl-prefix      [151] 10  "163BD6D4"
RADIUS:  Event-Timestamp     [55]  6   1362041588
RADIUS:  Acct-Delay-Time     [41]  6   0
RADIUS(0000000D): Started 5 sec timeout
.
.
.
RADIUS: Received from id 1646/1 1.1.1.1:1646, Accounting-response, len 20
RADIUS:  authenticator 79 F1 6A 38 07 C3 C8 F9 - 96 66 BE EF 5C FA 91 E6
```

Configuration Example for RADIUS Attribute 55 Event-Timestamp

Example: RADIUS Attribute 55 in Accounting and Authentication Packets

The following example shows a configuration that sends RADIUS attribute 55 in accounting and authentication packets:

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa authentication ppp default group radius
Device(config)# aaa accounting network default start-stop group radius
Device(config)# radius-server host 192.0.2.3
Device(config)# radius-server attribute 55 include-in-acct-req
Device(config)# radius-server attribute 55 access-req include
Device(config)# exit
```

Additional References for RADIUS Attribute 55 Event-Timestamp

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
Security commands	• Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z
Configuring Authentication	"Configuring Authentication" chapter in *Authentication, Authorization, and Accounting Configuration Guide*
Configuring RADIUS	"Configuring RADIUS" chapter in *RADIUS Configuration Guide*

Standards and RFCs

Standard/RFC	Title
RFC 2138	*Remote Authentication Dial In User Service (RADIUS)*

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

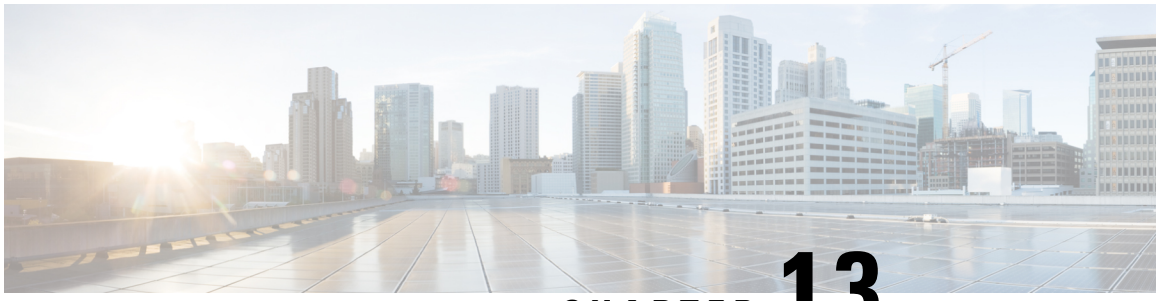
Feature Information for RADIUS Attribute 55 Event-Timestamp

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 19: Feature Information for RADIUS Attribute 55 Event-Timestamp

Feature Name	Releases	Feature Information
RADIUS Attribute 55 Event-Timestamp	Cisco IOS XE Release 3.9S	The RADIUS Attribute 55 Event-Timestamp feature allows a network access server (NAS) to insert an event time-stamp attribute in accounting and authentication packets sent to the RADIUS server with or without Network Time Protocol (NTP) synchronization. The following commands were introduced or modified: **radius-server attribute 55 access-req include** and **radius-server attribute 55 include-in-acct-req**.



CHAPTER 13

RADIUS Attribute 104

The RADIUS Attribute 104 feature allows private routes (attribute 104) to be specified in a RADIUS authorization profile. The private routes affect only packets that are received on an individual interface. The routes are stored apart from the global routing table and are not injected into any routing protocols for redistribution.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 104

- You must be using a Cisco RADIUS server.
- You should be familiar with configuring RADIUS.
- You should be familiar with policy-based routing (PBR) and private routes.
- You should be familiar with configuring access control lists (ACLs).
- Before using the RADIUS Attribute 104 feature, you must configure RADIUS AAA authorization and RADIUS route download.

- The following memory bytes are requireF:\tips-migration
  - One route map--50 bytes.
  - One match-set clause--600 bytes.
  - One extended ACL--366 bytes.
  - For N number of attribute 104s, the memory requirement is (600+366)*N+50=1000*N(approximate) per user.

Restrictions for RADIUS Attribute 104

- If you already have PBR locally (statically) configured under the interface, and you specify attribute 104, the locally configured PBR will be disabled.
- If a pseudo next-hop address is involved, there must be a route available in the routing table for the next-hop address. If a route is not available, the packet will not be policy routed.
- Policy routing does not order the match-set clauses and relies on the first match, so you should specify the attributes in the order in which you want them to be matched.
- Metric numbers cannot be used in the attribute.

Information About RADIUS Attribute 104

Policy-Based Routing Background

PBR provides a mechanism for the forwarding, or routing of, data packets on the basis of defined policies. The policies are not wholly dependent on the destination address but rather on other factors, such as type of service, source address, precedence, port numbers, or protocol type.

Policy-based routing is applied to incoming packets. All packets that are received on an interface that has policy-based routing enabled are considered for policy-based routing. The router passes the packets through enhanced packet filters called route maps. On the basis of the criteria that are defined in the route maps, the packets are forwarded to the appropriate next hop.

Each entry in a route map statement contains a combination of match clauses and set clauses or commands. The match clauses define the criteria for whether appropriate packets meet the particular policy (that is, whether the conditions are met). The set clauses provide instruction for how the packets should be routed after they have met the match criteria. The match clause specifies which set of filters a packet must match for the corresponding set clause to be applied.

Attribute 104 and the Policy-Based Route Map

This section discusses the attribute 104 feature and how it works with policy-based route maps.

RADIUS Attribute 104 Overview

Using the RADIUS Attribute 104 feature, you can specify private routes in your RADIUS authorization profile. The private routes you specify will affect only packets that are received on an individual interface.

The routes are stored apart from the global routing table and are not injected into any routing protocols for redistribution.

Permit Route Map

Route map statements can be marked as “permit” or “deny.” If the statement is marked “permit,” the set clause is applied to the packets that match the match criteria. For attribute 104, when you are configuring the route map, you need to mark the route map as “permit,” as follows. See Related Documents, on page 114 for where to find information on configuring a route map.

Default Private Route

The policy routing process proceeds through the route map until a match is found. If no match is found in the route map, the global routing table is consulted. If you have specified a default route in your user profile, any further routes beyond the default route are effectively ignored.

Route Map Order

You need to specify route maps on the server in the order that you want them to be applied.

How to Apply RADIUS Attribute 104

Applying RADIUS Attribute 104 to Your User Profile

You can apply RADIUS attribute 104 to your user profile by adding the following to the RADIUS server database.

SUMMARY STEPS

1. Apply RADIUS attribute 104 to your user profile.

DETAILED STEPS

	Command or Action	Purpose
Step 1	Apply RADIUS attribute 104 to your user profile.	`Ascend-Private-Route=”dest_addr/netmask next_hop”` The destination network address of the router is “dest_addr/netmask”, and the address of the next-hop router is “next_hop.”

Examples

The following is a sample user profile that creates three private routes that are associated with the caller:

```
username Password="ascend"; User-Service=Framed-User
   Framed-Protocol=PPP,
   Framed-Address=10.1.1.1,
```

```
Framed-Netmask=255.0.0.0,
Ascend-Private-Route="172.16.1.1/16 10.10.10.1"
Ascend-Private-Route="192.168.1.1/32 10.10.10.2"
Ascend-Private-Route="10.20.0.0/1 10.10.10.3"
Ascend-Private-Route="10.0.0.0/0 10.10.10.4"
```

Using the above profile, the private routing table for the connection contains the following routes, including a default route:

```
Destination/Mask     Gateway
172.16.1.1/16         10.10.10.1
192.168.1.1/32         10.10.10.2
10.20.20.20/1       10.10.10.3
10.0.0.0/0            10.10.10.4
```

Verifying Route Maps

You can use the following **show** commands to verify the route maps that have been configured.

SUMMARY STEPS

1. **enable**
2. **show ip policy**
3. **show route-map** [*map-name* | **dynamic** [*dynamic-map-name* | **application** [*application-name*]] | **all**]

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 policy** **Example:** `Router# show ip policy`	Displays the route map that is used for policy routing.
Step 3	**show route-map** [*map-name*	**dynamic** [*dynamic-map-name*	**application** [*application-name*]]	**all**] **Example:** `Router# show route-map`	Displays all route maps that are configured or only the one that is specified.

Troubleshooting the RADIUS Profile

If your private route configuration is not working properly, you may want to reread the section "Policy-Based Routing Background, on page 110." This section may help you determine what is happening to the packets. In addition, the following **debug** commands can be used to troubleshoot your RADIUS profile.

SUMMARY STEPS

1. **enable**
2. **debug radius**
3. **debug aaa per-user**
4. debug ip policy

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug radius** **Example:** `Router# debug radius`	Displays information associated with RADIUS.
Step 3	**debug aaa per-user** **Example:** `Router# debug aaa per-user`	Displays the attributes that are applied to each user as the user authenticates.
Step 4	debug ip policy **Example:** `Router# debug ip policy`	Displays IP routing packet activity.

Configuration Examples for RADIUS Attribute 104

Route-Map Configuration in Which Attribute 104 Has Been Applied Example

The following output is a typical route-map configuration to which attribute 104 has been applieF:\tips-migration

```
Router# show route-map dynamic
route-map AAA-01/08/04-14:13:59.542-1-AppSpec, permit, sequence 0, identifier 1639994476
  Match clauses:
    ip address (access-lists): PBR#1 PBR#2
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
route-map AAA-01/08/04-14:13:59.542-1-AppSpec, permit, sequence 1, identifier 1640264784
  Match clauses:
    ip address (access-lists): PBR#3 PBR#4
  Set clauses:
  Policy routing matches: 0 packets, 0 bytes
route-map AAA-01/08/04-14:13:59.542-1-AppSpec, permit, sequence 2, identifier 1645563704
  Match clauses:
```

```
    ip address (access-lists): PBR#5 PBR#6
    length 10 100
  Set clauses:
    ip next-hop 10.1.1.1
    ip gateway10.1.1.1
  Policy routing matches: 0 packets, 0 bytes
Current active dynamic routemaps = 1
```

Additional References

The following sections provide references related to RADIUS NAS-IP-Address Attribute Configurability.

Related Documents

Related Topic	Document Title
Configuring AAA	"Authentication, Authorization, and Accounting (AAA)" section of *Cisco IOS Security Configuration Guide: Securing User Services*
Configuring RADIUS	" Configuring RADIUS " module.
RADIUS commands	*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 website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

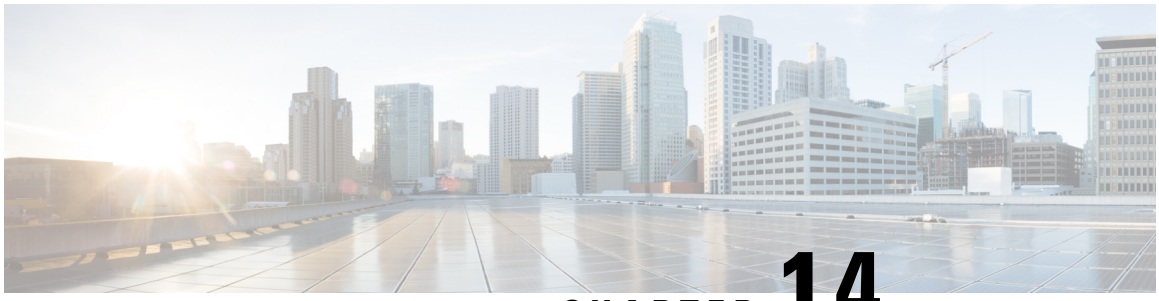
Feature Information for RADIUS Attribute 104

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 20: Feature Information for RADIUS Attribute 104

Feature Name	Releases	Feature Information
RADIUS Attribute 104	Cisco IOS XE Release 3.9S	The RADIUS Attribute 104 feature allows private routes (attribute 104) to be specified in a RADIUS authorization profile. The private routes affect only packets that are received on an individual interface. The routes are stored apart from the global routing table and are not injected into any routing protocols for redistribution. The following commands were introduced or modifieF:\tips-migration **show ip policy**, **show route-map**.



CHAPTER 14

RADIUS NAS-IP-Address Attribute Configurability

The RADIUS NAS-IP-Address Attribute Configurability feature allows an arbitrary IP address to be configured and used as RADIUS attribute 4, NAS-IP-Address, without changing the source IP address in the IP header of the RADIUS packets. This feature may be used for situations in which service providers are using a cluster of small network access servers (NASs) to simulate a large NAS to improve scalability. This feature allows the NASs to behave as a single RADIUS client from the perspective of the RADIUS server.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS NAS-IP-Address Attribute Configurability

The following requirements are necessary before configuring this feature:

- Experience with IP Security (IPSec) and configuring both RADIUS servers and authentication, authorization, and accounting (AAA) is necessary.
- RADIUS server and AAA lists must be configured.

Restrictions for RADIUS NAS-IP-Address Attribute Configurability

The following restrictions apply if a cluster of RADIUS clients are being used to simulate a single RADIUS client for scalability. Solutions, or workarounds, to the restrictions are also provided.

- RADIUS attribute 44, Acct-Session-Id, may overlap among sessions from different NASs.

There are two solutions. Either the **radius-server attribute 44 extend-with-addr** or **radius-server unique-ident** command can be used on NAS routers to specify different prepending numbers for different NAS routers.

- RADIUS server-based IP address pool for different NASs must be managed.

The solution is to configure different IP address pool profiles for different NASs on the RADIUS server. Different NASs use different pool usernames to retrieve them.

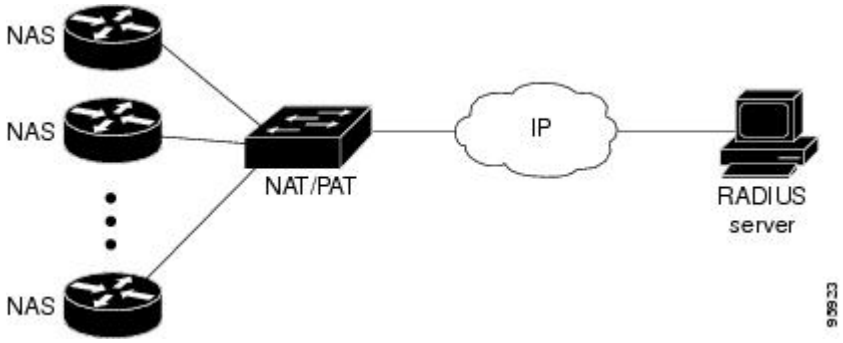
- RADIUS request message for sessions from different NASs must be differentiated.

One of the solutions is to configure different format strings for RADIUS attribute 32, NAS-Identifier, using the **radius-server attribute 32 include-in-access-req** command on different NASs.

Information About RADIUS NAS-IP-Address Attribute Configurability

To simulate a large NAS RADIUS client using a cluster of small NAS RADIUS clients, as shown in the figure below, a Network Address Translation (NAT) or Port Address Translation (PAT) device is inserted in a network. The device is placed between a cluster of NASs and the IP cloud that is connected to a RADIUS server. When RADIUS traffic from different NASs goes through the NAT or PAT device, the source IP addresses of the RADIUS packets are translated to a single IP address, most likely an IP address on a loopback interface on the NAT or PAT device. Different User Datagram Protocol (UDP) source ports are assigned to RADIUS packets from different NASs. When the RADIUS reply comes back from the server, the NAT or PAT device receives it, uses the destination UDP port to translate the destination IP address back to the IP address of the NAS, and forwards the reply to the corresponding NAS.

The figure below demonstrates how the source IP addresses of several NASs are translated to a single IP address as they pass through the NAT or PAT device on the way to the IP cloud.



RADIUS servers normally check the source IP address in the IP header of the RADIUS packets to track the source of the RADIUS requests and to maintain security. The NAT or PAT solution satisfies these requirements because only a single source IP address is used even though RADIUS packets come from different NAS routers.

However, when retrieving accounting records from the RADIUS database, some billing systems use RADIUS attribute 4, NAS-IP-Address, in the accounting records. The value of this attribute is recorded on the NAS routers as their own IP addresses. The NAS routers are not aware of the NAT or PAT that runs between them and the RADIUS server; therefore, different RADIUS attribute 4 addresses will be recorded in the accounting records for users from the different NAS routers. These addresses eventually expose different NAS routers to the RADIUS server and to the corresponding billing systems.

Using the RADIUS NAS-IP-Address Attribute Configurability Feature

The RADIUS NAS-IP-Address Attribute Configurability feature allows you to freely configure an arbitrary IP address as RADIUS NAS-IP-Address, RADIUS attribute 4. By manually configuring the same IP address, most likely the IP address on the loopback interface of the NAT or PAT device, for all the routers, you can hide a cluster of NAS routers behind the NAT or PAT device from the RADIUS server.

How to Configure RADIUS NAS-IP-Address Attribute Configurability

Configuring RADIUS NAS-IP-Address Attribute Configurability

Before configuring the RADIUS NAS-IP-Address Attribute Configurability feature, you must have configured the RADIUS servers or server groups and AAA method lists.

To configure the RADIUS NAS-IP-Address Attribute Configurability feature, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server attribute 4** *ip-address*

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	**radius-server attribute 4** *ip-address* **Example:** `Router (config)# radius-server attribute 4 10.2.1.1`	Configures an IP address to be used as the RADIUS NAS-IP-Address, attribute 4.

Monitoring and Maintaining RADIUS NAS-IP-Address Attribute Configurability

To monitor the RADIUS attribute 4 address that is being used inside the RADIUS packets, use the **debug radius** command.

SUMMARY STEPS

1. **enable**
2. **debug radius**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**debug radius** **Example:** `Router# debug radius`	Displays information associated with RADIUS.

Example

The following sample output is from the **debug radius** command:

```
Router# debug radius
RADIUS/ENCODE(0000001C): acct_session_id: 29
RADIUS(0000001C): sending
RADIUS(0000001C): Send Access-Request to 10.0.0.10:1645 id 21645/17, len 81
RADIUS:  authenticator D0 27 34 C0 F0 C4 1C 1B - 3C 47 08 A2 7E E1 63 2F
RADIUS:  Framed-Protocol     [7]   6   PPP                       [1]
RADIUS:  User-Name           [1]   18  "shashi@pepsi.com"
RADIUS:  CHAP-Password       [3]   19  *
RADIUS:  NAS-Port-Type       [61]  6   Virtual                   [5]
RADIUS:  Service-Type        [6]   6   Framed                    [2]
RADIUS:  NAS-IP-Address      [4]   6   10.0.0.21
UDP: sent src=10.1.1.1(21645), dst=10.0.0.10(1645), length=109
UDP: rcvd src=10.0.0.10(1645), dst=10.1.1.1(21645), length=40
RADIUS: Received from id 21645/17 10.0.0.10:1645, Access-Accept, len 32
RADIUS:  authenticator C6 99 EC 1A 47 0A 5F F2 - B8 30 4A 4C FF 4B 1D F0
RADIUS:  Service-Type        [6]   6   Framed                    [2]
```

```
RADIUS:  Framed-Protocol      [7]   6   PPP                       [1]
RADIUS(0000001C): Received from id 21645/17
```

Configuration Examples for RADIUS NAS-IP-Address Attribute Configurability

Configuring a RADIUS NAS-IP-Address Attribute Configurability Example

The following example shows that IP address 10.0.0.21 has been configured as the RADIUS NAS-IP-Address attribute:

```
radius-server attribute 4 10.0.0.21
radius-server host 10.0.0.10 auth-port 1645 acct-port 1646 key cisco
```

Additional References

The following sections provide references related to RADIUS NAS-IP-Address Attribute Configurability.

Related Documents

Related Topic	Document Title
Configuring AAA	"Authentication, Authorization, and Accounting (AAA)" section of *Cisco IOS Security Configuration Guide: Securing User Services*
Configuring RADIUS	" Configuring RADIUS " module.
RADIUS commands	*Cisco IOS Security Command Reference*

Standards

Standards	Title
No new or modified standards are supported by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature.	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
No new or modified RFCs are supported by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

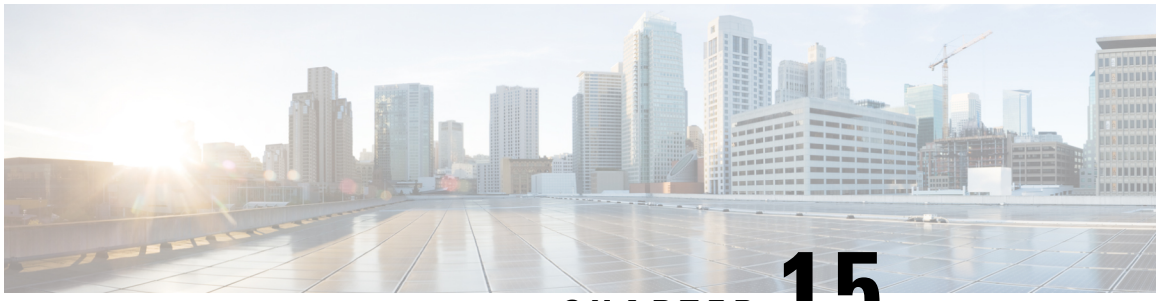
Feature Information for RADIUS NAS-IP-Address Attribute Configurability

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 21: Feature Information for RADIUS NAS-IP-Address Attribute Configurability

Feature Name	Releases	Feature Information
RADIUS NAS-IP-Address Attribute Configurability	Cisco IOS XE Release 3.9S	This feature allows an arbitrary IP address to be configured and used as RADIUS attribute 4, NAS-IP-Address, without changing the source IP address in the IP header of the RADIUS packets. The **radius-server attribute 4** command was introduced this feature.



CHAPTER 15

RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

The RADIUS Attribute 5 (NAS-Port) Format Specified on a Per-Server Group Level feature allows configurations to be customized for different RADIUS server groups. This flexibility allows customized network access server- (NAS-) port formats to be used instead of global formats.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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.

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 RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

- You must be running a Cisco IOS image that contains the authentication, authorization, and accounting (AAA) component.

Information About RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

RADIUS Attribute 5 Format Customization

Prior to Cisco IOS Release 12.3(14)T, Cisco IOS software allowed RADIUS attributes that were sent in access requests or accounting requests to be customized on a global basis. You could customize how each configurable attribute should function when communicating with a RADIUS server. Since the implementation of server groups, global attribute configurations were not flexible enough to address the different customizations that were required to support the various RADIUS servers with which a router might be interacting. For example, if you configured the **global radius-server attribute nas-port format command**option, every service on the router that interacted with a RADIUS server was used in the same way.

Effective with Cisco IOS Release 12.3(14)T, you can configure your router to support override flexibility for per-server groups. You can configure services to use specific named methods for different service types on a RADIUS server. The service types can be set to use their own respective service groups. This flexibility allows customized NAS-port formats to be used instead of the global formats.

How to Configure RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

Configuring the RADIUS Attribute 5 Format on a Per-Server Group Level

To configure your router to support the RADIUS Attribute 5 format on a per-server group level, perform the following steps.

Note To use this per-server group capability, you must actively use a named method list within your services. You can configure one client to use a specific named method while other clients use the default format.

Before you begin

Before performing these steps, you should first configure method lists for AAA as is applicable for your situation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa group server radius** *group-name*
4. **server** *ip-address* [**auth-port** *port-number*] [**acct-port** *port-number*]
5. **attribute nas-port format** *format-type* [*string*]

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	**aaa group server radius** *group-name* **Example:** `Router (config)# aaa group server radius radius1`	Groups different RADIUS server hosts into distinct lists and distinct methods and enters server-group configuration mode.
Step 4	**server** *ip-address* [**auth-port** *port-number*] [**acct-port** *port-number*] **Example:** `Router (server-group)# server 172.101.159.172 auth-port 1645 acct-port 1646`	Configures the IP address of the RADIUS server for the group server.
Step 5	**attribute nas-port format** *format-type* [*string*] **Example:** `Router (server-group)# attribute nas-port format d`	Configures a service to use specific named methods for different service types. • The service types can be set to use their own respective server groups.

Monitoring and Maintaining RADIUS Attribute 5 Format on a Per-Server Group Level

To monitor and maintain RADIUS Attribute 5 Format on a Per-Server Group Level, perform the following steps (the **debug** commands may be used separately):

SUMMARY STEPS

1. **enable**
2. **debug aaa sg-server selection**
3. **debug radius**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**debug aaa sg-server selection** **Example:** `Router# debug aaa sg-server selection`	Displays information about why the RADIUS and TACACS+ server group system in a router is choosing a particular server.
Step 3	**debug radius** **Example:** `Router# debug radius`	Displays information showing that a server group has been selected for a particular request.

Configuration Examples for RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

RADIUS Attribute 5 Format Specified on a Per-Server Level Example

The following configuration example shows a leased-line PPP client that has chosen to send no RADIUS Attribute 5 while the default is to use format F:\tips-migration

```
interface Serial2/0
 no ip address
 encapsulation ppp
 ppp accounting SerialAccounting
 ppp authentication pap
aaa accounting network default start-stop group radius
aaa accounting network SerialAccounting start-stop group group1
aaa group server radius group1
 server 10.101.159.172 auth-port 1645 acct-port 1646
 attribute nas-port none
radius-server host 10.101.159.172 auth-port 1645 acct-port 1646
radius-server attribute nas-port format d
```

Additional References

The following sections provide references related to RADIUS Vendor-Specific Attributes (VSA) and RADIUS Disconnect-Cause Attribute Values.

Related Documents

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

Related Topic	Document Title
Security commands	*Cisco IOS Security Command Reference*
Security Features	*Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
Security Server Protocols	Security Server Protocols section of the *Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
RADIUS Configuration	Configuring RADIUS feature module.

Standards

Standard	Title
Internet Engineering Task Force (IETF) Internet Draft: Network Access Servers Requirements	Network Access Servers Requirements: Extended RADIUS Practices

MIBs

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

RFCs

RFC	Title
RFC 2865	Remote Authentication Dial In User Service (RADIUS)

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for RADIUS Attribute 5 NAS-Port Format Specified on a Per-Server Group Level

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 22: Feature Information for RADIUS Attribute 5 (NAS-Port) Format Specified on a Per-Server Group Level

Feature Name	Releases	Feature Information
RADIUS Attribute 5 (NAS-Port) Format Specified on a Per-Server Group Level	Cisco IOS XE Release 3.9S	The RADIUS Attribute 5 (NAS-Port) Format Specified on a Per-Server Group Level feature allows configurations to be customized for different RADIUS server groups. This flexibility allows customized network access server- (NAS-) port formats to be used instead of global formats. The following commands were introduced or modifieF:\tips-migration **attribute nas-port format**.