



RADIUS 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 is stored on the RADIUS daemon.

This appendix describes the following types of RADIUS attributes supported in Broadband Network Gateway (BNG):

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RADIUS IETF Attributes

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. Because IETF attributes are standard, the attribute data is predefined and well known; thus all clients and servers who exchange AAA information via 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) derived from one IETF attribute-vendor-specific (attribute 26). Attribute 26 allows a vendor to create an additional 255 attributes however they wish. That is, a vendor can create an attribute that does not match the data of any IETF attribute and encapsulate it behind attribute 26; thus, the newly created attribute is accepted if the user accepts attribute 26.

Table 1: Supported RADIUS IETF Attributes

| Name | Value | Type |
|-----------------------|---------|------|
| Acct-Authentic | integer | 45 |
| Acct-Delay-Time | integer | 41 |
| Acct-Input-Giga-Words | integer | 52 |
| Acct-Input-Octets | integer | 42 |

| Name | Value | Type |
|-------------------------------|----------|------|
| Acct-Input-Packets | integer | 47 |
| Acct-Interim-Interval | integer | 85 |
| Acct-Link-Count | integer | 51 |
| Acct-Output-Giga-Words | integer | 53 |
| Acct-Output-Octets | integer | 43 |
| Acct-Output-Packets | integer | 48 |
| Acct-Session-Time | integer | 46 |
| Acct-Status-Type | integer | 40 |
| Acct-Terminate-Cause | integer | 49 |
| CHAP-Challenge | binary | 40 |
| CHAP-Password | binary | 3 |
| Dynamic-Author-Error-Cause | integer | 101 |
| Event-Timestamp | integer | 55 |
| Filter-Id | binary | 11 |
| Framed-Protocol | integer | 7 |
| Framed-IP-Address | ipv4addr | 8 |
| Framed-Route | "string" | 22 |
| login-ip-addr-host | ipv4addr | 14 |
| Multilink-Session-ID | string | 50 |
| Nas-Identifier | string | 32 |
| NAS-IP-Address | ipv4addr | 4 |
| NAS-Port | integer | 5 |
| Reply-Message | binary | 18 |
| Service-Type | integer | 6 |
| Tunnel-Assignment-Id | string | 32 |
| Tunnel-Packets-Lost | integer | 86 |
| X-Ascend-Client-Primary-DNS | ipv4addr | 135 |
| X-Ascend-Client-Secondary-DNS | ipv4addr | 136 |
| NAS-IPv6-Address | string | 95 |
| Delegated-IPv6-Prefix | binary | 123 |
| Stateful-IPv6-Address-Pool | binary | 123 |
| Framed-IPv6-Prefix | binary | 97 |

| Name | Value | Type |
|---------------------|--------|------|
| Framed-Interface-Id | binary | 96 |
| Framed-IPv6-Pool | string | 100 |
| Framed-IPv6-Route | string | 99 |
| login-ip-addr-host | string | 98 |

IETF Tagged Attributes on LAC

The IETF Tagged Attributes support on L2TP Access Concentrator (LAC) provides a means of grouping tunnel attributes referring to the same tunnel in an Access-Accept packet sent from the RADIUS server to the LAC. The Access-Accept packet can contain multiple instances of same RADIUS attributes, but with different tags. The tagged attributes support ensures that all attributes pertaining to a given tunnel contain the same value in their respective tag fields, and that each set includes an appropriately-valued instance of the Tunnel-Preference attribute. This conforms to the tunnel attributes that are to be used in a multi-vendor network environment, thereby eliminating interoperability issues among Network Access Servers (NASs) manufactured by different vendors.

For details of RADIUS Attributes for Tunnel Protocol Support, refer [RFC 2868](#).

These examples describe the format of IETF Tagged Attributes:

```
Tunnel-Type = :0:L2TP, Tunnel-Medium-Type = :0:IP, Tunnel-Server-Endpoint = :0:"1.1.1.1",
Tunnel-Assignment-Id = :0:"1", Tunnel-Preference = :0:1, Tunnel-Password = :0:"hello"
```

A tag value of 0 is used in the above example in the format of :0:, to group those attributes in the same packet that refer to the same tunnel. Similar examples are:

```
Tunnel-Type = :1:L2TP, Tunnel-Medium-Type = :1:IP, Tunnel-Server-Endpoint = :1:"2.2.2.2",
Tunnel-Assignment-Id = :1:"1", Tunnel-Preference = :1:1, Tunnel-Password = :1:"hello"
```

```
Tunnel-Type = :2:L2TP, Tunnel-Medium-Type = :2:IP, Tunnel-Server-Endpoint = :2:"3.3.3.3",
Tunnel-Assignment-Id = :2:"1", Tunnel-Preference = :2:2, Tunnel-Password = :2:"hello"
```

```
Tunnel-Type = :3:L2TP, Tunnel-Medium-Type = :3:IP, Tunnel-Server-Endpoint = :3:"4.4.4.4",
Tunnel-Assignment-Id = :3:"1", Tunnel-Preference = :3:2, Tunnel-Password = :3:"hello"
```

```
Tunnel-Type = :4:L2TP, Tunnel-Medium-Type = :4:IP, Tunnel-Server-Endpoint = :4:"5.5.5.5",
Tunnel-Assignment-Id = :4:"1", Tunnel-Preference = :4:3, Tunnel-Password = :4:"hello"
```

```
Tunnel-Type = :5:L2TP, Tunnel-Medium-Type = :5:IP, Tunnel-Server-Endpoint = :5:"6.6.6.6",
Tunnel-Assignment-Id = :5:"1", Tunnel-Preference = :5:3, Tunnel-Password = :5:"hello"
```

Table 2: Supported IETF Tagged Attributes

| IETF Tagged Attribute Name | Value | Type |
|----------------------------|---------|------|
| Tunnel-Type | integer | 64 |
| Tunnel-Medium-Type | integer | 65 |
| Tunnel-Client-Endpoint | string | 66 |
| Tunnel-Server-Endpoint | string | 67 |

| IETF Tagged Attribute Name | Value | Type |
|----------------------------|---------|------|
| Tunnel-Password | string | 69 |
| Tunnel-Assignment-ID | string | 82 |
| Tunnel-Preference | integer | 83 |
| Tunnel-Client-Auth-ID | string | 90 |
| Tunnel-Server-Auth-ID | string | 91 |

RADIUS Vendor-Specific Attributes

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.

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 this 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.

IETF Attribute 26 (Vendor-Specific) encapsulates vendor specific attributes, thereby, allowing vendors to support their own extended attributes otherwise not suitable for general use.

```
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"
```

The following example shows how to configure avpair aaa attribute to enable IPv6 router advertisements from an IPv4 subscriber interface:

```
Cisco-avpair= "ipv6:start-ra-on-ipv6-enable=1"
```

Attribute 26 contains these three elements:

- Type
- Length

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



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.

Table 3: Supported Cisco Vendor-Specific RADIUS Attributes

| Name | Value | Type | Present in AAA message type |
|-----------------------------|---------|------|--|
| access-loop-encapsulation | binary | 1 | Access-accept, Accounting-request |
| accounting-list | string | 1 | Access-accept, CoA, Accounting-request |
| acct-input-gigawords-ipv4 | integer | 1 | Accounting-request |
| acct-input-octets-ipv4 | integer | 1 | Accounting-request |
| acct-input-packets-ipv4 | integer | 1 | Accounting-request |
| acct-input-gigawords-ipv6 | integer | 1 | Accounting-request |
| acct-input-octets-ipv6 | integer | 1 | Accounting-request |
| acct-input-packets-ipv6 | integer | 1 | Accounting-request |
| acct-output-gigawords-ipv4 | integer | 1 | Accounting-request |
| acct-output-octets-ipv4 | integer | 1 | Accounting-request |
| acct-output-packets-ipv4 | integer | 1 | Accounting-request |
| acct-output-gigawords-ipv6 | integer | 1 | Accounting-request |
| acct-output-octets-ipv6 | integer | 1 | Accounting-request |
| acct-output-packets-ipv6 | integer | 1 | Accounting-request |
| acct-policy-in | string | 1 | Access-request |
| acct-policy-map | string | 1 | Access-request |
| acct-policy-out | string | 1 | Access-request |
| actual-data-rate-downstream | integer | 1 | Access-accept, Accounting-request |

| Name | Value | Type | Present in AAA message type |
|---|---------|------|------------------------------------|
| actual-data-rate-upstream | integer | 1 | Access-accept, Accounting-request |
| actual-interleaving-delay-downstream | integer | 1 | Access-accept, Accounting-request |
| actual-interleaving-delay-upstream | integer | 1 | Access-accept, Accounting-request |
| addr-pool Note This is for IPv4 subscriber. | string | 1 | Access-accept |
| addrv6 | string | 1 | Access-accept, Accounting-request |
| attainable-data-rate-downstream | integer | 1 | Access-accept, Accounting-request |
| attainable-data-rate-upstream | integer | 1 | Access-accept, Accounting-request |
| circuit-id-tag | string | 1 | Access-accept, Accounting-request |
| cisco-nas-port | string | 2 | Access-accept, Accounting-request |
| client-mac-address | string | 1 | Access-accept, Accounting-request |
| command | string | 1 | CoA |
| connect-progress | string | 1 | Accounting-request |
| connect-rx-speed | integer | 1 | Access-accept, Accounting-request |
| connect-tx-speed | integer | 1 | Access-accept, Accounting-request |
| delegated-ipv6-pool | string | 1 | Access-accept |
| dhcp-class | string | 1 | Access-accept |
| dhcp-client-id | string | 1 | Accounting-request |
| dhcp-vendor-class | string | 1 | Access-request, Accounting-request |
| dhcpv6-class | string | 1 | Access-accept |
| disc-cause-ext | string | 1 | Accounting-request |
| disconnect-cause | string | 1 | Accounting-request |
| dual-stack-delay | integer | 1 | Access-accept |

| Name | Value | Type | Present in AAA message type |
|---|---------|------|------------------------------------|
| idlethreshold | integer | 1 | Access-accept, CoA |
| idle-timeout | integer | 1 | Access-accept, CoA |
| idle-timeout-direction | string | 1 | Access-accept, CoA |
| if-handle | integer | 1 | Accounting-request |
| inacl | string | 1 | Access-accept |
| intercept-id | integer | 1 | Access-accept |
| ip-addresses | string | 1 | Access-request, Accounting-request |
| ipv4-unnumbered | string | 1 | Access-accept |
| Note This attribute-value pair (AVP) is preferred for BNG in Cisco IOS XR Software, and it is equivalent to the ip-unnumbered AVP in Cisco IOS Software. | | | |
| ipv6_inacl | string | 1 | Access-accept, CoA |
| ipv6_outacl | string | 1 | Access-accept, CoA |
| ipv6-addr-pool | string | 1 | Access-accept |
| ipv6-dns-servers-addr | string | 1 | Access-accept |
| ipv6-enable | integer | 1 | Access-accept |
| ipv6-mtu | integer | 1 | Access-accept |
| ipv6-strict-rpf | integer | 1 | Access-accept |
| ipv6-unreachable | integer | 1 | Access-accept |
| l2tp-tunnel-password | string | 1 | Access-accept |
| ipv6 nd start-ra-on-ipv6-enable | Integer | 1 | Access-accept |
| login-ip-host | string | 1 | Accounting-request |
| maximum-interleaving-delay-downstream | integer | 1 | Access-request, Accounting-request |
| maximum-interleaving-delay-upstream | integer | 1 | Access-request, Accounting-request |
| maximum-data-rate-downstream | integer | 1 | Access-request, Accounting-request |
| maximum-data-rate-upstream | integer | 1 | Access-request, Accounting-request |
| md-dscp | integer | 1 | Access-accept |

| Name | Value | Type | Present in AAA message type |
|--|---------|------|---------------------------------------|
| md-ip-addr | ipaddr | 1 | Access-accept |
| md-port | integer | 1 | Access-accept |
| minimum-data-rate-downstream | integer | 1 | Access-request, Accounting-request |
| minimum-data-rate-downstream-low-power | integer | 1 | Access-request, Accounting-request |
| minimum-data-rate-upstream | integer | 1 | Access-request, Accounting-request |
| minimum-data-rate-upstream-low-power | integer | 1 | Access-request, Accounting-request |
| outacl | string | 1 | Access-accept |
| parent-if-handle | integer | 1 | Access-request, Accounting-request |
| parent-session-id | string | 1 | Accounting-request |
| pppoe_session_id | integer | 1 | Accounting-request |
| primary-dns | ipaddr | 1 | Access-accept |
| qos-policy-in | string | 1 | Access-accept, CoA |
| qos-policy-out | string | 1 | Access-accept, CoA |
| redirect-vrf | string | 1 | Access-accept |
| remote-id-tag | string | 1 | Access-request, Accounting-request |
| sa | string | 1 | Access-accept, CoA |
| sd | string | 1 | RADIUS CoA |
| secondary-dns | ipaddr | 1 | Access-accept |
| service-name | string | 1 | Accounting-request |
| Stateful-IPv6-Address-Pool | string | 1 | Access-accept |
| sub-pbr-policy-in | string | 1 | Access-accept, CoA |
| sub-qos-policy-in | string | 1 | Access-accept |
| sub-qos-policy-out | string | 1 | Access-accept |
| Tunnel-Client-endpoint | ipaddr | 1 | Access-accept, Accounting-request |
| tunnel-id | string | 1 | Access-accept |
| tunnel-medium-type | string | 1 | Access-accept |

| Name | Value | Type | Present in AAA message type |
|------------------------|---------|------|------------------------------------|
| Tunnel-Server-endpoint | ipaddr | 1 | Access-accept, Accounting-request |
| tunnel-tos-reflect | string | 1 | Access-accept |
| tunnel-tos-setting | integer | 1 | Access-accept |
| tunnel-type | string | 1 | Access-accept |
| username | string | 1 | Access-request, Accounting-request |
| vpdn-template | string | 1 | Access-accept |
| vpn-id | string | 1 | Access-accept |
| vpn-vrf | string | 1 | Access-accept |
| vrf-id | integer | 1 | Access-accept, Accounting-request |
| wins-server | ipaddr | 1 | Access-accept |

Vendor-Specific Attributes for Account Operations

Table 4: Supported Vendor-Specific Attributes for Account Operations

| RADIUS AVP | Value | Type | Action |
|-----------------------------------|--------|------|---------------------|
| subscriber:command=account-logon | string | 1 | account logon |
| subscriber:command=account-logoff | string | 1 | account logoff |
| subscriber:command=account-update | string | 1 | account update |
| subscriber:sa=<service-name> | string | 1 | service activate |
| subscriber:sd=<service-name> | string | 1 | service de-activate |

RADIUS ADSL Attributes

Table 5: Supported RADIUS ADSL Attributes

| Name | Value | Type |
|--------------------------------------|---------|------|
| Access-Loop-Encapsulation | binary | 144 |
| Actual-Interleaving-Delay-Downstream | integer | 142 |
| Actual-Interleaving-Delay-Upstream | integer | 140 |
| Actual-Data-Rate-Downstream | integer | 130 |
| Actual-Data-Rate-Upstream | integer | 129 |

| Name | Value | Type |
|--|----------------|------|
| Attainable-Data-Rate-Downstream | integer | 134 |
| Attainable-Data-Rate-Upstream | integer | 133 |
| Agent-Circuit-Id | string | 1 |
| IWF-Session | boolean social | 254 |
| Maximum-Interleaving-Delay-Downstream | integer | 141 |
| Maximum-Interleaving-Delay-Upstream | integer | 139 |
| Maximum-Data-Rate-Downstream | integer | 136 |
| Maximum-Data-Rate-Upstream | integer | 135 |
| Minimum-Data-Rate-Downstream | integer | 132 |
| Minimum-Data-Rate-Downstream-Low-Power | integer | 138 |
| Minimum-Data-Rate-Upstream | integer | 131 |
| Minimum-Data-Rate-Upstream-Low-Power | integer | 137 |
| Agent-Remote-Id | string | 2 |

RADIUS ASCEND Attributes

Table 6: Supported RADIUS Ascend Attributes

| Name | Value | Type |
|-----------------------------|----------|------|
| Ascend-Client-Primary-DNS | ipv4addr | 135 |
| Ascend-Client-Secondary-DNS | ipv4addr | 136 |
| Ascend-Connection-Progress | integer | 196 |
| Ascend-Disconnect-Cause | integer | 195 |
| Ascend-Multilink-Session-ID | integer | 187 |
| Ascend-Num-In-Multilink | integer | 188 |

RADIUS Microsoft Attributes

Table 7: Supported RADIUS Microsoft Attributes

| Name | Value | Type |
|--------------------|----------|------|
| MS-1st-NBNS-Server | ipv4addr | 30 |
| MS-2nd-NBNS-Server | ipv4addr | 31 |

| Name | Value | Type |
|------------------|----------|------|
| MS-CHAP-ERROR | binary | 2 |
| MS-Primary-DNS | ipv4addr | 28 |
| MS-Secondary-DNS | ipv4addr | 29 |

RADIUS Disconnect-Cause Attributes

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.

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 8: Supported Disconnect-Cause Attributes

| Cause Code | Value | Description |
|------------|-----------------------------|---|
| 0 | No-Reason | No reason is given for the disconnect. |
| 1 | No-Disconnect | The event was not disconnected. |
| 2 | Unknown | Reason unknown. |
| 3 | Call-Disconnect | The call has been disconnected. |
| 4 | CLID-Authentication-Failure | Failure to authenticate number of the calling-party. |
| 9 | No-Modem-Available | A modem is not available to connect the call. |
| 10 | No-Carrier | No carrier detected. Note Codes 10, 11, and 12 can be sent if there is a disconnection during initial modem connection. |
| 11 | Lost-Carrier | Loss of carrier. |
| 12 | No-Detected-Result-Codes | Failure to detect modem result codes. |

| Cause Code | Value | Description |
|------------|----------------------------|---|
| 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. Note 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. |
| 29 | Close-Virtual-Connection | User closes a virtual connection. |
| 30 | End-Virtual-Connection | Virtual connected has ended. |
| 31 | Exit-Rlogin | User exists Rlogin. |
| 32 | Invalid-Rlogin-Option | Invalid Rlogin option selected. |
| 33 | Insufficient-Resources | Insufficient resources. |
| 40 | Timeout-PPP-LCP | PPP LCP negotiation timed out. Note Codes 40 through 49 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. |

| Cause Code | Value | Description |
|------------|-------------------------------|--|
| 46 | PPP-Closed-Event | Upper layer requested that the session be closed. |
| 47 | NCP-Closed-PPP | PPP session closed because there were no NCPs open. |
| 48 | MP-Error-PPP | PPP session closed because of an MP error. |
| 49 | PPP-Maximum-Channels | PPP session closed because maximum channels were reached. |
| 50 | Tables-Full | Disconnect due to full terminal server tables. |
| 51 | Resources-Full | Disconnect due to full internal resources. |
| 52 | Invalid-IP-Address | IP address is not valid for Telnet host. |
| 53 | Bad-Hostname | Hostname cannot be validated. |
| 54 | Bad-Port | Port number is invalid or missing. |
| 60 | Reset-TCP | TCP connection has been reset. Note Codes 60 through 67 apply to Telnet or raw TCP sessions. |
| 61 | TCP-Connection-Refused | TCP connection has been refused by the host. |
| 62 | Timeout-TCP | TCP connection has timed out. |
| 63 | Foreign-Host-Close-TCP | TCP connection has been closed. |
| 64 | TCP-Network-Unreachable | TCP network is unreachable. |
| 65 | TCP-Host-Unreachable | TCP host is unreachable. |
| 66 | TCP-Network-Admin Unreachable | TCP network is unreachable for administrative reasons. |
| 67 | TCP-Port-Unreachable | TCP port in unreachable. |
| 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. |
| 150 | RADIUS-Disconnect | Disconnected by RADIUS request. |

| Cause Code | Value | Description |
|------------|----------------------------|---|
| 151 | Local-Admin-Disconnect | Administrative disconnect. |
| 152 | SNMP-Disconnect | Disconnected by SNMP request. |
| 160 | V110-Retries | Allowed V.110 retries have been exceeded. |
| 170 | PPP-Authentication-Timeout | PPP authentication timed out. |
| 180 | Local-Hangup | Disconnected by local hangup. |
| 185 | Remote-Hangup | Disconnected by remote end hangup. |
| 190 | T1-Quiesced | Disconnected because T1 line was quiesced. |
| 195 | Call-Duration | Disconnected because the maximum duration of the call was exceeded. |
| 600 | VPN-User-Disconnect | Call disconnected by client (through PPP). Code is sent if the LNS receives a PPP terminate request from the client. |
| 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. |

| Cause Code | Value | Description |
|------------|----------------------|---|
| 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. |
| 608 | VPN-Call-Redirect | VPN call redirect is enabled. |

