ASR9K BNG RADIUS and CoA deployment guide

Part 1

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Executive summary

The purpose of this document is to address the questions related to the use of RADIUS attribute in ASR9K BNG deployment, and help network engineers inside and outside of Cisco to deploy BNG easier, especially on the interoperation between ASR9K BNG and RADIUS backend system.

- How does ASR9K BNG work with the radius server/COA client for AAA?
- What's the call flow for each step of ASR9K-AAA communication?
- What does the typical radius/COA message look like ?
- What attributes are supposed to be in what message ?
- What's the supported IETF/Cisco vender specific attribute in the ASR9K BNG.
- What's the different between IOS and IOS XR regarding radius implementation?
- What's the correct format for each attribute?
- To complement a specific task, what attributes are needed?
- Anything else need to know about the AAA?

This document could be used as a complementary document to the "Cisco ASR 9000 Series Aggregation Services Router Broadband Network Gateway Configuration Guide" published on www.cisco.com.

This is the part 1 of this document , focusing on the Authentication, Authorization and CoA/PoD.

Part 2 will focus on Accounting.

For more useful external ASR9000 BNG technical articles, please visit https://supportforums.cisco.com/document/12253636/asr9000-bng-links

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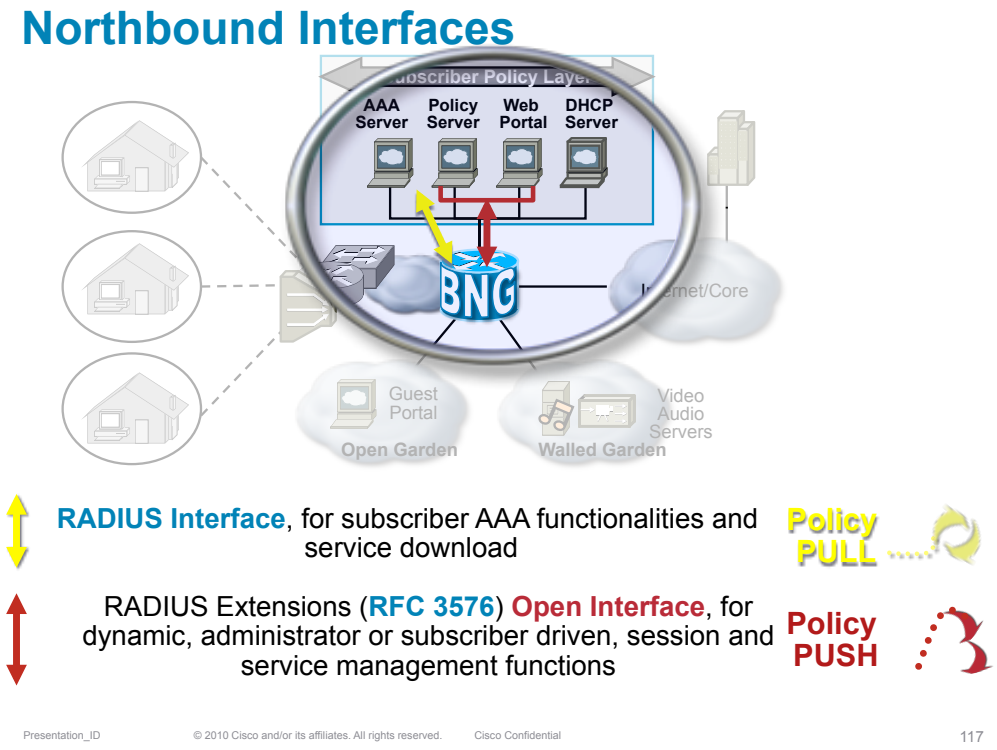
1. Chapter 1, ASR9K's RADIUS overview

1.1. BNG relationship with RADIUS SERVER

ASR9K BNG acts as a policy enforcement point in the network, it works via two northern bound interfaces, RADIUS and COA, with external backend system for subscriber management.



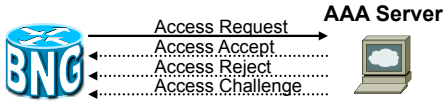
ASR9K works with AAA in two ways.

1, BNG is a RADIUS client, sending radius request to a external RADIUS server(pull mode).

Following actions are under this model.

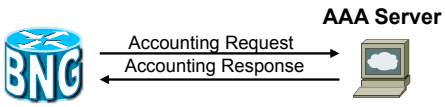
- Authentication for session or service
- Authorization for session or service
- Accounting for session or service

RADIUS Interface—Access Request



- Access Request is used for
  - Session Authentication
  - Session Authorization
  - Service Profile Download
- Access Accept is used to return
  - Credential Verification Notification
  - User profile and associated services
  - Service Profile Download
- Access Reject is used for
  - Credential Verification Failure Notification
- Access Challenge is used for
  - PPP CHAP Authentication

RADIUS Interface—Accounting Request

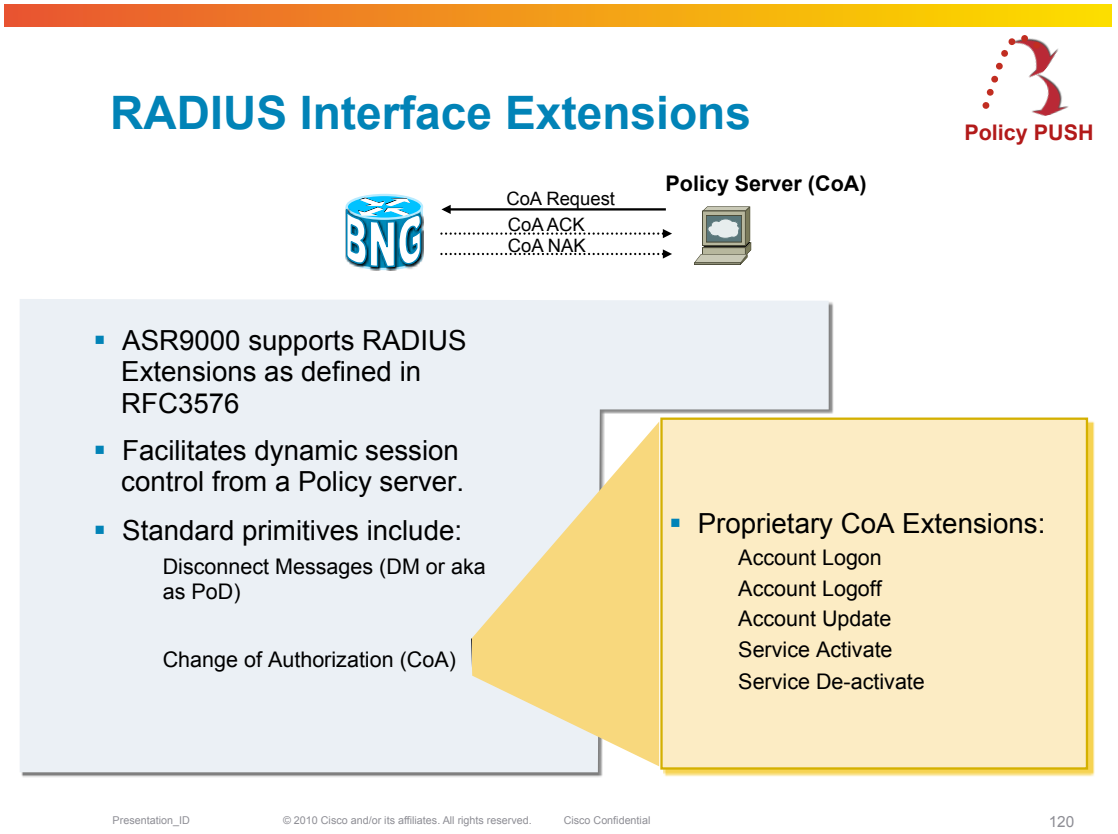


- Accounting Request Start is used to signal
  - Session Start
- Accounting Request Stop is used to signal
  - Session Termination
- Accounting Request Interim is used to
  - Provide interval counters

2, BNG is a COA server, receiving COA request from a external COA client.(push mode)

Following actions are under this model.

- Account-logon
- Account-logoff (also known as PoD or MS)
- Account-update.
- Service-activate
- Service-deactivate



1.2. BNG RADIUS configuration task

To enable an ASR9K BNG to work together with external RADIUS server/COA client, you need to complete following basic configuration on ASR9K. Also, you need to do some basic configuration in radius server/COA client accordingly. Information needed to be configured on both sides and match each other.

For radius

- Radius client/server IP address
- UDP Port used for authentication and accounting
- Share key

For COA

- COA client/server IP address
- UDP Port used for COA communication
- Share key

Here is an basic AAA configuration as an example .

```
radius-server host 172.18.88.223 auth-port 1812 acct-port 1813
 key 7 110A1016141D5A5E57
!
radius-server host 192.168.200.221 auth-port 1812 acct-port 1813
 key 7 104D000A061843595F

!
aaa server radius dynamic-author
 port 1700
 client 192.168.200.223 vrf default
  server-key 7 030752180500701E1D


aaa group server radius S99_GRP1
 server 192.168.200.221 auth-port 1812 acct-port 1813
 source-interface MgmtEth0/RSP0/CPU0/0
!
aaa group server radius S99_GRP2
 server 172.18.88.223 auth-port 1812 acct-port 1813
 source-interface Loopback99

aaa accounting subscriber S99_AAA_list broadcast group S99_GRP1 group
S99_GRP2
```

```
aaa authorization subscriber S99_AAA_list group S99_GRP1 group
S99_GRP2
aaa authentication subscriber S99_AAA_list group S99_GRP1 group
S99_GRP2
```

1.3. RADIUS attributes

1.3.1.ASR9K BNG supported RADIUS attributes

There is a list of supported radius attribute in the section of "RADIUS attributes" of "Cisco ASR 9000 Series Aggregation Services Router Broadband Network Gateway Configuration Guide". You can find the latest version here http://www.cisco.com/c/en/us/td/docs/routers/asr9000/software/asr9k_r5-2/bng/configuration/guide/b-bng-cg52xasr9k/b-bng-cg52xasr9k_appendix_01001.html#reference_F61E65B1915C49D5B1C402B9513D355D (some supported attributes are missing in the above document but will be explained in this deployment guide).

Unfortunately, above document only tells what attributes are supported , but it dose not explain what attributes are supposed to be in what radius message, or what information will be carried by what attribute, or how to build the user-profile to use those attributes to achieve a certain session configuration.

1.3.2.Cisco AVPair overview

Besides supporting most of the IETF radius attributes, Cisco ASR9K BNG uses cisco VSA to achieve many goals.

Cisco VSA always started with type 26, and vendor-id 9, followed by various of string.

Type = 26	Length	Vendor-Id Cisco = 9, Ascend = 529
Vendor Id (cont)		String

Among the Cisco VSA, Cisco AV-pair is the most popular format for ASR9K to use to communicate to the RADIUS server or CoA client.

Cisco AV-pair is the Cisco VSA with vendor type 1,which is a cleartext AV-Pair.

Besides the Cisco-AVpair with Vendor type 1, there are other Cisco VSA with vendor type from 2 to other 255, but ASR9K BNG does not use them as of now, with the known exception of Cisco VSA Cisco-NAS-Port (with vendor type 2) used in access-request and accounting-request , and Subscriber-Password. (with vendor type 249) used in CoA request to carry the encrypted password.

Regarding Cisco-AVPair, under the same format(type 26, vendor-Id 9, vendor type 1) , there could be different string in the attribute-specific part(string is the

only supported type). In this way we can use Cisco-AVpair to present different "Attribute=Value" straight-forwardly . The attribute-specific string could be divided to 3 parts.

Cisco-Avpair = "protocol:attribute=value"

For example

```
Cisco-avpair = "ip:ipv4-mtu=1480"
```

to specify ipv4 mtu to 1480

```
Cisco-avpair = "ip:addr-pool=pppoe_pool2"
```

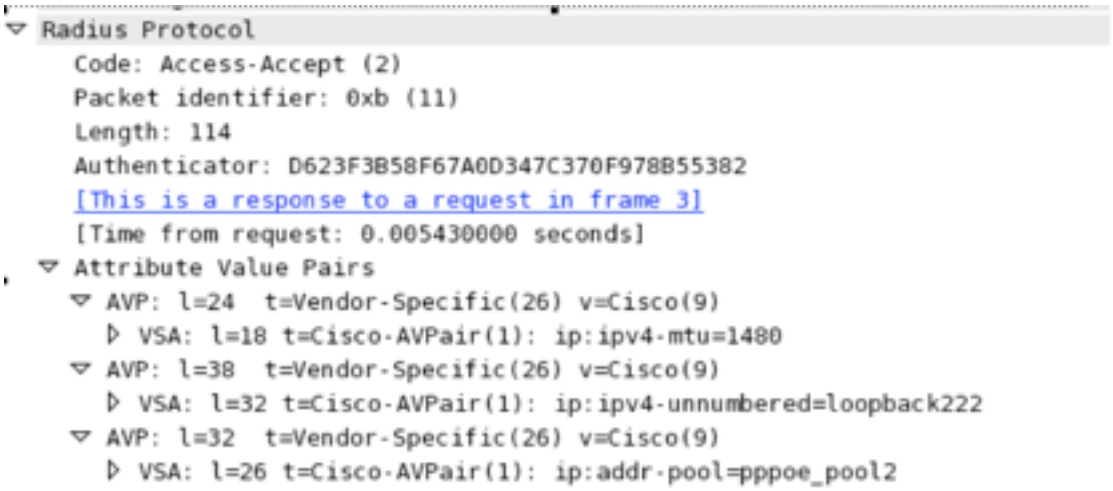
to specify the name of the ip pool to pppoe_pool2

To better understand how Cisco-AVPair works, following are an example how to construct an user profile in the users.conf file in a FreeRADIUS server, and the accordingly radius packet captured and displayed in wireshark.

User profile in radius server

```
User@domain.com Auth-Type := Local, User-Password == "cisco"
        Cisco-avpair = "ip:ipv4-mtu=1480",
        Cisco-avpair += "ip:ipv4-unnumbered=Loopback222",
        Cisco-avpair += "ip:addr-pool=pppoe_pool2"
```

Radius packet decoding



1.3.3.key explanations for Cisco AVPair for ASR9K BNG

Here are some things need to highlight regarding the Cisco AV-Pair.

- In a single radius message, there may be more than one Cisco-Avpair(they share the same format -type 26, vendor-Id 9, vendor type 1) included， so the radius server need to support including multiple VSA with same type in the same message.

- The protocol part before the colon in Cisco-AVpair will be ignored by IOS XR BNG implementation(but the protocol part is meaningful under IOS). For the sake of compatibility, it's OK to keep the protocol part in Cisco-AVpair defined in the existing backend system. For instance, for ASR9K BNG, following Cisco-AVpair are equivalent to each other.

Cisco-avpair = "ip:ipv4-unnumbered=Loopback222"
Cisco-avpair = "ipv4-unnumbered=Loopback222"
Cisco-avpair = "ipv4:ipv4-unnumbered=Loopback222"

- Not all of the Cisco-AVpair supported by IOS based BRAS/ISG get supported by IOS XR based BNG implementation. An unsupported Cisco AV-Pair or VSA from other vendor in a access-accept would cause the failure of session establishment and marked as “PAP failed” although the BNG get an access-accept from radius server. In following case, there is a Cisco-avpair = “wins-server=1.1.1.1" in the access-accept which is not supported by BNG.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  disconnect-history   last
Tue May  6 16:17:05.734 UTC

[ IEDGE DISCONNECT HISTORY LAST SESSIONS ]

 Location: 0/RSP0/CPU0

Disconnect Reason:        PAP Authentication failed
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_PPP_PAP_FAIL (25)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_USER_ERROR (17)
Time Disconnected:        2014:05:06 16:13:05
Client:                   ppp_ma
Subscriber Label:         0x0000007d
Interface:                BE101.99.pppoe1555

[ Session Info ]

Interface:                Unknown
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE
IPv4 State:               Up Pending, Tue May  6 16:13:01 2014
IPv6 State:               Up Pending, Tue May  6 16:13:01 2014
Mac Address:              3c07.545f.c041
Account-Session Id:       00000613
Nas-Port:                 1694524691
User name:                PPP_SUPER@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x0000007d
Created:                  Tue May  6 16:13:01 2014
State:                    Connected
Authentication:           unauthenticated
Authorization:            unauthorized
Ifhandle:                 0x0000af20
Session History ID:       0
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Tue May  6 16:13:01 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Tue May  6 16:13:05 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: 'AAA_BASE' detected the 'fatal'
condition 'Bad response or attribute not defined'][aaa: Error]
```

```
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA: None
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003b
  Type        : Template
  Status      : Applied
------------------------
[Event History]
   May  6 16:13:01.952 SUBDB produce done
```

To prevent this from happened, a CLI could be used.

```
radius-server vsa  attribute  ignore unknown
```

- Some Cisco-AVpair is exchangeable to some IETF standard attribute or adsl-vsa, another words, it is identical to use a Cisco-AVPair or an IETF standard attribute to achieve a certain goal when applicable. Following example shows that you can use either a Cisco-AVpair or an IETF attribute to specify the ipv4 pool from which an IPv4 address is assigned to a session.

IETF standard attribute:

```
 Framed-IP-Pool = pppoe_pool2
```

Cisco-AVpair:

```
Cisco-avpair = “ip:addr-pool=pppoe_pool2”
```

- There is a way to use CLI to display the radius attributes downloaded to a session upon authentication/authorization as part of the user-profile, but you may find that the name of the attribute displayed by CLI is not identical to the name of the radius attribute defined in the radius server. The reason is that the CLI displayed AAA attributes are internal named, to which one or more

RADIUS attributes are mapping. That fact also explains why we can use either a cisco-AVPair or a IETF attributes to fill the same AAA attribute in some case.

For example

IETF standard attribute： Framed-IP-Pool = S99_POOL_PPPV4_VRF

or Cisco-AVpair： Cisco-avpair = “ip:addr-pool= S99_POOL_PPPV4_VRF”

is mapping(or translated) to internal aaa attribute

addr-pool with value S99_POOL_PPPV4_VRF

when you issue the CLI “show subscriber session all detail internal”, you get following display.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all detail  internal
Mon May  5 11:22:14.972 UTC
Interface:               Bundle-Ether101.99.pppoe1520

… display snippet…
User Profile received from AAA:
 Attribute List: 0x500f9ff0
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
```

.

2. Chapter 2, how RADIUS/CoA attribute work on a session

2.1.AAA attribute and RADUS attribute

Here the term of AAA attribute is not identical to the RADIUS attribute. AAA Attribute has been defined internally in the BNG implementation essentially, for the purpose of session identity or configuration.

Roughly speaking there are two kinds of AAA attribute.

- **Identity/credential attributes**, for example, username, password, pppoe-session-id,client-mac-address, physical-port etc.
- **Configuration attribute**, for example, inacl, outacl, addr, primary-dns etc.

The information of identity/credential AAA attributes are normally extracted from other source and may be translated to radius attributes which are included in the radius access-request or accounting-request message to report to external RADIUS server.

On the contrary , the configuration AAA attributes normally come from CLI (dynamic-template) or external RADIUS server on reception of an access-accept message during authentication or CoA request. BNG will parse the radius attribute, build the AAA attributes accordingly and store them in somewhere for other usage, such as building the configuration block of a session.

Every supported radius attribute(standard of VSA) has an AAA attributes to map to , but please be noted that not all of the AAA attributes will be communicated from/to an external RADIUS server, hence, not all of the AAA attributes has a 1:1 mapping radius attribute. For example, there is an AAA attribute called “if-handle”, which is an internal information only used by other process/component, and it is not reported to radius server since RADIUS server do not need or understand this kind of information.

Essentially, AAA attributes are the internal data structures, and radius attributes are the containers of information from/to external RADIUS server. RADIUS attributes sent to RADIUS server are retrieved from AAA attributes , and the

radius attributes download from external RADIUS server are interpreted to AAA attributes to store in the database on the BNG and used by other components.

The reason why it's needed to explain the difference and relationship between AAA attributes and RADIUS attributes is that some of the debug/show display present only AAA attributes. This may make people confused, in case people do want to see what radius attributes are downloaded and applied to a session. There are a mapping table between internal AAA attributes and radius attributes http://wikicentral.cisco.com/display/GROUP/AAA+Attribute+Mapping, but it's an Cisco internal link and not accessible to people out off cisco. Fortunately, most of the AAA attributes name are self-explaining and identical to the name its RADUS AVPair counterpart.

2.1.1.show downloaded RADIUS attribute

Following is the show command to display the radius attributes downloaded from radius server during in access-accept.

```
RP/0/RSP0/CPU0:Roy_BNG_1#show subscriber  session filter  username  PPP2@S99
detail  internal
Thu Jul 17 00:50:55.992 UTC
Interface:                Bundle-Ether101.99.pppoe7
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Thu Jul 17 00:39:12 2014
IPv4 Address:             1.1.99.253, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Down, Thu Jul 17 00:39:11 2014
Mac Address:              a857.4e06.4f47
Account-Session Id:       00000007
Nas-Port:                 1694524679
User name:                PPP2@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000046
Created:                  Thu Jul 17 00:39:11 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x00001520
Session History ID:       1
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Thu Jul 17 00:39:11 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
```

```
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Thu Jul 17 00:39:12 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting:
  Acct-Session-Id:          00000007
  Method-list:              S99_AAA_list
  Accounting started:       Thu Jul 17 00:39:12 2014
  Interim accounting:       On, interval 10 mins
    Last successful update: Thu Jul 17 00:49:13 2014
    Next update in:         00:08:17 (dhms)
    Last update sent:       Thu Jul 17 00:49:13 2014
    Updates sent:           1
    Updates accepted:       1
    Updates rejected:       0
    Update send failures:   0
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9f68
1:  ipv4-unnumbered len= 12  value= Loopback1099
2:  addr-pool       len= 14  value= S99_POOL_PPPV4
3:  accounting-list len= 12  value= S99_AAA_list
4:  acct-interval   len=  4  value= 600(258)
5:  primary-dns     len=  4  value= 222.8.8.8
6:  secondary-dns   len=  4  value= 222.9.9.9
7:  session-timeout len=  4  value= 3600(e10)
8:  route           len= 30  value= 192.168.200.99 255.255.255.255
9:  sub-qos-policy-in len= 20  value= S99_IN_POLICING_256K
10:  sub-qos-policy-out len= 21  value= S99_OUT_POLICING_512K
11:  outacl          len= 11  value= S99_ACL_out
12:  inacl           len= 10  value= S99_ACL_in
13:  addr            len=  4  value= 1.1.99.253
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005a
  Type        : Template
  Status      : Applied
-------------------------
[Last IPv6 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   Jul 17 00:39:12.512 SUBDB produce done [many]
   Jul 17 00:39:12.512 IPv4 Up
```

Comparing to following log message from radius server, you will find

- Above show command give attribute list with the AAA attribute name rather than radius attribute name.

- For radius attribute cisco AVpair, the AAA attribute name is identical to the AVpair name, but for IETF standard radius attributes , the RADIUS AAA attribute name is different, but not difficult to guess what is what.

```
Sending Access-Accept of id 34 to 192.168.88.99 port 18253
      Cisco-AVPair = "ipv4-unnumbered=Loopback1099"
      Cisco-AVPair += "addr-pool=S99_POOL_PPPV4"
      Cisco-AVPair += "accounting-list=S99_AAA_list"
      Acct-Interim-Interval += 600
      Cisco-AVPair += "primary-dns=222.8.8.8"
      Cisco-AVPair += "secondary-dns=222.9.9.9"
      Session-Timeout += 3600
      Framed-Route += "192.168.200.99 255.255.255.255"
      Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K"
      Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
      Cisco-AVPair += "outacl=S99_ACL_out"
      Cisco-AVPair += "inacl=S99_ACL_in"
      Framed-IP-Address += 1.1.99.253
```

2.1.2.debug command to display radius attributes

“debug radius” (could run with filter like “debug radius filter mac-address”)CLI directly gives the name of the radius attributes and it’s content , but there is a bug CSCuh48079 causing some of the cisco AV-pair could not be decoded correctly , and it will be fixed in 5.2.0 and 5.1.3 release.

```
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS: Send Access-Request to 172.18.88.221:1812 id
39, len 243
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  authenticator 20 74 C6 01 CA 67 E1 2B - E3 88
9C 68 05 36 BA 89
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    41
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  NAS-Port            [5]     6
1694524680
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  NAS-Port-Id         [87]    16
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    22
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  User-Name           [1]     10      PPP2@S99
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Service-Type        [6]     6       Framed[0]
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  User-Password      [2]     18      *
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]: Unsuppoted attribute.
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    33
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Framed-Protocol     [7]     6       PPP[0]
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  NAS-Port-Type       [61]    6       Virtual
PPPoEoQinQ[0]
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Called-Station-Id   [30]    4       99
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Calling-Station-Id  [31]    16
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Event-Timestamp     [55]    6
1405559130
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Nas-Identifier      [32]    11      Roy_BNG_1
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  NAS-IP-Address      [4]     6
192.168.88.99
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]:  RADIUS:  Acct-Session-Id     [44]    10      00000008
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]: Using global deadtime = 0 sec
RP/0/RSP0/CPU0:Jul 17 01:05:30.917 : radiusd[1117]: Start timer thread rad_ident 39 remote_port 1812
remote_addr 0xac1258dd, socket 1342483648 rctx 0x500f7848
```

```
RP/0/RSP0/CPU0:Jul 17 01:05:30.917 : radiusd[1117]: Successfully sent packet and started timeout handler
for rctx 0x500f7848
RP/0/RSP0/CPU0:Jul 17 01:05:30.916 : radiusd[1117]: Got global deadtime 0
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]: rctx found is 0x500f7848
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]: Radius packet decryption complete with rc = 0
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:  authenticator F0 FF 82 CD BC 76 76 72 - FD 8E
55 27 90 8F 8C 9D
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    36
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    32
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    36
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS: Received from id 39 172.18.88.221:1812,
Access-Accept, len 389
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:  Acct-Interim-Interval[85]    6       600
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    29
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    31
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:  Session-Timeout     [27]    6       3600
RP/0/RSP0/CPU0:Jul 17 01:05:30.956 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    46
RP/0/RSP0/CPU0:Jul 17 01:05:30.955 : radiusd[1117]:  RADIUS:  Framed-Route        [22]    32
192.168.200.99 255.255.255.255
RP/0/RSP0/CPU0:Jul 17 01:05:30.956 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    26
RP/0/RSP0/CPU0:Jul 17 01:05:30.956 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    24
RP/0/RSP0/CPU0:Jul 17 01:05:30.956 : radiusd[1117]:  RADIUS:  Class               [25]    11      S99_PPPOE
RP/0/RSP0/CPU0:Jul 17 01:05:30.956 : radiusd[1117]:  RADIUS:  Framed-IP-Address   [8]     6
1.1.99.253
```

2.1.3.debug command to display internal AAA attributes

Another debug command “debug aaa-sub all” display the information of AAA attributes related to the session, see following example for the same session.

```
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 17 01:13:21.722 : iedged[246]: [AAA_BASE:client] nas-port-type
not configured on interface.
RP/0/RSP0/CPU0:Jul 17 01:13:21.722 : iedged[246]: [AAA_BASE:client] Nas-Port format selected :
PPPPPPPPVVVVVVVVVVVVVVVVUUUUUUUU.
RP/0/RSP0/CPU0:Jul 17 01:13:21.722 : iedged[246]: [AAA_BASE:client] adding formatted nas-port : 1694524681
RP/0/RSP0/CPU0:Jul 17 01:13:21.722 : iedged[246]: [AAA_BASE:client] adding formatted nas-port-id :
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:13:21.722 : iedged[246]: [AAA_BASE:client] aaa radius attribute format
FORMAT_CALLED_STATION_ID
RP/0/RSP0/CPU0:Jul 17 01:13:21.723 : iedged[246]: [AAA_BASE:client] format FORMAT_CALLED_STATION_ID found
in data base
RP/0/RSP0/CPU0:Jul 17 01:13:21.723 : iedged[246]: [AAA_BASE:client] formatted string 99,length = 2
RP/0/RSP0/CPU0:Jul 17 01:13:21.723 : iedged[246]: [AAA_BASE:client] aaa radius attribute format
FORMAT_CALLING_STATION_ID
RP/0/RSP0/CPU0:Jul 17 01:13:21.723 : iedged[246]: [AAA_BASE:client] format FORMAT_CALLING_STATION_ID found
in data base
RP/0/RSP0/CPU0:Jul 17 01:13:22.812 : iedged[246]: [AAA_BASE:client]  aaa_base_req_alloc:Allocated aaa base
req structure 50baa4d8, 50d2b9a8
RP/0/RSP0/CPU0:Jul 17 01:13:22.812 : iedged[246]: [AAA_BASE:client]  aaa_base_req_request_init: Setting the
req param for req type 1073725228
RP/0/RSP0/CPU0:Jul 17 01:13:22.812 : iedged[246]: [AAA_BASE:client]  aaa_base_req_set_context: Setting the
context structure for the aaa req
RP/0/RSP0/CPU0:Jul 17 01:13:22.812 : iedged[246]: [AAA_BASE:client]  aaa_base_req_set_callback: Setting the
callback function for the req
RP/0/RSP0/CPU0:Jul 17 01:13:22.812 : iedged[246]: [AAA_BASE:client]  aaa_base_req_add_attr_list: Setting
the attribute list for the req
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:client]   Attribute List --   1:  if-handle
len=  4  5536(15a0)  2:  client-mac-address len= 14  a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_api: AAA Base
Server Pulse handler-Received 0 msg type
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: FSM
State: INIT Event:0
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: Added
req in hash table id 43
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:client]  aaa_base_req_send: Sending the req
request from Client to Server
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 0 Server Group Name: S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 1 Server Group Name: S99_GRP2
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 2 Server Group Name:
```

```
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 3 Server Group Name:
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init:
broadcast is NOTSET
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm] aaa_base_req_handle_fsm_state_init: Named
server group is selected
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: First
Server group selected S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic] Attribute List: 0x50d2bdc8
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init:
Method List S99_AAA_list
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  1:  if-handle       len=  4
5536(15a0)
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  3:  string-session-id len=  8
00000009
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  4:  nas-port        len=  4
1694524681(65006509)
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  5:  interface       len= 14
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  6:  username        len=  8  PPP2@S99
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  7:  protocol-type   len=  4  ppp
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  8:  service-type    len=  4  Framed
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  9:  authen-type     len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>pap
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  10:  password        len=  5  svc<0>
prot<0> tag<0> mand<1> client<0x0><opaque value>
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  11:  connect-progress len=  4  LCP
Open
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  12:  Framed-Protocol len=  4  PPP
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  13:  parent-if-handle len=  4
4704(1260)
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  14:  port-type       len=  4  Virtual
PPPoE over QinQ
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  15:  dnis            len=  2  99
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  16:  formatted-clid  len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  17:  Event-Timestamp len=  4
1405559602(53c72332)
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  18:  inner-vlan-id   len=  4  99(63)
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic]  19:  outer-vlan-id   len=  4  101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 0  Application id 0
RP/0/RSP0/CPU0:Jul 17 01:13:22.813 : iedged[246]: [AAA_BASE:generic]  2:  client-mac-address len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_send: sent msg ipc_send
passed buf_len: 368
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_alloc:Allocated aaa
base req structure 5013a898, 5013add8
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : radiusd[1117]: [AAA_BASE:generic] Attribute List: 0x5013b1ac
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : radiusd[1117]: [AAA_BASE:generic]  1:  if-handle       len=  4
5536(15a0)
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : radiusd[1117]: [AAA_BASE:generic]  2:  client-mac-address len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  3:  string-session-id len=  8
00000009
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  4:  nas-port        len=  4
1694524681(65006509)
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  5:  interface       len= 14
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  6:  username        len=  8
PPP2@S99
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  7:  protocol-type   len=  4  ppp
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  8:  service-type    len=  4  Framed
RP/0/RSP0/CPU0:Jul 17 01:13:22.814 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_aipc_handle_aaa_base_msg:
Received IPC message Type 0 App type 0
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  10:  password        len=  5
svc<0> prot<0> tag<0> mand<1> client<0x0><opaque value>
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  11:  connect-progress len=  4  LCP
Open
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  12:  Framed-Protocol len=  4  PPP
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  13:  parent-if-handle len=  4
4704(1260)
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  14:  port-type       len=  4
Virtual PPPoE over QinQ
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  15:  dnis            len=  2  99
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  16:  formatted-clid  len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  17:  Event-Timestamp len=  4
1405559602(53c72332)
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  18:  inner-vlan-id   len=  4
99(63)
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  19:  outer-vlan-id   len=  4
101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: FSM
State: INIT Event:3
```

```
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:AAA Base
Client Handler...
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:Calling
client call back function
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:fsm]  aaa_base_handle_aaa_msg: Invoking call
back function for app type 0
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:generic]  9:  authen-type     len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>pap
RP/0/RSP0/CPU0:Jul 17 01:13:22.815 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_get_server_group_name:
Server group name: S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:22.855 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_add_attr_list: Setting
the attribute list for the req
RP/0/RSP0/CPU0:Jul 17 01:13:22.855 : radiusd[1117]: [AAA_BASE:client]   Attribute List --   1:  ipv4-
unnumbered len= 12  svc<0> prot<0> tag<0> mand<1> client<0x0>Loopback1099  2:
RP/0/RSP0/CPU0:Jul 17 01:13:22.855 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_api: AAA Base
Server Pulse handler-Received 1 msg type
RP/0/RSP0/CPU0:Jul 17 01:13:22.855 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_authen_received: FSM State: AUTHEN RECEIVED Event:6
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic] Attribute List: 0x5013b1ac
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  1:  ipv4-unnumbered len= 12  svc<0>
prot<0> tag<0> mand<1> client<0x0>Loopback1099
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  2:  addr-pool       len= 14  svc<0>
prot<0> tag<0> mand<1> client<0x0>S99_POOL_PPPV4
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  3:  accounting-list len= 12  svc<0>
prot<0> tag<0> mand<1> client<0x0>S99_AAA_list
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  4:  acct-interval   len=  4  svc<0>
prot<0> tag<0> mand<0> client<0x0>600(258)
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  5:  primary-dns     len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>222.8.8.8
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  6:  secondary-dns   len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>222.9.9.9
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  7:  session-timeout len=  4  svc<0>
prot<0> tag<0> mand<0> client<0x0>3600(e10)
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  8:  route           len= 30  svc<0>
prot<0> tag<0> mand<0> client<0x0>192.168.200.99 255.255.255.255
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  9:  sub-qos-policy-in len= 20
svc<0> prot<0> tag<0> mand<1> client<0x0>S99_IN_POLICING_256K
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  10:  sub-qos-policy-out len= 21
svc<0> prot<0> tag<0> mand<1> client<0x0>S99_OUT_POLICING_512K
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  11:  outacl          len= 11
svc<0> prot<0> tag<0> mand<1> client<0x0>S99_ACL_out
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  12:  inacl           len= 10
svc<0> prot<0> tag<0> mand<1> client<0x0>S99_ACL_in
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  13:  class           len=  9
svc<0> prot<0> tag<0> mand<0> client<0x0>53 39 39 5f 50 50 50 4f 45
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  14:  addr            len=  4
svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.253
RP/0/RSP0/CPU0:Jul 17 01:13:22.856 : radiusd[1117]: [AAA_BASE:generic]  15:  Authentic       len=  4
svc<0> prot<0> tag<0> mand<1> client<0x0>RADIUS
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_send: sent msg
ipc_send passed buf_len: 448
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_free: Freeing the aaa
base req structure 5013a898, 5013add8
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 1 App type 0 id 43
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_authen_sent: FSM State: AUTHEN SENT Event:9
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_authen_sent: Received PASS status from radius
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:AAA Base
Client Handler...
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:Calling
client call back function
RP/0/RSP0/CPU0:Jul 17 01:13:22.857 : iedged[246]: [AAA_BASE:client]  aaa_base_req_free: Freeing the aaa
base req structure 50baa4d8, 50d2b9a8
RP/0/RSP0/CPU0:Jul 17 01:13:23.017 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_client_handler client
context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 17 01:13:23.017 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_client_handler:
IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 368
RP/0/RSP0/CPU0:Jul 17 01:13:23.051 : iedged[246]: [AAA_BASE:client]  aaa_base_req_alloc:Allocated aaa base
req structure 50d2b9a8, 50baa4d8
RP/0/RSP0/CPU0:Jul 17 01:13:23.051 : iedged[246]: [AAA_BASE:client]  aaa_base_req_request_init: Setting the
req param for req type 1073725240
RP/0/RSP0/CPU0:Jul 17 01:13:23.051 : iedged[246]: [AAA_BASE:client]  aaa_base_req_set_context: Setting the
context structure for the aaa req
RP/0/RSP0/CPU0:Jul 17 01:13:23.051 : iedged[246]: [AAA_BASE:client]  aaa_base_req_set_callback: Setting the
callback function for the req
RP/0/RSP0/CPU0:Jul 17 01:13:23.051 : iedged[246]: [AAA_BASE:client]  aaa_base_req_add_attr_list: Setting
the attribute list for the req
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:client]   Attribute List --   1:  acct-interval
len=  4  svc<0> prot<0> tag<0> mand<1> client<0x0>600(258)  2:  Acc
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:client]  aaa_base_req_send: Sending the req
request from Client to Server
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_api: AAA Base
Server Pulse handler-Received 4 msg type
```

```
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: FSM
State: INIT Event:2
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: Added
req in hash table id 44
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init:
Method List S99_AAA_list
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 0 Server Group Name: S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 1 Server Group Name: S99_GRP2
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 2 Server Group Name:
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]   aaa_base_req_handle_fsm_state_init:
Method List: 3 Server Group Name:
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init:
broadcast is NOTSET
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm] aaa_base_req_handle_fsm_state_init: Named
server group is selected
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: First
Server group selected S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic] Attribute List: 0x50baa62c
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  1:  acct-interval   len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>600(258)
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  2:  Acct-Status-Type len=  4  Start
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  3:  Event-Timestamp len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>1405559603(53c72333)
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  4:  parent-if-handle len=  4
4704(1260)
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  5:  port-type       len=  4  Virtual
PPPoE over QinQ
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  6:  outer-vlan-id   len=  4  101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:23.052 : iedged[246]: [AAA_BASE:generic]  7:  inner-vlan-id   len=  4  99(63)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  8:  protocol-type   len=  4  ppp
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  9:  if-handle       len=  4
5536(15a0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  10:  client-mac-address len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  11:  string-session-id len=  8
00000009
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  12:  nas-port        len=  4
1694524681(65006509)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  13:  interface       len= 14
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  14:  dnis            len=  2  99
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  15:  formatted-clid  len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  16:  username        len=  8
PPP2@S99
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  17:  addr            len=  4
1.1.99.253
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  18:  Authentic       len=  4  RADIUS
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  19:  class           len=  9  53 39
39 5f 50 50 50 4f 45
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  20:  vrf-id          len=  4
1610612736(60000000)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  21:  route           len= 40
192.168.200.99 255.255.255.255 0.0.0.0 1
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  22:  ipv4-session-state len=  1  true
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  23:  physical-subslot len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  24:  physical-adapter len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  25:  physical-slot   len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  26:  physical-chassis len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  27:  physical-port   len=  4  101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  28:  pppoe-session-id len=  4  9(9)
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  29:  Framed-Protocol len=  4  PPP
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  30:  service-type    len=  4  Framed
RP/0/RSP0/CPU0:Jul 17 01:13:23.053 : iedged[246]: [AAA_BASE:generic]  31:  connect-progress len=  4  IPCP
Open
RP/0/RSP0/CPU0:Jul 17 01:13:23.054 : iedged[246]: [AAA_BASE:generic]  32:  password        len=  5  <opaque
value>
RP/0/RSP0/CPU0:Jul 17 01:13:23.054 : iedged[246]: [AAA_BASE:generic]  33:  accounting-type len=  4
subscriber
RP/0/RSP0/CPU0:Jul 17 01:13:23.054 : iedged[246]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 4  Application id 0
RP/0/RSP0/CPU0:Jul 17 01:13:23.054 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_send: sent msg ipc_send
passed buf_len: 575
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_aipc_handle_aaa_base_msg:
Received IPC message Type 4 App type 0
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_alloc:Allocated aaa
base req structure 5013a898, 5013add8
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic] Attribute List: 0x5013b1ac
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  1:  acct-interval   len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>600(258)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  2:  Acct-Status-Type len=  4  Start
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  3:  Event-Timestamp len=  4  svc<0>
prot<0> tag<0> mand<1> client<0x0>1405559603(53c72333)
```

```
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  4:  parent-if-handle len=  4
4704(1260)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  5:  port-type       len=  4
Virtual PPPoE over QinQ
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  6:  outer-vlan-id   len=  4
101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  7:  inner-vlan-id   len=  4  99(63)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  8:  protocol-type   len=  4  ppp
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  9:  if-handle       len=  4
5536(15a0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  10:  client-mac-address len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  11:  string-session-id len=  8
00000009
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  12:  nas-port        len=  4
1694524681(65006509)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  13:  interface       len= 14
0/0/101/99.101
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  14:  dnis            len=  2  99
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  15:  formatted-clid  len= 14
a857.4e06.4f47
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  16:  username        len=  8
PPP2@S99
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  17:  addr            len=  4
1.1.99.253
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  18:  Authentic       len=  4
RADIUS
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  19:  class           len=  9  53 39
39 5f 50 50 50 4f 45
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  20:  vrf-id          len=  4
1610612736(60000000)
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  21:  route           len= 40
192.168.200.99 255.255.255.255 0.0.0.0 1
RP/0/RSP0/CPU0:Jul 17 01:13:23.055 : radiusd[1117]: [AAA_BASE:generic]  22:  ipv4-session-state len=  1
true
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  23:  physical-subslot len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  24:  physical-adapter len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  25:  physical-slot   len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  26:  physical-chassis len=  4  0(0)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  27:  physical-port   len=  4
101(65)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  28:  pppoe-session-id len=  4  9(9)
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  29:  Framed-Protocol len=  4  PPP
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  30:  service-type    len=  4
Framed
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  31:  connect-progress len=  4  IPCP
Open
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  32:  password        len=  5
<opaque value>
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  33:  accounting-type len=  4
subscriber
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_init: FSM
State: INIT Event:5
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:AAA Base
Client Handler...
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:Calling
client call back function
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:fsm]  aaa_base_handle_aaa_msg: Invoking call
back function for app type 0
RP/0/RSP0/CPU0:Jul 17 01:13:23.056 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_get_server_group_name:
Server group name: S99_GRP1
RP/0/RSP0/CPU0:Jul 17 01:13:23.059 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_client_handler client
context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 17 01:13:23.059 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_client_handler:
IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 448
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_add_attr_list: Setting
the attribute list for the req
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:client]   Attribute List --
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:generic]  aaa_base_handle_aaa_api: AAA Base
Server Pulse handler-Received 5 msg type
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_acct_received: FSM State: ACCT RECEIVED Event:8
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:generic] Attribute List: 0x5013b1ac
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_send: sent msg
ipc_send passed buf_len: 37
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_free: Freeing the aaa
base req structure 5013a898, 5013add8
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 5 App type 0 id 44
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_acct_sent:
FSM State: ACCT SENT Event:11
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:AAA Base
Client Handler...
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : iedged[246]: [AAA_BASE:fsm]  aaa_base_req_handle_fsm_state_acct_sent:
Received PASS status from radius
```

```
RP/0/RSP0/CPU0:Jul 17 01:13:23.102 : iedged[246]: [AAA_BASE:client]  aaa_base_req_free: Freeing the aaa
base req structure 50d2b9a8, 50baa4d8
RP/0/RSP0/CPU0:Jul 17 01:13:23.101 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_msg:Calling
client call back function
RP/0/RSP0/CPU0:Jul 17 01:13:23.258 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_client_handler client
context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 17 01:13:23.258 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_client_handler:
IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 575
RP/0/RSP0/CPU0:Jul 17 01:13:23.303 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_client_handler client
context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 17 01:13:23.303 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_client_handler:
IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 37
```

2.2.SADB - Subscriber Attribute Database

Subscriber Identity and Credential AAA Attributes from different components are stored in this Database. SADB does not save the subscriber configuration. show session information can give most of the AAA attributes information

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  sadb
Thu Jul 17 00:39:21.129 UTC


Sublabel: 0x00000046 Node_ID: 00000001 Signature: 0xabcdef12 Version: 1 Rev: 17
Length: 383

Attribute list: 1343138132
1:  parent-if-handle len=  4  4704(1260)
2:  port-type       len=  4  Virtual PPPoE over QinQ
3:  outer-vlan-id   len=  4  101(65)
4:  inner-vlan-id   len=  4  99(63)
5:  protocol-type   len=  4  ppp
6:  if-handle       len=  4  5408(1520)
7:  client-mac-address len= 14  a857.4e06.4f47
8:  string-session-id len=  8  00000007
9:  nas-port        len=  4  1694524679(65006507)
10:  interface       len= 14  0/0/101/99.101
11:  dnis            len=  2  99
12:  formatted-clid  len= 14  a857.4e06.4f47
13:  username        len=  8  PPP2@S99
14:  addr            len=  4  1.1.99.253
15:  Authentic       len=  4  RADIUS
16:  class           len=  9  53 39 39 5f 50 50 50 4f 45
17:  vrf-id          len=  4  1610612736(60000000)
18:  route           len= 40  192.168.200.99 255.255.255.255 0.0.0.0 1
19:  ipv4-session-state len=  1  true
20:  accounting-list len= 12  S99_AAA_list
21:  start_time      len=  4
```

2.3.SUBDB - Subscriber Database and session config handling

2.3.1.session config from multiple sources including radius server

There is another database called Subscriber Database(SUBDB) to store the config and the association of config to session. The unit of config object applied to a session is attribute, which could come from following five types of TEMPLATE.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database association  type  ?
  ipsubscriber         IP Subscriber Interface dynamic template type
  ppp                  PPP Interface dynamic template type
  service-profile      Service Profile dynamic template type
  subscriber-service   Subscriber Service dynamic template type
  user-profile         User Profile dynamic template type
```

There are different way to handle the config attributes from different type of template.

Further more , when same attributes are applied to a session from more than one templates, preference ordering is needed.

template type	ipsubscriber	ppp	subscriber-service	user-profile	service-profile

where to define the template with its attributes	BNG	BNG	BNG	radius server	radius server
example of the config	dynamic-template type ipsubscriber UNNUMBER ipv4 unnumbered Loopback500	dynamic-template type ppp S99_DT_PTA_MIN ppp ipcp peer-address pool S99_POOL_PPPV4 ipv4 unnumbered Loopback1099	dynamic-template type service S99_SERVICE_2 service-policy input S99_IN_POLICING_1M service-policy output S99_OUT_SHAPING_9M_H ipv4 access-group S99_ACL_in_2 ingress ipv4 access-group S99_ACL_out_2 egress	PPP6@S99 Cleartext-Password := "cisco" Cisco-avpair = "ipv4-unnumbered=Loopback1199", Cisco-avpair += "addr-pool=S99_POOL_PPPV4_VRF", Cisco-avpair += "subscriber:sa=S99_SERVICE_2", Cisco-avpair += "vrf-id=S99_VRF"	DOWNLOADING_SERVICE_1 Cleartext-Password := "cisco" Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K", Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
activate/ deactive in control policy (CLI)	supported	supported	supported	not supported	supported
activate/ deactive by attribute downloaded in access-accepted	supported	supported	supported	not supported	supported (5.2.0), SA=SERVICE_NAME and method-list=<MLIST>
activate/ deactive by COA	supported, SA=SERVICE_NAME	supported, SA=SERVICE_NAME	supported, SA=SERVICE_NAME	not supported	supported, SA=SERVICE_NAME and method-list=<MLIST>
sevice-update via COA	not supported	not supported	not supported	not supported	supported
attributes individually pull/push from radius server/COA	not supported	not supported	not supported	supported	not supported
preference	lowest	lowest	low	highest	medium

Please be noted that Dynamic-template type service will take precedence over type ipsubscriber/ppp. “sh subscriber database association <>” will give the order it which it is done. dynamic-template- type ppp, type ipsub are equal to each other in terms of preference.

2.3.2.Example of multi-source session config

Following example shows how the config attributes from different source are applied to a session in different ways.

Config on ASR9K BNG

```
interface Bundle-Ether101.99
 description PPPoEv4 access-interface for student_99
 service-policy type control subscriber S99_CP_PTA_SERVICE_DOWNLOAD
 pppoe enable
 encapsulation dot1q 101 second-dot1q 99
 ethernet-services access-group S99_PPPoE_ONLY ingress



policy-map type control subscriber S99_CP_PTA_SERVICE_DOWNLOAD
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list !downloading user-profile in
this step!!
   20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list
S99_AAA_list !!service authorization to get the definition of
service-profile in this step!!
30 activate dynamic-template S99_DT_PTA_MIN !!activate local defined
dynamic-template in this step!!


aaa authorization subscriber S99_AAA_list group S99_GRP1 group
S99_GRP2



dynamic-template
 type ppp S99_DT_PTA_MIN
  ppp ipcp peer-address pool S99_POOL_PPPV4
  ipv4 unnumbered Loopback1099
```

```
 type ppp S99_DT_LCP
  ppp authentication pap chap

type service S99_SERVICE_2
  service-policy input S99_IN_POLICING_1M
  service-policy output S99_OUT_SHAPING_9M_H
  ipv4 access-group S99_ACL_in_2 ingress
  ipv4 access-group S99_ACL_out_2 egress

!!!!please be noted there is no definition of service
“DOWNLOADING_SERVICE_1” as a dynamic-template, it’s defined as a
service-profile in radius server!!!
```

Config on radius server

```
###user-profile defined in radius server###
PPP6@S99    Cleartext-Password := "cisco"
        Cisco-avpair = "ipv4-unnumbered=Loopback1199",
        Cisco-avpair += "addr-pool=S99_POOL_PPPV4_VRF",
        Cisco-avpair += "subscriber:sa=S99_SERVICE_2",
        Cisco-avpair += “vrf-id=S99_VRF"

###service profile defined in radius server##
DOWNLOADING_SERVICE_1  Cleartext-Password := "cisco"
        Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K",
        Cisco-AVPair += “sub-qos-policy-out=S99_OUT_POLICING_512K”


!!please be noted that the attributes defined in the user-profile and
service-profile conflict to some of the attributes defined in the
local dynamic-template. the result will show you how an attribute
from a source with higher preference overrides those from a source
with lower preference.!!!
```

Log on Radius server

```
rad_recv: Access-Request packet from host 192.168.88.99 port 34305, id=180, leng
th=243
        Cisco-AVPair = "client-mac-address=a857.4e06.4f47"
        Acct-Session-Id = "000005f0"
        NAS-Port = 1694524912
        NAS-Port-Id = "0/0/101/99.101"
        Cisco-NAS-Port = "0/0/101/99.101"
        User-Name = "PPP6@S99"
        Service-Type = Framed-User
        User-Password = "cisco"
        X-Ascend-Connect-Progress = LCP-Opened
        Cisco-AVPair = "connect-progress=LCP Open"
        Framed-Protocol = PPP
        NAS-Port-Type = 37
```

```
        Called-Station-Id = "99"
        Calling-Station-Id = "a857.4e06.4f47"
        Event-Timestamp =
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99

Sending Access-Accept of id 180 to 192.168.88.99 port 34305
        Cisco-AVPair = "ipv4-unnumbered=Loopback1199"
        Cisco-AVPair += "addr-pool=S99_POOL_PPPV4_VRF"
        Cisco-AVPair += "subscriber:sa=S99_SERVICE_2"
        Cisco-AVPair += "vrf-id=S99_VRF"
Mon May 05 11:23:07 2014 : Info: Finished request 0.


rad_recv: Access-Request packet from host 192.168.88.99 port 34305, id=181, leng
th=84
        User-Name = "DOWNLOADING_SERVICE_1"
        User-Password = "cisco"
        Service-Type = Outbound-User
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99

Sending Access-Accept of id 181 to 192.168.88.99 port 34305
        Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K"
        Cisco-AVPair += “sub-qos-policy-out=S99_OUT_POLICING_512K"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all detail  internal
Mon May  5 11:22:14.972 UTC
Interface:                Bundle-Ether101.99.pppoe1520
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Mon May  5 11:22:01 2014
IPv4 Address:             1.1.99.1, VRF: S99_VRF   !!pool and VRF-id downloaded as
part of user-profile overrides those defined locally in dynamic-template type ppp
S99_DT_PTA_MIN!!
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Down, Mon May  5 11:21:59 2014
Mac Address:              a857.4e06.4f47
Account-Session Id:       000005f0
Nas-Port:                 1694524912
User name:                PPP6@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000069
Created:                  Mon May  5 11:21:59 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x0000a660
Session History ID:       15
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Mon May  5 11:21:59 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
```

```
  event Session-Activate match-first [at Mon May  5 11:22:01 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
[cerr: No error][aaa: Success]
      30 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9ff0
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
Services:
  Name         : S99_DT_LCP
  Service-ID   : 0x400003b
  Type         : Template
  Status       : Applied
-------------------------
  Name         : S99_SERVICE_2
  Service-ID   : 0x400002a
  Type         : Multi Template
  Status       : Applied
-------------------------
  Name         : DOWNLOADING_SERVICE_1
  Service-ID   : 0x4000084
  Type         : Profile
  Status       : Applied
-------------------------
  Name         : S99_DT_PTA_MIN
  Service-ID   : 0x4000057
  Type         : Template
  Status       : Applied
-------------------------
[Last IPv6 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   May  5 11:22:01.472 SUBDB produce done [many]
   May  5 11:22:01.472 IPv4 Up



RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber manager  sadb
Mon May  5 11:28:35.975 UTC


Sublabel: 0x00000069 Node_ID: 00000001 Signature: 0xabcdef12 Version: 1 Rev: 13
Length: 300

Attribute list: 1343138132
1:  parent-if-handle len=  4  4448(1160)
2:  port-type       len=  4  Virtual PPPoE over QinQ
3:  outer-vlan-id   len=  4  101(65)
4:  inner-vlan-id   len=  4  99(63)
5:  protocol-type   len=  4  ppp
6:  if-handle       len=  4  42592(a660)
7:  client-mac-address len= 14  a857.4e06.4f47
```

```
8:  string-session-id len=  8  000005f0
9:  nas-port        len=  4  1694524912(650065f0)
10:  interface       len= 14  0/0/101/99.101
11:  dnis            len=  2  99
12:  formatted-clid  len= 14  a857.4e06.4f47
13:  username        len=  8  PPP6@S99
14:  vrf-id          len=  4  1610612753(60000011)
15:  ip-vrf          len=  7  S99_VRF
16:  Authentic       len=  4  RADIUS
17:  addr            len=  4  1.1.99.1
18:  ipv4-session-state len=  1  true



RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database  association
Mon May  5 11:28:53.711 UTC

Location 0/RSP0/CPU0

Bundle-Ether101.99.pppoe1520, subscriber label 0x69
  Name                            Template Type
  --------                        -------------
  U00000069                       User profile
  DOWNLOADING_SERVICE_1:S99_AAA_listService profile
  S99_SERVICE_2                   Service
  S99_DT_PTA_MIN                  PPP
  S99_DT_LCP                      PPP


!


#### QoS defined in the service-profile take effect overriding the one defined in
the dynamic-template type service S99_SERVICE_2 ######

RP/0/RSP0/CPU0:Roy_BNG_1#sh policy-map applied   interface   Bundle-
Ether101.99.pppoe1520
Mon May  5 11:38:19.858 UTC

Input policy-map applied to Bundle-Ether101.99.pppoe1520:

  policy-map S99_IN_POLICING_256K
   class class-default
    police rate 256 kbps
    !
   !

Output policy-map applied to Bundle-Ether101.99.pppoe1520:

  policy-map S99_OUT_POLICING_512K
   class class-default
    police rate 512 kbps


###ACL defined in the dynamic-template type service S99_SERVICE_2 takes effect
since it's the only source with ACL defined####
RP/0/RSP0/CPU0:Roy_BNG_1#sh access-lists  ipv4 interface  Bundle-
Ether101.99.pppoe1520
Mon May  5 11:40:52.269 UTC
Input ACL (common): N/A (interface): S99_ACL_in_2
Output ACL: S99_ACL_out_2
```

```
###following CLI give you the derived config applied to a session after the
preference calculation ( some of the attribuet from user-profile and service-
profile are not displayed correctly, bug will be fixed in 5.2.0 release) ###
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  running-config
Thu Jul 17 01:54:35.224 UTC
Subscriber Label: 0x4a
dynamic-template
 type ppp S99_DT_LCP
  ipv4 mtu 700
 !
!

% No such configuration item(s)

dynamic-template
 type service S99_SERVICE_2
  ipv4 access-group S99_ACL_in_2 ingress
 !
!

dynamic-template
 type service S99_SERVICE_2
  ipv4 access-group S99_ACL_out_2 egress
 !
!

% No such configuration item(s)

dynamic-template
 type ppp S99_DT_LCP
  ppp ipcp mask 255.255.0.0
 !
!

dynamic-template
 type ppp S99_DT_LCP
  ppp authentication pap chap
 !
!

dynamic-template
 type ppp S99_DT_LCP
  ppp mru ignore
 !
 --More-- % No such configuration item(s)
% No such configuration item(s)
!



% No such configuration item(s)

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database  configuration  name
DOWNLOADING_SERVICE_1:S99_AAA_list
Thu Jul 17 02:01:13.871 UTC

Subscriber configuration database object 'DOWNLOADING_SERVICE_1:S99_AAA_list' on
node 0/RSP0/CPU0

 Template:               DOWNLOADING_SERVICE_1:S99_AAA_list
   Type:                 Service profile
```

```
   Feature:              QoS
     Attribute:          qos/service/sub_sp_in
       SysDB pathname:   /cfg/gl/dynamic-templates/service-profile/
DOWNLOADING_SERVICE_1:S99_AAA_list/qos/service/sub_sp_in
       Datatype:         packed
       Value:
                         00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 15 53 39
: ..C!..........S9
                         00000010 : 39 5F 49 4E 5F 50 4F 4C 49 43 49 4E 47 5F 32 35
: 9_IN_POLICING_25
                         00000020 : 36 4B 00 03 00 04 00 00 00 00 05 00 01 00 06 00
: 6K..............
                         00000030 : 00
: .
     Attribute:          qos/service/sub_sp_out
       SysDB pathname:   /cfg/gl/dynamic-templates/service-profile/
DOWNLOADING_SERVICE_1:S99_AAA_list/qos/service/sub_sp_out
       Datatype:         packed
       Value:
                         00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 16 53 39
: ..C!..........S9
                         00000010 : 39 5F 4F 55 54 5F 50 4F 4C 49 43 49 4E 47 5F 35
: 9_OUT_POLICING_5
                         00000020 : 31 32 4B 00 03 00 04 00 00 00 00 05 00 01 00 06
: 12K.............
                         00000030 : 00 00
: ..
 Config DB entry size: 354 bytes
```

3. Chapter 3, Authentication and Authorization

3.1. Terminology and fact

In IOS XR, both authentication and authorization refer to the action of sending a access-request message to the RADIUS server and expecting a access-accept or access-reject with or without some attributes included.

What's the difference between authentication and authorization?

3.1.1.Authentication

The term and CLI key word “Authentication” is applicable to the case where the user credentials is extracted from a protocol and send to the RADIUS server without any modification. Following are some scenarios a “authentication” is supposed to be used.

- **PPPOE PTA SESSION**

Username/password from PAP/CHAP in a PPP LCP negotiation.

- **WEB-LOGON FOR BOTH PPPOE AND IPOE SESSION**

Username/password are inputed by a subscriber on a portal, and received by the BNG from a COA request.

Please be noted current implementation on ASR9K BNG do not allow modification to the username and password before sending it to the radius server for authentication. If the modification of username is needed, the only way is using key word authorization.

3.1.2.Authorization

The term and CLI key word “authorization” is applicable to the case that the user credential is extracted from other source, such as the line information known to BNG naturally, or the case that the user credential is extract from a information carried to BNG by protocol such as DHCP/PPPoE. In later case, it’s possible for the credential to be modified before sending to the RADIUS server.

- **TRANSPARENT AUTO-LOGON**

Username is built by the information belong to a subscriber such as MAC, circuit ID, remote ID, option 60 etc. for TAL(transparent auto logon). In this case a common password is supposed to be configured in the BNG in the control policy and works for all of the sessions subjected to that control policy.

- **LAC AUTHORIZATION USING DOMAIN NAME**

In this case, the LAC is supposed to send only the domain name part of the username which is learned from the PAP/CHAP to the Whole seller's RADIUS server to get the information needed to build a L2TP tunnel the LNS.

Following are some config examples for session authentication/authorization usage in different use cases.

>>>>PPPoE PTA authentication using PAP<<<<

username/password input by subscriber user_1@domain.com/password

username/password sent to radius user_1@domain.com/password (unchanged)

```
policy-map type control subscriber PPPoE_PTA
 event session-start match-all
  class type control subscriber CLASS_PPPoE do-all
   1 activate dynamic-template AUTH
  !
 !
 event session-activate match-all
  class type control subscriber CLASS_PPPoE do-until-failure
   10 authenticate aaa list default
   20 activate dynamic-template PPPoE

end-policy-map
```

>>>>PPPoE LAC authorization using domain name<<<<

username/password input by subscriber user_1@domain.com/password

username/password sent to LAC radius domain.com/cisco

```
policy-map type control subscriber PPP_LAC
 event session-start match-all
  class type control subscriber CLASS_PPPoE do-all
   1 activate dynamic-template AUTH

  !
 !
 event session-activate match-all
  class type control subscriber CLASS_PTA do-all
   10 authorize aaa list DUAL_RADIUS format VPDN_DOMAIN password
cisco
  !
 !
```

```
 end-policy-map

aaa attribute format VPDN_DOMAIN
 username-strip prefix-delimiter @
```

>>>>IPoE,TAL authorization on session-start, then do authentication for web logon when TAL fails<<<<

on session-start

username/password input by subscriber n/a

username/password sent to radius xxxx.xxxx.xxxx(source MAC)/cisco

on account-logon

username/password input by subscriber user_1@domain.com/password

username/password sent to radius user_1@domain.com/password

(unchanged)

```
policy-map type control subscriber IPoE_WLAN
 event session-start match-first
  class type control subscriber IP do-until-failure
   10 activate dynamic-template UNAUTH_TPL
   20 authorize aaa list IPoE_WLAN format USERNAME password cisco
  !
 !
 event authorization-failure match-first
  class type control subscriber IP do-until-failure
   10 activate dynamic-template HTTPRDRT_TPL
   20 set-timer UNAUTH_TMR 3
  !
 !
 event account-logon match-first
  class type control subscriber IP do-until-failure
   10 authenticate aaa list IPoE_WLAN
   20 deactivate dynamic-template HTTPRDRT_TPL
  !
 !
 event timer-expiry match-first
  class type control subscriber UNAUTH_TMR_CM do-until-failure
   10 disconnect
  !
 !
 end-policy-map

aaa attribute format USERNAME
 format-string length 253 "%s" client-mac-address-ietf
```

- **SERVICE AUTHORIZATION**

When you have a dynamic-template activated in a control policy but there is no content of that dynamic-template defined locally, an action of "authorization" could also be used to get the detail information of that "service" by sending access-request message to the radius server with the name of the service in the "username" with fixed password "cisco"(seems no place to configure it), expecting the attribute associated to that "service" to be downloaded in an access-accept message.

Following are a call flow of a service authorization.

Config on ASR9K BNG

```
policy-map type control subscriber S99_CP_PTA_SERVICE_DOWNLOAD
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list
S99_AAA_list
   30 activate dynamic-template S99_DT_PTA_MIN


aaa authorization subscriber S99_AAA_list group S99_GRP1 group
S99_GRP2
```

Config on radius server

```
PPP6@S99    Cleartext-Password := "cisco"
        Cisco-avpair = "ipv4-unnumbered=Loopback1199",
        Cisco-avpair += "addr-pool=S99_POOL_PPPV4_VRF",
        Cisco-avpair += "subscriber:sa=S99_SERVICE_2",
        Cisco-avpair += "vrf-id=S99_VRF"


DOWNLOADING_SERVICE_1  Cleartext-Password := "cisco"
        Cisco-AVPair = "sub-qos-policy-in=S99_IN_POLICING_256K",
        Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
```

Log on Radius server

```
rad_recv: Access-Request packet from host 192.168.88.99 port 34305, id=180, leng
th=243
        Cisco-AVPair = "client-mac-address=a857.4e06.4f47"
        Acct-Session-Id = "000005f0"
        NAS-Port = 1694524912
        NAS-Port-Id = "0/0/101/99.101"
        Cisco-NAS-Port = "0/0/101/99.101"
        User-Name = "PPP6@S99"
        Service-Type = Framed-User
        User-Password = "cisco"
        X-Ascend-Connect-Progress = LCP-Opened
        Cisco-AVPair = "connect-progress=LCP Open"
        Framed-Protocol = PPP
        NAS-Port-Type = 37
        Called-Station-Id = "99"
        Calling-Station-Id = "a857.4e06.4f47"
        Event-Timestamp =
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99

Sending Access-Accept of id 180 to 192.168.88.99 port 34305
        Cisco-AVPair = "ipv4-unnumbered=Loopback1199"
        Cisco-AVPair += "addr-pool=S99_POOL_PPPV4_VRF"
        Cisco-AVPair += "subscriber:sa=S99_SERVICE_2"
        Cisco-AVPair += "vrf-id=S99_VRF"
Mon May 05 11:23:07 2014 : Info: Finished request 0.


rad_recv: Access-Request packet from host 192.168.88.99 port 34305, id=181, leng
th=84
        User-Name = "DOWNLOADING_SERVICE_1"
        User-Password = "cisco"
        Service-Type = Outbound-User
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99

Sending Access-Accept of id 181 to 192.168.88.99 port 34305
        Cisco-AVPair = "sub-qos-policy-in=S99_IN_POLICING_256K"
        Cisco-AVPair += “sub-qos-policy-out=S99_OUT_POLICING_512K"
```

Please be noted that the authentication and authorization are not mandatory for the establishment of a session, you can have a session activated without defining any action of authentication/authorization in the control policy, this is fine from ASR9K’s perspective.

But normally, you would like to configure an action explicitly to disconnect a session or apply some particular service to a session which failed to authenticate/authorise, such as HTTP redirect or limit the reachability/

bandwidth of the subscriber for session management purpose. To achieve that, you need to define the event of authentication-failure or authorisation-failure explicitly with actions beneath them.

```
RP/0/RSP0/CPU0:ASR9K-42-BNG(config-pmap)#event ?
  account-logoff              Account logoff event
  account-logon               Account logon event
  authentication-failure      Authentication failure event
  authentication-no-response  Authentication no response event
  authorization-failure       Authorization failure event
  authorization-no-response   Authorization no response event
```

3.1.3.Authenticated and authorised state

Following are the description in detail what happens when authentication/ authorization is conducted .

- When there is an action of “authenticate” defined in the control policy and a access-accept received, the session will be marked as “authenticated”, the session will be alive and in activated state.

- When there is an action of “authenticate” defined in the control policy and a access-reject received, the session will be torn down immediately, unless in the control policy there is an event of “unauthenticate” defined and make the BNG to take other actions to that session. In later case, the session will be marked as “unauthenticated”, but the session will be alive and in activated state.

- When there is **no** action of “authenticate” defined in the control policy, a session could be established without communication with RADIUS server for authentication. The session will be marked as “unauthenticated”, but the session will be alive and in activated state.

- The logic for authorization is quite the same to that for authentication. It worth a noting that before 5.1.1 release, there is only the flag for authentication in the BNG implementation, the missing of authorisation flag

make it impossible to reflect the state of authorisation and further processing based on the authorisation state. To improve that, ddts CSCue06943 was raised and fixed from 5.1.1 release. From 5.1.1 release onward when you do “show subscriber session all detail “ from the console, you can see both authentication flag and authorisation flag. Please be noted that they are independent flag, reflecting the state of authentication and authorisation respectively.

Display for session authenticated(5.1.1)

```
====================================
RP/0/0/CPU0:server# show subscriber session all detail
Interface:                GigabitEthernet0/0/0/0.3.pppoe1
Circuit ID:               circuit_id1
Remote ID:                remote_id1
Type:                     PPPoE:PTA
IPv4 State:               Up, Tue Sep 10 14:27:06 2013
IPv4 Address:             10.0.0.6, VRF: default
Mac Address:              0219.a220.e809
Account-Session Id:       00000009
Nas-Port:                 Unknown
User name:                basic@cisco.com
Outer VLAN ID:            15
Subscriber Label:         0x00000207
Created:                  Tue Sep 10 14:27:02 2013
State:                    Activated <—session is live and OK
Authentication:           authenticated
Authorization:            unauthorized  !<-new in 5.1.1 release
Access-interface:         GigabitEthernet0/0/0/0.3
Policy Executed:
policy-map type control subscriber POLICY1
  event Session-Start match-all [at Tue Sep 10 14:27:02 2013]
    class type control subscriber PTA_CLASS do-all [Succeeded]
      1 activate dynamic-template PPP_PTA_TEMPLATE [Succeeded]
      3 activate dynamic-template ACCOUNT2 [Succeeded]
  event Session-Activate match-all [at Tue Sep 10 14:27:06 2013]
    class type control subscriber PTA_CLASS do-all [Succeeded]
      3 authenticate aaa list default [Succeeded]
```

Display for session authorised(5.1.1)

```
====================================
RP/0/0/CPU0:one#show subsc sess all det
Interface:                GigabitEthernet0/2/0/1.2.ip1
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Packet-trigger
IPv4 State:               Up, Tue Sep 10 17:01:13 2013
IPv4 Address:             21.10.10.8, VRF: default
Mac Address:              0077.7770.0001
```

```
Account-Session Id:       04000002
Nas-Port:                 Unknown
User name:                0077.7770.0001
Outer VLAN ID:            2
Subscriber Label:         0x04000001
Created:                  Tue Sep 10 17:01:13 2013
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Access-interface:         GigabitEthernet0/2/0/1.2
Policy Executed:
policy-map type control subscriber PL2
  event Session-Start match-first [at Tue Sep 10 17:01:13 2013]
    class type control subscriber class-default do-all [Succeeded]
      1 activate dynamic-template pkt-trig1 [Succeeded]
      2 authorize aaa list default [Succeeded]
```

Display for session without flag of authorization(4.3.1)

```
=====================================
RP/0/RSP0/CPU0:BNG_SandBox_Feature#sh subscriber  sess all detail
Tue Dec 18 11:57:51.408 PST
Interface:                Bundle-Ether102.7.pppoe89
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Tue Dec 18 11:57:47 2012
IPv4 Address:             140.1.1.3, VRF: default
Mac Address:              4284.c29e.0000
Account-Session Id:       00000055
Nas-Port:                 12583052
User name:                cisco
Outer VLAN ID:            140
Inner VLAN ID:            1
Subscriber Label:         0x00000055
Created:                  Tue Dec 18 11:57:47 2012
State:                    Activated
Authentication:           authenticated
Access-interface:         Bundle-Ether102.7
Policy Executed:
policy-map type control subscriber BELL-6
  event Session-Start match-first [at Tue Dec 18 11:57:47 2012]
    class type control subscriber PPP do-all [Succeeded]
      10 activate dynamic-template PPP_CHAP_PAP [Succeeded]
  event Session-Activate match-first [at Tue Dec 18 11:57:47 2012]
    class type control subscriber BELL_CANADA_DOMAIN do-until-failure [Failed]
    class type control subscriber BELL_CANADA_DOMAIN_NON do-until-failure [Failed]
    class type control subscriber PPP do-until-failure [Succeeded]
      10 authenticate aaa list default [Succeeded]
      20 activate dynamic-template PPP_BELL [Succeeded]
Session Accounting: disabled
Last COA request received: unavailable
[Last IPv6 down]
Disconnect Reason:
```

4. Chapter 4, Attributes in Access-Request - report session information

4.1. Manipulation of attributes - the principle

- The attributes included in to access-accept message is decided by the code, no CLI is provided to specify what attributes should be included in a access-accept message.
- The format and value of some of the attributes could be customized using a CLI.
- it's allowed to use a attribute list to filter the attributes allowed to be sent.

4.2. IPoE session access-request

A typical IPoE TAL access-request message including following attributes
Note: the attribute type for cisco AVpair is always string, since the whole AVpair is a string, for example Cisco-AVPair: if-handle=134540832, here the "if-handle=134540832" is a string.

Type	Vendor	Attribute name	Attribute value	Attribute value type	Information filled	Note
26,9,1	Cisco	Cisco-AVPair	client-mac-address=value	String	MAC of the client	System generated
26,3561,1	ADSL forum	Agent-Circuit-Id		string		

26,3561,2	ADSL forum	Agent-Remote-Id		string		
26,9,1	Cisco	Cisco-AVPair	remote-id-tag=value	String	DHCP option 82 Remote-id	From DHCP packet or inserted on 9K by CLI
26,9,1	Cisco	Cisco-AVPair	circuit-id-tag=value	String	DHCP option 82 Circuit-id	From DHCP packet or inserted on 9K by CLI
26,9,1	Cisco	Cisco-AVPair	dhcp-vendor-class=value	String	DHCP option 60	IPoE only, extracted from DHCP discover
87	IETF	NAS-Port-Id	value	String	Slot/port/vlan etc, that the session coming from	Customizable per system or per nas-port-type
26,9,2	Cisco	Cisco-NAS-Port	Cisco-NAS-Port=value	String	Slot/port/vlan etc, that the session coming from	The same value to IETF Nas-Port-ID
1	IETF	User-Name		String		Customizable format per control policy
6	IETF	Service-Type		integer	Dialout-Framed-User(code 5) for IPoE	System generated, not configurable
2	IETF	User-Password		Encrypted	Configured password in control policy-map for IPoE TAL	Configurable per control policy
44	IETF	Acct-Session-Id		String	Unique ID for session	system generated, format configurable per system

26,9,1	Cisco	parent-if-handle		String	Internal number indicating , meaningless to radius server	
61	IETF	NAS-Port-Type		integer	Type of the access-interface	Value customizable per access-interface
30	IETF	Called-Station-Id		String	By default it is Circuit-id	Format customizable per system or per nas-port-type
31	IETF	Calling-Station-Id		String	By default it is Remote-id	Format customizable per system or per nas-port-type
55	IETF	Event-Timestamp		integer		System generated
32	IETF	NAS-Identifier		string	Hostname configured in BNG	System generated
4	IETF	NAS-IP-Address		ipv4addr	Radius source interface address configured in BNG, need to match the registered host address in RADIUS server	System generated
5	IETF	NAS-Port		integer	physical port information of the NAS which is authenticating the user	Format customizable per system or per nas-port-type

See appendix 1 for an example of access-request message for DHCP initiated IPoE session

4.3. PPPoE session access-reqeust

A typical PPPoE access-request message including following attributes

Red part is the difference comparing to IPoE access-request

Type	Vendor	Attribute name	Attribute value	Attribute value type	Information filled	Note
26,9,1	Cisco	Cisco-AVPair	client-mac-address=value	String	MAC of the client, in format of "a857.4e06.4f47"	system generated
26,3561,1	ADSL forum	Agent-Circuit-Id		string	pppoe tag circuit-id	present only when pppoe circuit-id exists
26,3561,2	ADSL forum	Agent-Remote-Id		string	pppoe tag remote-id	present only when pppoe remote-id exists
26,9,1	Cisco	Cisco-AVPair	remote-id-tag=value	String	pppoe tag circuit-id	present only when pppoe circuit-id exists
26,9,1	Cisco	Cisco-AVPair	circuit-id-tag=value	String	pppoe tag remote-id	present only when pppoe remote-id exists
~~26,9,1~~	~~Cisco~~	~~Cisco-AVPair~~	~~dhcp-vendor-class=value~~	~~String~~	~~DHCP option 60~~	~~IPoE only, extracted from DHCP discover~~
87	IETF	NAS-Port-Id	value	String	Slot/port/vlan etc, that the session coming from	always included. Customizable per system or per nas-port-type
26,9,2	Cisco	Cisco-NAS-Port	Cisco-NAS-Port=value	String	Slot/port/vlan etc, that the session coming from	The same value to IETF Nas-Port-ID

1	IETF	User-Name		String	from ppp protocol	
6	IETF	Service-Type		integer	Framed-User (code 2) for PPPoE	System generated, not configurable
2	IETF	User-Password		Encrypted	from ppp protocol	
44	IETF	Acct-Session-Id		String	Unique ID for session	system generated, format configurable per system
26,9,1	Cisco	parent-if-handle		String	Internal number indicating , meaningless to radius server	meaningless to RADIUS server, not present anymore from 5.1.1.
61	IETF	NAS-Port-Type		integer	Type of the access-interface	Value customizable per access-interface
30	IETF	Called-Station-Id		String	By default it is Circuit-id	Format customizable per system or per nas-port-type
31	IETF	Calling-Station-Id		String	By default it is Remote-id	Format customizable per system or per nas-port-type
55	IETF	Event-Timestamp		integer		System generated
32	IETF	NAS-Identifier		string	Hostname configured in BNG	System generated

4	IETF	NAS-IP-Address		ipv4addr	Radius source interface address configured in BNG, need to match the registered host address in RADIUS server	System generated
5	IETF	NAS-Port		integer	physical port information of the NAS which is authenticating the user	presence only with explicitly configuration(aaa radius attribute nas-port format). Format customizable per system or per nas-port-type
196	Ascend	X-Ascend-Connect-Progress		integer	Indicates the state of the connection before it disconnects. For PPPoE access request this value is set to 65, “LCP is in the Open state.”	http://docs.snake.de/TNT/7/radius/attrib.htm
26,9,1	Cisco	Cisco-AVPair	connect-progress=value	string	For PPPoE access request this value is set to “connect-progress=LCP Open”	
7	IETF	Framed-Protocol		integer	Set to 1, code for “PPP”	
3	IETF	CHAP-Password	c			CHAP only
60	IETF	CHAP-Challenge				CHAP only

See appendix 2 for an example of access-request message for PPPoE PTA session .

4.4.Customising the attribute in access-request

4.4.1.NAS-Port-Type

By default, ASR9K populate the nas-port-type attribute based on the actual type and encapsulation configuration of a access-interface under which a session is created, detail information is in following table.

Nas-port-type	**Values**	**Example interface/ encapsulation**	**Whether value can be derived from associated interface**	**Whether value can be configured on the interface configuration mode**
ASYNC	0		No	Yes
SYNC	1		No	Yes
ISDN	2		No	Yes
ISDN_V120	3		No	Yes
ISDN_V110	4		No	Yes
VIRTUAL	5		No	Yes
ISDN_PIAFS	6		No	Yes
X75	9		No	Yes
ETHERNET	15		No	Yes
PPPATM	30		No	Yes
PPPOEOA	31		No	Yes
PPPOEOE	32		Yes	Yes
PPPOEOVLAN	33	Int g 0/0/0/0.1 Encapsulation dot1Q 10(supported from 5.1.1 release)	Yes	Yes

PPPOEOQINQ	34	Int g 0/0/0/0.1 Encapsulation dot1Q 10 second dot1Q 100(supported from 5.1.1 release)	Yes	Yes
VIRTUAL_PPPOEOE	35	N/A	Yes	Yes
VIRTUAL_PPPOEOVLAN	36	Int bundle-e 100.1 Encapsulation dot1Q 10	Yes	Yes
VIRTUAL_PPPOEOQINQ	37	Int bundle-e 100.1 Encapsulation dot1Q 10 second dot1Q 100	Yes	Yes
IPSEC	38		No	Yes
IPOEOE	39		Yes	Yes
IPOEOVLAN	40	Int g 0/0/0/0.1 Encapsulation dot1Q 10(supported from 5.1.1 release)	Yes	Yes
IPOEOQINQ	41	Int g 0/0/0/0.1 Encapsulation dot1Q 10 second dot1Q 100(supported from 5.1.1 release)	Yes	Yes
VIRTUAL_IPOEOE	42	N/A	Yes	Yes
VIRTUAL_IPOEOVLAN	43	Int bundle-e 100.1 Encapsulation dot1Q 10	Yes	Yes
VIRTUAL_IPOEOQINQ	44	Int bundle-e 100.1 Encapsulation dot1Q 10 second dot1Q 100	Yes	Yes

Before 5.1.1 release, only session over bundle subinterface is supported. A bundle subinteface is a virtual interface, so 36, 37, 43, 44 are possible nas-port-type value derived from interface with BNG enabled.

In 5.1.1 release, with the support of BNG over physical interface, you will see type 33, 34, 40, 41.

On the other hand, the NAS-Port-Type is made configurable for each main interface, or VLAN sub-interface. With a different NAS-Port-Type value configured on the interface, the NAS-Port and NAS-Port-ID gets formatted according to the formats defined globally for the new NAS-Port-Type configured on the interface, instead of the actual value of NAS-Port-Type that the interface has. This in turn sends different formats of NAS-Port, NAS-Port-ID and NAS-Port-Type to the RADIUS server for the subscribers under different production models.

In the case of sub-interfaces, the hierarchy to be followed in deciding the format of NAS-Port-Type to be sent to the RADIUS server is:

1. Verify whether the NAS-Port-Type is configured on the sub-interface in which the subscriber session arrives.
2. If NAS-Port-Type is not configured on the sub-interface, verify whether it is configured on the main physical interface（or main bundle-etherent interface). The format of NAS-Port or NAS-Port-ID is based on the NAS-Port-Type retrieved in Step 1 or Step 2.
3. If NAS-Port-Type is configured on neither the sub-interface nor the main physical interface, the format of NAS-Port or NAS-Port-ID is based on the format of the default NAS-Port-Type of the sub-interface.
4. If a NAS-Port or NAS-Port-ID format is not configured for the NAS-Port-Type retrieved in steps 1, 2 or 3, the format of NAS-Port or NAS-Port-ID is based on the default formats of NAS-Port or NAS-Port-ID.

Use following command to configure NAS-Port-Type per interface or sub-interface:

```
aaa radius attribute nas-port-type <nas-port-type>
```

The best of practices is to configure the nas-port-type per access-interface (bundle sub-interface)

4.4.2.AAA Attribute Format

It is possible to define a customized format for some attributes. The configuration syntax for creating a new format is:

```
aaa attribute format <format-name> format-string [length] <string>
*[<Identity-Attribute>]
```

where:

- format-name — Specifies the name given to the attribute format. This name is referred when the format is applied on an attribute.
- length — (Optional) Specifies the maximum length of the formatted attribute string. If the final length of the attribute string is greater than the value specified in LENGTH, it is truncated to LENGTH bytes. The maximum value allowed for LENGTH is 255. If the argument is not configured, the default is also 255.
- string — Contains regular ASCII characters that includes conversion specifiers. Only the % symbol is allowed as a conversion specifier in the STRING. The STRING value is enclosed in double quotes.
- Identity-Attribute — Identifies a session, and includes user-name, ip-address, and mac-address. A list of currently-defined identity attributes is displayed on the CLI.

In 4.3.1 release following identity-attributes are supported .

```
RP/0/RSP0/CPU0:Roy_BNG_1(config)#aaa attribute  format TEST format-string
"%s" ?
  OR                            OR between two attributes
  addr                          Source IP address of subscriber
  circuit-id-tag                Circuit-Id Tag
  client-mac-address            MAC address of client
  client-mac-address-ietf       MAC address of client in ietf format
  client-mac-address-raw        MAC address of client in raw format
  dhcp-vendor-class             DHCP vendor class name
  dhcpv6-interface-id           DHCPv6 Interface-Id
  inner-vlan-id                 Inner VLAN ID needed to form NAS Port
```

```
  outer-vlan-id                 Outer VLAN ID needed to form NAS Port
  physical-adapter              Physical adapter needed to form NAS Port
  physical-chassis              Physical chassis needed to form NAS Port
  physical-port                 Physical port needed to form NAS Port
  physical-slot                 Physical slot needed to form NAS Port
  physical-subslot              Physical subslot needed to form NAS Port
  port-type                     Interface/Port type
  pppoe-session-id              PPPOE Session Id
  remote-id-tag                 Remote-Id Tag
  username                      The name of the user
```

In 5.1.0 release following identity-attributes are supported.

```
RP/0/RSP0/CPU0:Roy_BNG_1(config)#aaa attribute  format   TEST format-string
"%s" ?
  OR                        OR between two attributes
  addr                      Source IP address of subscriber
  circuit-id-tag            Circuit-Id Tag
  client-mac-address        MAC address of client
  client-mac-address-ietf   MAC address of client in ietf format
  client-mac-address-raw    MAC address of client in raw format
  dhcp-client-id            DHCP Client Identifier
  dhcp-client-id-spl        DHCP Client Id special string
  dhcp-user-class           DHCP User Class
  dhcp-vendor-class         DHCP vendor class name
  dhcpv6-interface-id       DHCPv6 Interface-Id
  inner-vlan-id             Inner VLAN ID needed to form NAS Port
  outer-vlan-id             Outer VLAN ID needed to form NAS Port
  physical-adapter          Physical adapter needed to form NAS Port
  physical-chassis          Physical chassis needed to form NAS Port
  physical-port             Physical port needed to form NAS Port
  physical-slot             Physical slot needed to form NAS Port
  physical-subslot          Physical subslot needed to form NAS Port
  port-type                 Interface/Port type
  pppoe-session-id          PPPOE Session Id
  remote-id-tag             Remote-Id Tag
  username                  The name of the user
  <cr>
```

Once the format is defined, the FORMAT-NAME can be applied to various AAA attributes. currently, only 4 attributes could be customised in this way.

- username (for authorisation)
- Nas-Port-ID
- calling-station-ID
- called-station-ID

The configurable AAA attributes that use the format capability are explained later.

4.4.3.Username

To some extent, you can construct the username only for authorization in a customised way. The use of a particular attribute format for the username could vary on a per control policy base, another words, it could be per access-interface based. Further more, class-map in a control policy gives a more granular way to customise the format of a username.

```
policy-map type control subscriber IPoE_WLAN
 event session-start match-first
  class type control subscriber IP do-until-failure
   10 activate dynamic-template UNAUTH_TPL
   20 authorize aaa list IPoE_WLAN format USERNAME_FORMAT password
cisco

aaa attribute format USERNAME_FORMAT
 format-string length 253 "%s" addr
```

Besides the format attribute for username construction, you can also modify the username by add/strip the domain name. in this case, you must use authorization in the control policy.

To strip a domain name in a username.

```
aaa attribute format REMOVING_DOMAIN
 username-strip suffix-delimiter @

policy-map type control subscriber S99_CP_PTA_AUTHOR_REMOVE_DOMAIN
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authorize aaa list S99_AAA_list format REMOVING_DOMAIN password
use-from-line
   20 activate dynamic-template S99_DT_PTA_MIN
```

Connect PPPoE session with username PPP1@S99

```
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS: Send Access-Request to
172.18.88.221:1812 id 96, len 239
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  authenticator 4D E9
FE 0E C6 53 C3 BA - A9 63 B5 1E 05 E0 2C 0E
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    41
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      000000a3
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  NAS-Port
[5]     6       1694524807
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  NAS-Port-Id
[87]    16      0/0/101/99.101
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    22
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  User-Name
[1]     6       PPP1
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  Service-Type
[6]     6       Framed[0]
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  User-Password
[2]     18      *
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]: Unsuppoted attribute.
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    33
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  Framed-Protocol
[7]     6       PPP[0]
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  NAS-Port-Type
[61]    6       Virtual PPPoEoQinQ[0]
RP/0/RSP0/CPU0:May  5 00:37:02.621 : radiusd[1117]:  RADIUS:  Called-Station-Id
[30]    4       99
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]:  RADIUS:  Calling-Station-Id
[31]    16      a857.4e06.4f47
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]:  RADIUS:  Event-Timestamp
[55]    6       1399250222
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]:  RADIUS:  Nas-Identifier
[32]    11      Roy_BNG_1
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]:  RADIUS:  NAS-IP-Address
[4]     6       192.168.88.99
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]: Got global deadtime 0
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]: Using global deadtime = 0 sec
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]: Start timer thread rad_ident 96
remote_port 1812 remote_addr 0xac1258dd, socket 1342483620 rctx 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:37:02.622 : radiusd[1117]: Successfully sent packet and
started timeout handler for rctx 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: rctx found is 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: Radius packet decryption
complete with rc = 0
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]:  RADIUS: Received from id 96
172.18.88.221:1812, Access-Accept, len 20
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]:  RADIUS:  authenticator 7B 6D
AB 6C 0F 66 99 2F - 06 AD AF 37 B4 A2 70 C9
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: Freeing server group
transaction_id (3300005C)
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: pack_length = 20 radius_len =
20
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: rad_nas_reply_to_client:
Received response from id : 96,packet type 2
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: (rad_nas_reply_to_client)
Successfully decoded the response No error: PASS
RP/0/RSP0/CPU0:May  5 00:37:02.654 : radiusd[1117]: (rad_nas_reply_to_client)
Successfully stored the preferred server info
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Mon May  5 00:37:10.733 UTC
Interface:                Bundle-Ether101.99.pppoe135
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Mon May  5 00:37:02 2014
IPv4 Address:             1.1.99.7, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Down, Mon May  5 00:37:01 2014
Mac Address:              a857.4e06.4f47
Account-Session Id:       000000a3
Nas-Port:                 1694524807
User name:                PPP1
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000041
Created:                  Mon May  5 00:37:01 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00003920
Session History ID:       20
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Mon May  5 00:37:01 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Mon May  5 00:37:02 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA: None
Services:
  Name        : S99_DT_LCP
RP/0/RSP0/CPU0:Roy_BNG_1#sh sub
sub-util  subscriber
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database  ?
  association    Association between subscriber sessions and dynamic templates
  configuration  Display subscriber configuration database information
  connection     Client connection identifiers
  interface      Mapping between subscriber labels and interface handles
  session        Subscriber Management Subscriber Session information(cisco-
support)
  statistics     Subscriber database statistics
  summary        Subscriber Database summary counts
  trace          Show Subscriber Database traces(cisco-support)
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  sadb
Mon May  5 00:37:26.408 UTC


Sublabel: 0x00000041 Node_ID: 00000001 Signature: 0xabcdef12 Version: 1 Rev: 14
Length: 294

Attribute list: 1343138132
```

```
1:  parent-if-handle len=  4  4448(1160)
2:  port-type       len=  4  Virtual PPPoE over QinQ
3:  outer-vlan-id   len=  4  101(65)
4:  inner-vlan-id   len=  4  99(63)
5:  protocol-type   len=  4  ppp
6:  if-handle       len=  4  14624(3920)
7:  client-mac-address len= 14  a857.4e06.4f47
8:  string-session-id len=  8  000000a3
9:  nas-port        len=  4  1694524807(65006587)
10:  interface       len= 14  0/0/101/99.101
11:  dnis            len=  2  99
12:  formatted-clid  len= 14  a857.4e06.4f47
13:  username        len=  4  PPP1
14:  author_status   len=  1  true
15:  addr            len=  4  1.1.99.7
16:  vrf-id          len=  4  1610612736(60000000)
17:  ipv4-session-state len=  1  true
```

To append a domain name to a username

```
aaa attribute format ADDING_DOMAIN format-string "%s@added_domain"
username
policy-map type control subscriber S99_CP_PTA_AUTHOR_ADD_DOMAIN
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authorize aaa list S99_AAA_list format ADDING_DOMAIN password
use-from-line
   20 activate dynamic-template S99_DT_PTA_MIN
```

Connect PPPoE session with username PPP1

```
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS: Send Access-Request to
172.18.88.221:1812 id 145, len 252
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  authenticator 13 E9 99 50 6D 38
01 45 - 50 62 4D DE BB 5C 44 9E
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Acct-Session-Id     [44]    10
00000115
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    41
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  NAS-Port            [5]     6
1694524921
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  NAS-Port-Id         [87]    16
0/0/101/99.101
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  User-Name           [1]     19
PPP1@added_domain
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Service-Type        [6]     6
Framed[0]
```

```
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  User-Password       [2]     18
*
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]: Unsuppoted attribute.
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    22
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    33
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Framed-Protocol     [7]     6
PPP[0]
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  NAS-Port-Type       [61]    6
Virtual PPPoEoQinQ[0]
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Called-Station-Id   [30]    4
99
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Calling-Station-Id  [31]    16
a857.4e06.4f47
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Nas-Identifier      [32]    11
Roy_BNG_1
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  NAS-IP-Address      [4]     6
192.168.88.99
RP/0/RSP0/CPU0:May  5 00:50:05.121 : radiusd[1117]:  RADIUS:  Event-Timestamp     [55]    6
1399251005
RP/0/RSP0/CPU0:May  5 00:50:05.122 : radiusd[1117]: Got global deadtime 0
RP/0/RSP0/CPU0:May  5 00:50:05.122 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:May  5 00:50:05.122 : radiusd[1117]: Using global deadtime = 0 sec
RP/0/RSP0/CPU0:May  5 00:50:05.122 : radiusd[1117]: Start timer thread rad_ident 145
remote_port 1812 remote_addr 0xac1258dd, socket 1342483620 rctx 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:50:05.122 : radiusd[1117]: Successfully sent packet and started
timeout handler for rctx 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: rctx found is 0x5015ba34
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: Radius packet decryption complete with rc
= 0
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]:  RADIUS: Received from id 145
172.18.88.221:1812, Access-Accept, len 20
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]:  RADIUS:  authenticator 17 24 49 DF 59 87
33 39 - E2 30 CA 3A BE 3C 8B 88
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: Freeing server group transaction_id
(55000013)
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: pack_length = 20 radius_len = 20
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: rad_nas_reply_to_client: Received response
from id : 145,packet type 2
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: (rad_nas_reply_to_client) Successfully
decoded the response No error: PASS
RP/0/RSP0/CPU0:May  5 00:50:05.153 : radiusd[1117]: (rad_nas_reply_to_client) Successfully
stored the preferred server info

RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al de
Mon May  5 00:50:11.725 UTC
Interface:                Bundle-Ether101.99.pppoe249
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Mon May  5 00:50:05 2014
IPv4 Address:             1.1.99.8, VRF: default
Mac Address:              a857.4e06.4f47
Account-Session Id:       00000115
Nas-Port:                 1694524921
User name:                PPP1@added_domain
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000068
Created:                  Mon May  5 00:50:04 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Access-interface:         Bundle-Ether101.99
Policy Executed:
policy-map type control subscriber S99_CP_PTA_AUTHOR_ADD_DOMAIN
  event Session-Start match-first [at Mon May  5 00:50:04 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [Succeeded]
  event Session-Activate match-first [at Mon May  5 00:50:05 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [Succeeded]
      20 activate dynamic-template S99_DT_PTA_MIN [Succeeded]
Session Accounting: disabled
Last COA request received: unavailable
```

```
[Last IPv6 down]
Disconnect Reason:

RP/0/RSP0/CPU0:Roy_BNG_1#sh sub
sub-util  subscriber
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  sadb
Mon May  5 00:50:21.022 UTC


Sublabel: 0x00000068 Node_ID: 00000001 Signature: 0xabcdef12 Version: 1 Rev: 14
Length: 303

Attribute list: 1343138132
1:  parent-if-handle len=  4  4448(1160)
2:  port-type       len=  4  Virtual PPPoE over QinQ
3:  outer-vlan-id   len=  4  101(65)
4:  inner-vlan-id   len=  4  99(63)
5:  protocol-type   len=  4  ppp
6:  if-handle       len=  4  21920(55a0)
7:  client-mac-address len= 14  a857.4e06.4f47
8:  string-session-id len=  8  00000115
9:  nas-port        len=  4  1694524921(650065f9)
10:  interface       len= 14  0/0/101/99.101
11:  dnis            len=  2  99
12:  formatted-clid  len= 14  a857.4e06.4f47
13:  username        len= 17  PPP1@added_domain
14:  author_status   len=  1  true
15:  addr            len=  4  1.1.99.8
16:  vrf-id          len=  4  1610612736(60000000)
17:  ipv4-session-state len=  1  true
```

4.4.4.NAS-Port-ID

By default NAS-Port-ID attribute will be filled with “<slot>/<subslot>/<port>/<vlan>” .

The format of the NAS-Port-ID attribute is customizable using the attribute format. Furthermore, you can configure different format for NAS-Port-ID for different Nas-port-type.

Following is an example of creating a customized Nas-Port-ID attribute and apply a predefined attribute format to Nas-Port-ID attribute.

```
aaa attribute format NAS_PORT_FORMAT
 format-string length 253 "eth%s/%s/%s:%s.%s %s0/0/0/0/0/0" physical-
slot physical-subslot physical-port outer-vlan-id inner-vlan-id
circuit-id-tag

aaa radius attribute nas-port-id format NAS_PORT_FORMAT type 36
```

Please be noted that when the access interface is a sub-interface of bundle-ethernet interface, the physical-slot=0, physical-subslot=0, physical-port=bundle-ID.

In this way, you can assign this customized NAS-port-ID format to a certain Nas-port-type, the access-request for sessions under an access interface with that particular Nas-port-type will follow this defined format to build a NAS-Port-ID.

If 'type' option is not specified, then the Nas-Port-ID for all interface types is constructed according to the format name specified in the command.

4.4.5.Called-Station-Id and Calling-Station-Id

By default calling-station-id attribute will be filled with remote-id and called-station-id attribute will be filled with circuit-id.

For PPPoE session, if the remote-id tag/circuit-id tag are present in the PPPoE packet, then the calling-station-id and called-station-id will not be included in the access-request/accounting-request packet without explicit configuration for the format of calling-station-id and called-station-id.

For IPoE session, if the DHCP option82 remote-id /circuit-id sub options are not present in the DHCP discover packet, then the calling-station-id and called-station-id will not be included in the access-request/accounting-request packet without explicit configuration for the format of calling-station-id and called-station-id.

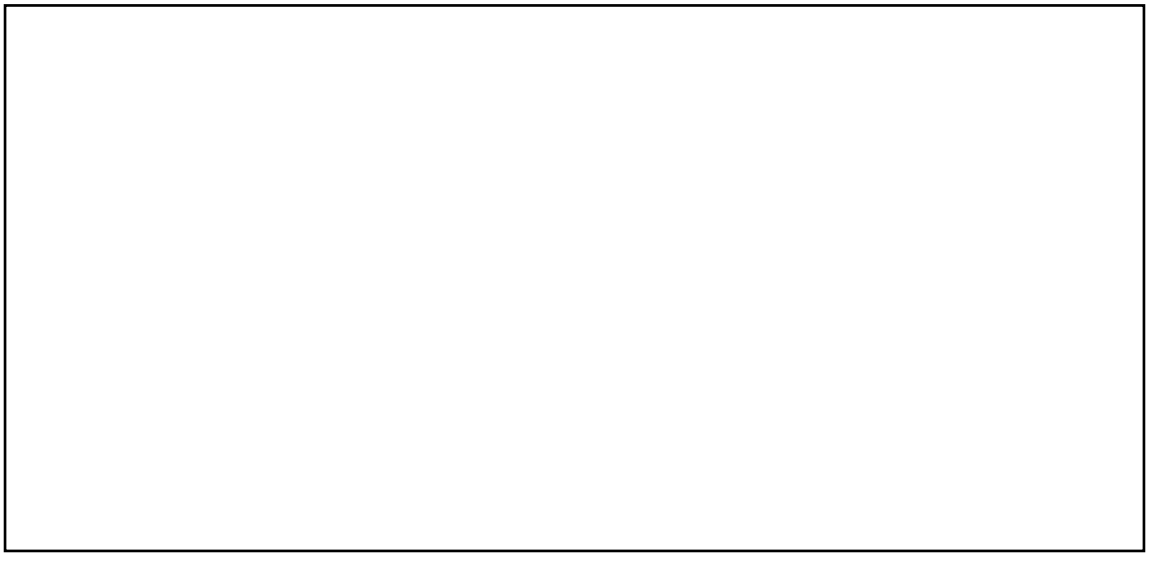
For IPoE, the remote-id /circuit-id could be inserted by BNG itself, no matter whether they are inserted by the access node. The inserted remote-id/circuit-id will be used to build the Called-Station-Id and Calling-Station-Id. To some extent, the inserted remote-id /circuit-id is also customisable.In this way, you can customise the Called-Station-Id and Calling-Station-Id indirectly.

```
RP/0/RSP0/CPU0:Roy_BNG_1(config)#dhcp ipv4 profile TEST  proxy  relay
information  option  remote-id  REMOTE_ID

RP/0/RSP0/CPU0:Roy_BNG_1(config)#dhcp ipv4  interface bundle-e 201.99
proxy  information  option  format-type  circuit-id  format-string
"%s" ?
  inner-vlan-id     Inner vlan id tag
  outer-vlan-id     Outer vlan id tag
  physical-chassis  Rack
  physical-port     Port
  physical-slot     Slot
  physical-subport  Subport
  physical-subslot  Subslot
```

The format of the called-station-id/calling-station-id attribute is customizable respectively using the attribute format. Furthermore, you can configure different format for called-station-id/calling-station-id for different Nas-port-type.

Examples of constructing called-station-ID and calling-station-ID with per nas-port-type based customisation (left) v.s. system based customisation(right).



```
aaa attribute format INTF_ID
 format-string length 253 "%s/%s/%s/%s_%s:%s" physical-chassis
physical-slot physical-subslot physical-port outer-vlan-id inner-
vlan-id
!
!
aaa attribute format FORMAT_CALLED_STATION_ID
 format-string length 253 "%s" inner-vlan-id
!
aaa attribute format FORMAT_CALLING_STATION_ID
 mac-address
!
aaa attribute format FORMAT_CALLED_STATION_ID_1
 format-string length 253 "%s" outer-vlan-id
!
aaa attribute format FORMAT_CALLING_STATION_ID_1
 format-string length 253 "%s" dhcp-client-id-spl
!
aaa radius attribute nas-port format e
PPPPPPPPVVVVVVVVVVVVVVVVVUUUUUUUU
aaa radius attribute Nas-Port-ID format INTF_ID type 1
aaa radius attribute called-station-id format
FORMAT_CALLED_STATION_ID_1 type 1
aaa radius attribute called-station-id format
FORMAT_CALLED_STATION_ID
aaa radius attribute calling-station-id format
FORMAT_CALLING_STATION_ID_1 type 1
aaa radius attribute calling-station-id format
FORMAT_CALLING_STATION_ID
```

```
interface Bundle-Ether201.99
 description student-99 DHCPv4 session
 aaa radius attribute nas-port-type Sync
 ipv4 point-to-point
 ipv4 unnumbered Loopback2099
 service-policy type control subscriber
S99_CP_DHCPV4_BASIC
 ipsubscriber ipv4 l2-connected
  initiator dhcp
 !
 encapsulation ambiguous dot1q 201 second-
dot1q 99-100
```

```
interface Bundle-Ether201.99
 description student-99 DHCPv4 session

 ipv4 point-to-point
 ipv4 unnumbered Loopback2099
 service-policy type control subscriber
S99_CP_DHCPV4_BASIC
 ipsubscriber ipv4 l2-connected
  initiator dhcp
 !
 encapsulation ambiguous dot1q 201 second-
dot1q 99-100
```

```
rad_recv: Access-Request packet from host
192.168.88.99 port 64459, id=44, lengt
h=264
Cisco-AVPair = "client-mac-
address=a857.4e06.4f47"
Cisco-AVPair = "dhcp-vendor-class=MSFT 5.0"
Acct-Session-Id = "0000001c"
NAS-Port = 3372271872
NAS-Port-Id = "0/0/0/201_201:99"
Cisco-NAS-Port = "0/0/0/201_201:99"
Service-Type = Outbound-User
User-Name = "a857.4e06.4f47"
User-Password = "cisco"
NAS-Port-Type = Sync
Called-Station-Id = "201"
Calling-Station-Id = ".WN.OG"
Event-Timestamp =
Cisco-AVPair = "dhcp-client-id=\250WN\006OG"
NAS-Identifier = "Roy_BNG_1"
NAS-IP-Address = 192.168.88.99
```

```
rad_recv: Access-Request packet from host
192.168.88.99 port 64459, id=47, lengt
h=267
Cisco-AVPair = "client-mac-
address=a857.4e06.4f47"
 Cisco-AVPair = "dhcp-vendor-class=MSFT 5.0"
 Acct-Session-Id = "0000001f"
 NAS-Port = 3372271872
 NAS-Port-Id = "0/0/201/99.201"
 Cisco-NAS-Port = "0/0/201/99.201"
 Service-Type = Outbound-User
 User-Name = "a857.4e06.4f47"
 User-Password = "cisco"
 NAS-Port-Type = 44
 Called-Station-Id = "99"
 Calling-Station-Id = "a857.4e06.4f47"
 Event-Timestamp =
 Cisco-AVPair = "dhcp-client-id=\250WN\006OG"
 NAS-Identifier = "Roy_BNG_1"
 NAS-IP-Address = 192.168.88.99
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager
sadb
Sun May  4 22:50:56.678 UTC

Sublabel: 0x00000055 Node_ID: 00000001 Signature:
0xabcdef12 Version: 1 Rev: 14
Length: 314

Attribute list: 1343138132
1:  protocol-type    len=  4  dhcp
2:  dhcp-client-id   len=  6  ^hWN^FOG
3:  port-type        len=  4  Serial
4:  inner-vlan-id    len=  4  99(63)
5:  outer-vlan-id    len=  4  201(c9)
6:  client-mac-address len= 14  a857.4e06.4f47
7:  parent-if-handle len=  4  4512(11a0)
8:  dhcp-vendor-class len=  8  MSFT 5.0
9:  string-session-id len=  8  0000001c
10:  nas-port        len=  4
3372271872(c900c900)
11:  interface       len= 16  0/0/0/201_201:99
12:  dnis            len=  3  201
13:  formatted-clid  len=  6  .WN.OG
14:  username        len= 14  a857.4e06.4f47
15:  author_status   len=  1  true
16:  addr            len=  4  2.1.99.1
17:  if-handle       len=  4  5984(1760)
18:  vrf-id          len=  4
1610612736(60000000)
19:  ipv4-session-state len=  1  true
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager
sadb
Sun May  4 23:22:42.786 UTC

Sublabel: 0x00000058 Node_ID: 00000001 Signature:
0xabcdef12 Version: 1 Rev: 14
Length: 319

Attribute list: 1343138132
1:  protocol-type    len=  4  dhcp
2:  dhcp-client-id   len=  6  ^hWN^FOG
3:  port-type        len=  4  Virtual IP over QinQ
4:  inner-vlan-id    len=  4  99(63)
5:  outer-vlan-id    len=  4  201(c9)
6:  client-mac-address len= 14  a857.4e06.4f47
7:  parent-if-handle len=  4  4512(11a0)
8:  dhcp-vendor-class len=  8  MSFT 5.0
9:  string-session-id len=  8  0000001f
10:  nas-port        len=  4
3372271872(c900c900)
11:  interface       len= 14  0/0/201/99.201
12:  dnis            len=  2  99
13:  formatted-clid  len= 14  a857.4e06.4f47
14:  username        len= 14  a857.4e06.4f47
15:  author_status   len=  1  true
16:  addr            len=  4  2.1.99.1
17:  if-handle       len=  4  6176(1820)
18:  vrf-id          len=  4
1610612736(60000000)
19:  ipv4-session-state len=  1  true
```

4.4.6.NAS-Port

The format of the NAS-Port attribute is customizable, and furthermore, you can define different NAS-Port format for different Nas-port-type.

The approach of associating a predefined attribute format to the attribute is not applicable for NAS-Port, we use an alternative configuration.

For more detail of nas-port format customization please visit

http://www.cisco.com/en/US/docs/routers/asr9000/software/asr9k_r4.3/bng/configuration/guide/b_bng_cg43asr9k_chapter_010.html#task_2F9E7DA9B8F647D3BA517CF9E5E228F0

Please be noted the nas-port format need to be configured explicitly. If a NAS-Port format is not configured for a NAS-Port-Type, the system looks for a default CLI configuration for the NAS-Port format. In the absence of both these configurations, for sessions with that particular NAS-Port-Type, the NAS-Port attribute is not sent to the RADIUS server.

4.4.7.Cisco-AVPair remote-id-tag, cuicuit-id-tag and dhcpv6-interface-id

Please be noted that in the access-request message, the same string reflecting the circuit id information will be carried in both adsl-vsa “Agent-Circuit-Id” and Cisco-AVPair “remote-id-tag”. Also, the same string reflecting the remote id information will be carried in both adsl-vsa “Agent-Remote-Id” and cisco-AVPair “remote-id-tag”.

Following are the behaviours how those two attributes are created.

- **DHCPV4 SESSION**

Regarding DHCPv4 session, when ASR9K acts as a DHCPv4 proxy, let’s focus on Cisco-AVPair remote-id-tag and cuicuit-id-tag.

- For IPoEv4 if the dhcpv4 option 82 is present in the FSOL, those information will be used in the AVPair.
- For IPoEv4 if the dhcpv4 option 82 is not present in the FSOL and there are no circuit-id/remote-id inserted by CLI explicitly in ASR9K, those information will not be included in the AVpair.
- For IPoEv4 if the dhcpv4 option 82 is present in the FSOL but circuit-id/remote-id are inserted by CLI in ASR9K, the inserted information will be included in the AVpair.

- **DHCPV6 SESSION**

Regarding DHCPv6 session, when ASR9K acts as a DHCPv6 proxy, let’s focus on Cisco-AVPair remote-id-tag and dhcpv6-interface-id

- DHCPv6 option 37 is equivalent of DHCPv4 option 82 remote-id, which will be put into AVPair remote-id-tag.

- DHCPv6 option 18 is equivalent to DHCPv4 option 82 circuit-id , but this information will not be present in AVpair circuit-id-tag, instead, it is put into another AVPair named “dhcpv6-interface-id”
- For IPoEv6 if the dhcpv6 option 18 and option 37 are present in the FSOL, those information will be used in the AVPair, option 18 for remote-id-tag and option 37 for dhcpv6-interface-id .
- For IPoEv6 if the dhcpv6 option 18 and option 37 are not present in the FSOL , ASR9K system will generate a remote-ID and interface-id automatically and those system generated information will be included in the AVpair.
- For IPoEv6 if the dhcpv6 option 18 and option 37 are present in the FSOL but circuit-id/interface-id are inserted by CLI in ASR9K, the inserted information will be included in the AVpair.

- **PPPOE SESSION**

Regarding PPPoE session, let’s focus on Cisco-AVPair remote-id-tag and cuicuit-id-tag.i

- For PPPoE if those information are present in the PPPoE tag in PPPoE PADI/PADR packet, those information will be used in the AVPair.
- For PPPoE if those information are not present in the PPPoE tag in PPPoE PADI/PADR packet, those information will not be included in the AVpair.
- There is no way to insert pppoe circuit-id/remote-id in ASR9K.

PPPoE circuit-id and remote-id are defined by ADSL forum, basically it’s a tag in PPPoE PADI and PADR packet inserted by the DSLAM or other access node supposedly to identify the DSLAM and/or the subscriber. You can find more information in http://www.broadband-forum.org/technical/download/TR-101.pdf . it’s quite like the DHCP opton 82 in context of DHCP initiated IPoE session.

In the BNG you can use following show command to find if there is pppoe circuit-id/remote-id present

```
RP/0/0/CPU0:demo#show pppoe interfaces GigabitEthernet0/1/0/0.pppoe1

GigabitEthernet0/1/0/0.pppoe1 is Complete
  Session id: 1
  Access interface: GigabitEthernet0/1/0/0
  BBA-Group: blue
  Local MAC address: aabb.cc00.8301
  Remote MAC address: aabb.cc00.8201
  Tags:
    Service-Name: service1
    Max-Payload: 1500
    IWF
    Circuit-ID: circuit1
    Remote-ID: remote1
```

5. Chapter 5, Attributes in Access-Accept - configure a session.

5.1.convention

- You see a example of the radius attribute here instead of a syntax.
- The referred config means you need those config on the box to work together with the attributes downloaded to achieve a goal.
- Equivalent configuration in dynamic-template is an alternative to the radius attributes which can work together with the referred config to achieve the same goal.
- You will see same attributes be explained in in difference clause for different use case(for example, PPP and IPoE session respectively), that is because the handling of some attributes varies on session type basis.

5.2.attributes usage in detail

NO. 1 V4 UNNUMBERED

——

Function

To specify the IPv4 unnumbered interface for PPPoE/IPoE session. Assigning an unnumbered interface to a V4 session is mandatory to have the IPv4 protocol stack up for a session.

Attributes

```
Cisco-AVPair = ”ipv4-unnumbered=Loopback12”
```

Referred configuration on BNG

```
interface Loopback12
 ipv4 address 192.168.88.12 255.255.255.255
```

Equivalent configuration in dynamic-template

```
dynamic-template type  ppp  TEST ipv4 unnumbered   loopback  12
```

Notes

- *Applicable for PPPoE PTA, DHCP triggered IPoE, PKT triggered IPoE, static session.*
- *Never include this attribute in the access-accept for a LAC session.*
- *This is the attribute to enable IPv4 address family for a session.*

NO. 2 V4 POOL FOR PPP

——

Function

To specify the name of the IPv4 pool for a PPPoE session.

Attributes

```
Cisco-avpair = “addr-pool=S99_POOL_PPPV4”
```

or

```
Framed-pool = "S99_POOL_PPPV4"
```

Referred configuration on BNG

```
pool vrf default ipv4 S99_POOL_PPPV4
 address-range 1.1.99.1 1.1.99.253
```

Equivalent configuration in dynamic-template

```
dynamic-template type  ppp TEST  ppp ipcp  peer-address  pool
S99_POOL_PPPV4
```

Notes

- *Applicable for PPPoE PTA*
- *Never include this attribute in the access-accept for a LAC session.*
- *the vrf the pool belong to must consist with the vrf configured for the session.*

NO. 3 V4 ADDRESS FOR PPPOE PTA SESSION

———

Function

To specify the IPv4 address assigned to a PPPoE client

Attributes

```
Cisco-avpair = “ip-addr=2.1.99.253”
```

or

Framed-Ip-Address = 2.1.99.253

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- *Applicable for PPPoE PTA session.*
- *Never include this attribute in the access-accept for a LAC session.*
- *usually go together with the attribute of net mask.*
- *the ipv4 address will be negotiate with client via PPPoE IPCP*

NO. 4 V4 NETMASK FOR PPPOE PTA SESSION

Function

To specify the IPv4 address netmask assigned to a PPPoE client

Attributes

Cisco-avpair = "netmask=255.255.255.0"

or

Framed-IP-Netmask = 255.255.255.0

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  ppp  TEST ppp ipcp mask  255.255.255.0
```

Notes

- *Applicable for PPPoE PTA session.*
- *Never include this attribute in the access-accept for a LAC session.*
- *usually go together with the attribute of ipv4 address.*
- *the netmask will be negotiated with client via PPPoE IPCP only when PPP client ask for that in a IPCP confreq, otherwise this will not be negotiated to the client. it does not matter for a PPP client given the point-to-point nature of PPP.*

NO. 5 V4 DNS SERVER FOR PPP PTA

——

Function

To specify the ipv4 address of the primary and secondary DNS server for PPPoE session.

Attributes

```
Cisco-avpair = "primary-dns=8.8.8.8",
Cisco-avpair = "secondary-dns=9.9.9.9"
```

or

```
Ascend-Client-Primary-DNS := 8.8.8.8
Ascend-Client-Secondary-DNS = 9.9.9.9
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  ppp TEST  ppp ipcp dns  8.8.8.8 9.9.9.9
```

Note

-radius attribute for v4 DNS for DHCP triggered IPoE session has not been supported yet as of 5.2.0, another word, you can download the DNS attribute from radius server, but BNG will not translate it to DHCP options in the offer message to the client.

NO. 6 IPV4 MTU FOR PPPOE PTA SESSION

———————————————————————————————————————

Function

To specify the IPv4 MTU for the PPPoE session interface.

Attributes

Cisco-avpair = "ipv4-mtu=1200"

(IETF attribute "Framed-MTU = 1200" does not work since the lack of distinguishing between v4 and v6)

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  ppp TEST ipv4 mtu 1200
```

Notes

- *Applicable for PPPoE PTA*
- *Never include this attribute in the access-accept for a LAC session.*
- *normally, BNG will honor the MRU sent by the PPP client during LCP, in that case, the ipv4 mtu configured in a dynamic template or downloaded from a radius server does not effect, unless you ignore the PPP MRU explicitly using following CLI "dynamic-template type ppp S99_DT_LCP ppp mru ignore"*
- *be careful about the IP fragmenting caused when specify a small MTU. ASR9K BNG does not forward the fragmented packet via a session to a subscriber.*
- *this approach has no impact on the MTU on the CPE.*
- *Use following CLI to check the ipv4 MTU for a session interface.*

```
RP/0/RSP0/CPU0:Roy_BNG_1# show ipv4 int Bundle-Ether101.99.pppoe1529
Bundle-Ether101.99.pppoe1529 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Interface is unnumbered.  Using address of Loopback1099 (1.1.99.254/24)
  MTU is 1500 (1200 is available to IP)
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is disabled
```

```
ICMP redirects are never sent
ICMP unreachables are always sent
ICMP mask replies are never sent
Table Id is 0xe0000000
```

Notes

- *Applicable for PPPoE PTA*
- *Never include this attribute in the access-accept for a LAC session.*
- *the DNS server ipv4 address will be negotiate with client via PPP IPCP.*
- *please be noted that Cisco-avpair += "wins-server=1.1.1.1" is unsupported, with this avpair included in the user-profile would fail the session establishment.*

No. 7 V4 framed-route for PPP PTA session

———

Function

To specify the IPv4 route associated to a PPPoE PTA session.

Attributes

Framed-route = "45.1.6.0 255.255.255.0 0.0.0.0 6 tag 7"

For PPPoE, the syntax is

Framed-Route = "vrf <prefix VRF> <prefix> <prefix mask> vrf <next hop vrf> <next hop prefix> <AD> tag <tag id>"

- Here the next hop prefix must be 0.0.0.0 or absent, otherwise the installation of the route would fail.
- AD is optional, without the presence of AD, the route will have a AD of 1.
- Tag is optional.
- vrf <prefix VRF> and vrf <next hop vrf> are ignored by ASR9K, they can be included in the attribute and have any value but take no effect.

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- For PPPoE session, this attribute is supported from day 1.
- There are some feature disparities between PPPoE and IPoE
- PPPoE
  - Cross VRF route is not supported, which means that the session, the prefix and next-hop of the route must be in the same VRF, the route will be installed into the VRF to which the session belong (the vrf specified by dyamic-template or Avpair vrf-id coming along with the framed-route on authentication).
  - To install a framed-route into a VRF (for example VRF_1) where the session is reside in , you can download following attribute from the radius and the route of 10.10.10.0 255.255.255.0 will be installed to vrf VRF_1.

```
Cisco-AVpair="vrf-id=VRF_1"
Framed-route="10.10.10.0 255.255.255.0"
```

  - COA pushing framed-route for pppoe session is not supported.
- IPoE(list here for comparison purpose, see more detail in later clause)
  - Cross VRF route is supported. The session and prefix could be in one VRF, the next-hop could be in another vrf.
  - COA pushing is supported for IPoE session.
- Never include this attribute in the access-accept for a LAC session.

Verified framed-route attribute format for pppoe PTA session

1) Prefix+mask only

```
PPP10@S99 Cleartext-Password := "cisco"
      Framed-Route = "15.0.0.0 255.255.255.0"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
 Attribute List: 0x500f9a18
1:  route           len= 22  value= 15.0.0.0 255.255.255.0

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Wed Jun 25 22:40:55.614 UTC

A    1.1.99.1/32 is directly connected, 00:00:41, Bundle-Ether101.99.pppoe36
A    15.0.0.0/24 is directly connected, 00:00:41, Bundle-Ether101.99.pppoe36

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Wed Jun 25 22:41:14.630 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 1, metric 0 (connected)
  Installed Jun 25 22:40:14.574 for 00:01:00
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe36
      Route metric is 0
  No advertising protos.
```

2) Prefix+mask+next-hop (identical to Framed-Route = "15.0.0.0 255.255.255.0")

```
PPP11@S99 Cleartext-Password := "cisco"
     Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
  Attribute List: 0x500f9a28
1:  route           len= 30  value= 15.0.0.0 255.255.255.0 0.0.0.0

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Wed Jun 25 22:42:33.781 UTC

A    1.1.99.4/32 is directly connected, 00:00:32, Bundle-Ether101.99.pppoe39
A    15.0.0.0/24 is directly connected, 00:00:32, Bundle-Ether101.99.pppoe39

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Wed Jun 25 22:42:48.162 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 1, metric 0 (connected)
  Installed Jun 25 22:42:01.298 for 00:00:47
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe39
      Route metric is 0
  No advertising protos.
```

3) with AD and tag

PPP12@S99 Cleartext-Password := "cisco"
Framed-Route = "15.0.0.0 255.255.255.0 4 tag 10"

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
User Profile received from AAA:
 Attribute List: 0x500f9a30
1:  route           len= 31  value= 15.0.0.0 255.255.255.0 4 tag 10

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Wed Jun 25 22:45:31.600 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 4, metric 0 (connected)
  Tag 10
  Installed Jun 25 22:44:27.271 for 00:01:04
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe40
      Route metric is 0
  No advertising protos.
```

4) with AD , but no tag

PPP13@S99 Cleartext-Password := "cisco"
Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0 4"

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
1:  route           len= 32  value= 15.0.0.0 255.255.255.0 0.0.0.0 4
RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Wed Jun 25 22:47:39.156 UTC

A    1.1.99.6/32 is directly connected, 00:00:35, Bundle-Ether101.99.pppoe41
A    15.0.0.0/24 is directly connected, 00:00:35, Bundle-Ether101.99.pppoe41

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Wed Jun 25 22:48:02.139 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 4, metric 0 (connected)
  Installed Jun 25 22:47:04.163 for 00:00:58
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe41
      Route metric is 0
  No advertising protos.
```

5) with tag , but no AD

```
PPP14@S99 Cleartext-Password := "cisco"
     Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0 tag 10"
```

```
  RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
   Attribute List: 0x500f9a38
1:  route           len= 37  value= 15.0.0.0 255.255.255.0 0.0.0.0 tag 10

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Wed Jun 25 23:09:37.743 UTC

A    1.1.99.7/32 is directly connected, 00:00:22, Bundle-Ether101.99.pppoe42
A    15.0.0.0/24 is directly connected, 00:00:22, Bundle-Ether101.99.pppoe42

RP/0/RSP0/CPU0:Roy_BNG_1#sh route 15.0.0.0/24
Wed Jun 25 23:09:53.069 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 1, metric 0 (connected)
  Tag 10
  Installed Jun 25 23:09:15.197 for 00:00:38
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe42
      Route metric is 0
  No advertising protos.
```

6) full format

```
PPP15@S99 Cleartext-Password := "cisco"
     Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10"
```

```
  RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
—display snippet—-
 1:  route           len= 39  value= 15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10

 RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Wed Jun 25 23:11:32.970 UTC

A    1.1.99.9/32 is directly connected, 00:00:23, Bundle-Ether101.99.pppoe44
A    15.0.0.0/24 is directly connected, 00:00:23, Bundle-Ether101.99.pppoe44

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Wed Jun 25 23:11:44.400 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 4, metric 0 (connected)
  Tag 10
  Installed Jun 25 23:11:09.231 for 00:00:35
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe44
      Route metric is 0
  No advertising protos.
```

7) Session and framed-route in vrf

```
PPP20@S99 Cleartext-Password := "cisco"
      Cisco-avpair = "ipv4-unnumbered=Loopback1199",
      Cisco-avpair += "addr-pool=S99_POOL_PPPV4_VRF",
      Cisco-avpair += "vrf-id=S99_VRF",
      Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10"
```

PPP session do not support cross VRF framed-route , which means the framed-route must be installed in the same vrf in which the session get terminated. Within the attribute you can have a vrf name of the prefix or/and the vrf name of the next-hop, but they are ignored by BNG when handling the attribute.

Another word, following four attributes are equivalent, leading to the same result as following.

```
Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10"
Framed-Route = “vrf S99_VRF 15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10"
Framed-Route = "vrf S100_VRF 15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10”
Framed-Route = "vrf S99_VRF 15.0.0.0 255.255.255.0 vrf S100_VRF 0.0.0.0 4 tag 10"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all
Wed Jun 25 23:54:02.348 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     Subscriber IP Addr / Prefix
                                               LNS Address (Vrf)
------------------------------------------------------------------------------
PPPoE:PTA    BE101.99.pppoe108        AC        1.1.99.4 (S99_VRF)
RP/0/RSP0/CPU0:Roy_BNG_1#


RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de in
Wed Jun 25 23:51:14.409 UTC
User Profile received from AAA:
 Attribute List: 0x500f9ad8
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
4:  route           len= 39  value= 15.0.0.0 255.255.255.0 0.0.0.0 4 tag 10

RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Wed Jun 25 23:52:27.590 UTC

A    1.1.99.4/32 is directly connected, 00:01:26, Bundle-Ether101.99.pppoe108
A    15.0.0.0/24 is directly connected, 00:01:26, Bundle-Ether101.99.pppoe108
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF 15.0.0.0/24
Wed Jun 25 23:52:49.230 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 4, metric 0 (connected)
  Tag 10
  Installed Jun 25 23:51:01.287 for 00:01:48
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe108
      Route metric is 0
  No advertising protos.
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all
Thu Jun 26 00:19:26.925 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     Subscriber IP Addr / Prefix
                                               LNS Address (Vrf)
------------------------------------------------------------------------------
PPPoE:PTA    BE101.99.pppoe121        AC        1.1.99.6 (S99_VRF)

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de  internal
Thu Jun 26 00:19:30.174 UTC
—-display snippet—-
User Profile received from AAA:
 Attribute List: 0x500f9af0
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
4:  route           len= 51  value= vrf S99_VRF 15.0.0.0 255.255.255.0 0.0.0.0 4
tag 10


RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Thu Jun 26 00:19:59.455 UTC
A    1.1.99.6/32 is directly connected, 00:00:39, Bundle-Ether101.99.pppoe121
A    15.0.0.0/24 is directly connected, 00:00:39, Bundle-Ether101.99.pppoe121
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all
Wed Jun 25 23:54:02.348 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     Subscriber IP Addr / Prefix
                                               LNS Address (Vrf)
PPPoE:PTA    BE101.99.pppoe122        AC        1.1.99.7 (S99_VRF)
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de  internal

User Profile received from AAA:
 Attribute List: 0x500f9af0
```

```
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
4:  route           len= 52  value= vrf S100_VRF 15.0.0.0 255.255.255.0 0.0.0.0 4
tag 10


RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S100_VRF
Thu Jun 26 00:22:40.355 UTC

% No matching vrf found

RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Thu Jun 26 00:22:53.992 UTC

A    1.1.99.7/32 is directly connected, 00:00:40, Bundle-Ether101.99.pppoe122
A    15.0.0.0/24 is directly connected, 00:00:40, Bundle-Ether101.99.pppoe122
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh  subscriber  sess al
Thu Jun 26 23:30:16.550 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     Subscriber IP Addr / Prefix
                                               LNS Address (Vrf)
------------------------------------------------------------------------------
PPPoE:PTA    BE101.99.pppoe5          AC        1.1.99.4 (S99_VRF)



RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all detail  internal
Thu Jun 26 23:25:54.246 UTC

User Profile received from AAA:
 Attribute List: 0x500f9cec
1:  ipv4-unnumbered len= 12  value= Loopback1199
2:  addr-pool       len= 18  value= S99_POOL_PPPV4_VRF
3:  ip-vrf          len=  7  value= S99_VRF
4:  route           len= 64  value= vrf S99_VRF 15.0.0.0 255.255.255.0 vrf S100_VRF
0.0.0.0 4 tag 10

RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Thu Jun 26 23:26:05.261 UTC

A    1.1.99.4/32 is directly connected, 00:00:19, Bundle-Ether101.99.pppoe5
A    15.0.0.0/24 is directly connected, 00:00:19, Bundle-Ether101.99.pppoe5
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF  15.0.0.0/24
Thu Jun 26 23:26:22.848 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 4, metric 0 (connected)
  Tag 10
  Installed Jun 26 23:25:46.152 for 00:00:36
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether101.99.pppoe5
      Route metric is 0
```

```
  No advertising protos.
```

NO. 8 V4 POOL FOR DHCP

——

Function

To specify the name of the IPv4 pool for DHCPv4 triggered IPoE session to get address assigned from, when ASR9K act as DHCPv4 SERVER.(5.1.0 release onward)

Attributes

Cisco-avpair = “addr-pool=S99_POOL_DHCPV4_2”

or

Framed-pool = “S99_POOL_DHCPV4_2"

Referred configuration on BNG

```
dhcp ipv4
 profile S99_SERVER_PROFILE server
  lease 0 0 10
  pool S99_POOL_DHCPV4   <—not necessary , put here on purpose to
show that this configure will be overrode by the pool name specified
in radius attribute.
  subnet-mask 255.255.255.255 <—not necessary , put here on purpose
to show that this configure will be overrode by the mask defined in
the pool.
  default-router 2.1.99.254

 !
 interface Bundle-Ether201.99 server profile S99_SERVER_PROFILE

pool vrf default ipv4 S99_POOL_DHCPV4 <—not necessary , put here on
purpose to show that this configure will be overrode by the pool name
specified  in radius attribute.
 network 2.1.99.0/24 default-router 2.1.99.254
```

```
pool vrf default ipv4 S99_POOL_DHCPV4_2 <— this is the definition for
the pool used by radius attributes.
 network 2.2.99.0/24 default-router 2.2.99.254
```

Equivalent configuration in dynamic-template

n/a

But you can define the ipv4 pool name statically in a dhcp ipv4 server profile or it's class.

```
dhcp ipv4  profile SERVER_PROFILE server  pool S99_POOL_DHCPV4_2
```

or

```
dhcp ipv4  profile SERVER_PROFILE server  class CLASS_TEST pool
S99_POOL_DHCPV4_2
```

Notes

- *Applicable for DHCPv4 triggered IPoE session*
- *here the ASR9K must act as a DHCPv4 server, this is part of the so called DHCP radius proxy feature..*
- *the vrf the pool belong to must consist with the vrf configured for the session.*
- *Note, with above configuration of pool, the net mask configured in the pool will not be overrode by net mask downloaded from radius server. See detail in following example.*

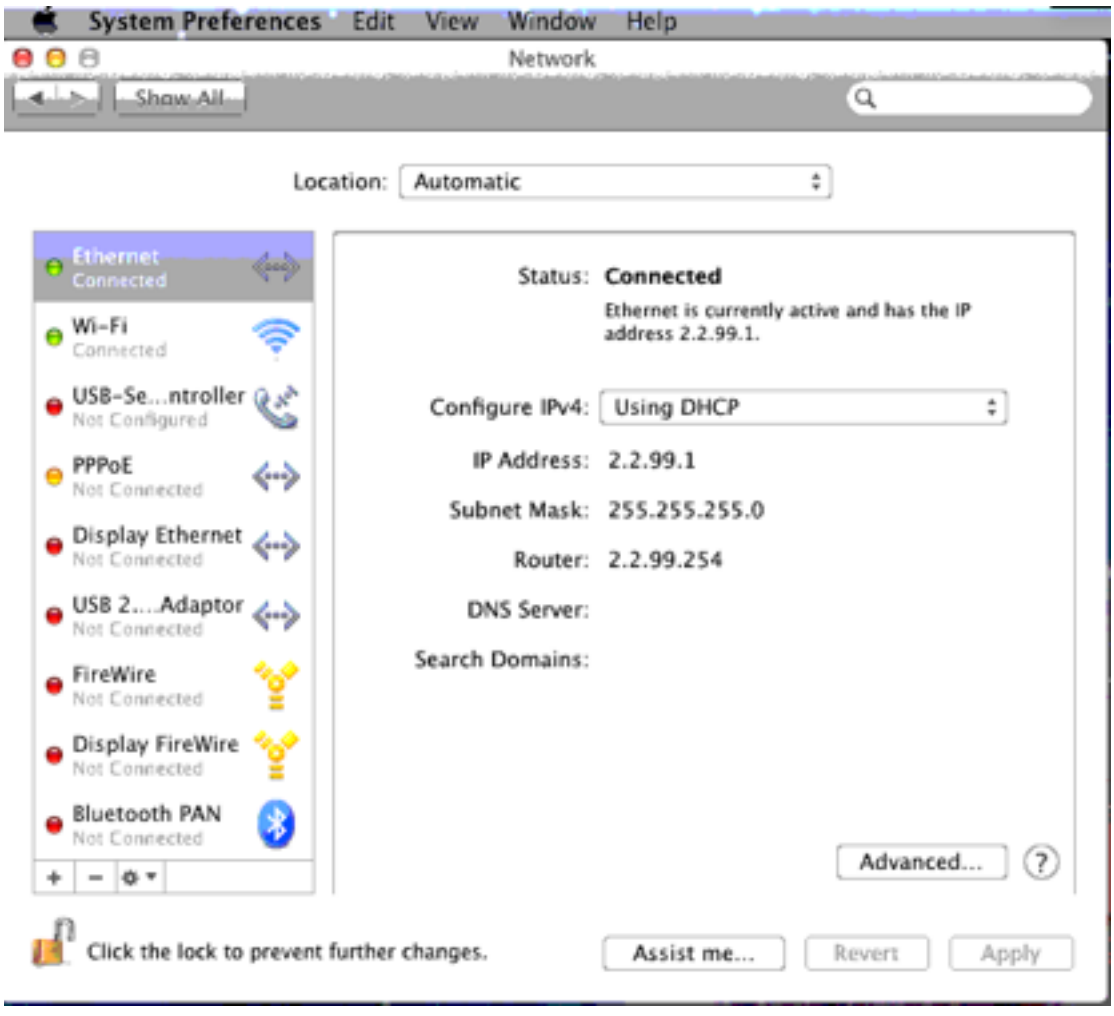
User-profile

```
Sending Access-Accept of id 46 to 192.168.88.99 port 52217
        Cisco-AVPair = "ipv4-unnumbered=Loopback2099"
        Cisco-AVPair += "addr-pool=S99_POOL_DHCPV4_2"
        Cisco-AVPair += "primary-dns=222.8.8.8"
        Cisco-AVPair += "secondary-dns=222.9.9.9"
        Cisco-AVPair += "ipv4-mtu=1200"
        Framed-IP-Netmask += 255.0.0.0
```

Session display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de  internal
Tue May 13 16:17:53.994 UTC
Interface:                Bundle-Ether201.99.ip6
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Tue May 13 16:09:19 2014
IPv4 Address:             2.2.99.1, VRF: default
```

```
IPv4 Up helpers:           0x00000040 {IPSUB}
IPv4 Up requestors:        0x00000040 {IPSUB}
Mac Address:               3c07.545f.c041
—display snippet—-
User Profile received from AAA:
 Attribute List: 0x500f97ac
1:  ipv4-unnumbered len= 12  value= Loopback2099
2:  addr-pool       len= 17  value= S99_POOL_DHCPV4_2
3:  primary-dns     len=  4  value= 222.8.8.8
4:  secondary-dns   len=  4  value= 222.9.9.9
5:  ipv4-mtu        len=  4  value= 1200(4b0)
6:  netmask         len=  4  value= 255.0.0.0   <— dose not take
effect in this case
```



NO. 9 - V4 ADDRESS FOR DHCP SESSION

———————————————————————————————————————

Function

To specify the IPv4 address assigned to a DHCPv4 triggered IPoE session, when ASR9K act as DHCPv4 SERVER.(5.1.0 release onward)

Attributes

Cisco-avpair = "ip-addr=2.1.99.253"

or

Framed-Ip-Address = 2.1.99.253

Referred configuration on BNG

```
dhcp ipv4
 profile S99_SERVER_PROFILE server
  lease 0 0 10
  subnet-mask 255.255.255.0
  default-router 2.1.99.254
 !
 interface Bundle-Ether201.99 server profile S99_SERVER_PROFILE
```

Equivalent configuration in dynamic-template

n/a

Notes

- *Applicable for DHCPv4 triggered IPoE session*
- *here the ASR9K must act as a DHCPv4 server, this is part of the so called DHCP radius proxy feature..*
- *usually go together with the attribute of net mask if there is no local definition in the dhcp ipv4 profile configuration block.*
- *Note, no attribute for default-gateway, so you need defaut-gateway defined locally in the dhcp ipv4 profile configuration block.*
- *the ipv4 address will be negotiate with client via DHCP.*
- *Note, the RADIUS specified address assigned to subscriber is not reflected in the usage of local IPv4 pool. In fact, with specific ipv4 address assigned by radius, you do not even need an IPv4 pool configured locally in this case, and the address-pool AVpair in the access-accept shows in following example is also insignificant . But you can still find the dhcp binding entry for that session.*

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de internal
Tue May 13 15:34:57.455 UTC
Interface:                Bundle-Ether201.99.ip1
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Tue May 13 15:21:59 2014
IPv4 Address:             2.2.99.250, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}

—-snip display—-
User Profile received from AAA:
 Attribute List: 0x500f97ac
1:  ipv4-unnumbered len= 12  value= Loopback2099
2:  addr-pool       len= 17  value= S99_POOL_DHCPV4_2   <—useless with the presence
of addr attributes downloaded
3:  primary-dns     len=  4  value= 222.8.8.8
4:  secondary-dns   len=  4  value= 222.9.9.9
5:  addr            len=  4  value= 2.2.99.250
6:  netmask         len=  4  value= 255.0.0.0  <—override the local defined /32
mask in above config, PC gets 2.2.99.250/8 address.
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000082
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   May 13 15:21:58.528 IPv4 Start
   May 13 15:21:59.808 SUBDB produce done
   May 13 15:21:59.936 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh pool ipv4 name S99_POOL_DHCPV4_2
Tue May 13 15:36:11.700 UTC

              Pool S99_POOL_DHCPV4_2 Allocations
--------------------------------------------------

VRF: default
Pool Id: 43
Pool Scope: VRF Specific Pool
Prefix Length: 0

Used:             0
Excl:             1
Free:           253
Total:          254

Utilization:    0%


RP/0/RSP0/CPU0:Roy_BNG_1#sh dhcp ipv4 server  binding
Tue May 13 16:02:31.504 UTC

                                          Lease
 MAC Address      IP Address      State    Remaining       Interface          VRF
Sublabel
--------------  --------------  ---------  ---------  -------------------
---------  ----------
```

```
3c07.545f.c041  2.2.99.250      BOUND      460        BE201.99            default
0x4c
```

NO. 10 - V4 NETMASK FOR DHCP SESSION

———

Function

To specify the IPv4 address netmask assigned to a DHCPv4 triggered IPoE session, when ASR9K act as DHCPv4 SERVER.(5.1.0 release onward)

Attributes

```
Cisco-avpair = "netmask=255.255.255.0"
```

or

```
Framed-IP-Netmask = 255.255.255.0
```

Referred configuration on BNG

```
dhcp ipv4
 profile S99_SERVER_PROFILE server
  lease 0 0 10
  default-router 2.1.99.254
 !
 interface Bundle-Ether201.99 server profile S99_SERVER_PROFILE
```

Equivalent configuration in dynamic-template

n/a

But you can define the mask statically in a dhcp ipv4 server profile or it's class.

```
dhcp ipv4  profile SERVER_PROFILE server  subnet-mask 255.255.255.0
```

or

```
dhcp ipv4  profile SERVER_PROFILE server  class TEST_CLASS  subnet-
mask 255.255.255.0
```

Notes

- *Applicable for DHCPv4 triggered IPoE session*
- *here the ASR9K must act as a DHCPv4 server, this is part of the so called DHCP radius proxy feature..*
- *usually go together with the attribute of IPv4 address.*
- *the ipv4 address net mask will be negotiated with client via DHCP.*

No. 11 - V4 framed-route for IPoE

———————————————————————————————————————

Function

To specify the IPv4 route associated to an IPoE session.

Attributes

Framed-route = "45.1.6.0 255.255.255.0 0.0.0.0 6 tag 7"

For IPoE, the syntax is

Framed-Route = "vrf <prefix VRF> <prefix> <prefix mask> vrf <next hop vrf> <next hop prefix> <AD> tag <tag id>"

- vrf <prefix VRF> is optional . The route will be installed into the vrf indicated explicitly by vrf <prefix VRF>, if there is no vrf <prefix VRF> in the attribute, the route will be installed into the vrf where the session belong, which is determined by the config in the dynamic-template of the downloaded Csico-AVPair vrf-id.
- prefix and prefix mask are mandatory.
- vrf <next hop vrf> is optional. The route will has a next-hop indicated explicitly by vrf <next hop vrf>, but if there is no vrf <next hop vrf> in the attribute, the next-hop will follow the vrf where the session

belong, which is determined by the config in the dynamic-template of the downloaded Csico-AVPair vrf-id.

<next hop prefix> is optional, without <next hop prefix> specified, the address assigned to the session by DHCP will be used as the next hop.

- AD is optional, without the presence of AD, the route will have a AD of 1.
- tag is optional.

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- For IPoE session(both DHCP and packet triggered session), this attributes is supported from 5.1.0 release.
- Cross VRF route is supported for IPoE session. The session and prefix could be in one VRF, the next-hop could be in another VRF.
- COA pushing is supported for IPoE session.

Verified framed-route attribute format for pppoe PTA session

1) prefix and netmask only(in default vrf)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
      Framed-Route = "15.0.0.0 255.255.255.0"
```

Please be noted that the the next-hop is not specified in the attribute and BNG use the address assigned by DHCP to the client as the next-hop in it's routing table.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de in
Fri Jun 27 11:14:56.486 UTC
Interface:                Bundle-Ether201.99.ip2
IPv4 Address:             2.1.99.1, VRF: default
—display snippet—
User Profile received from AAA:
 Attribute List: 0x500f96ac
1:  route           len= 22  value= 15.0.0.0 255.255.255.0
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000084
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jun 27 11:14:49.344 IPv4 Start
   Jun 27 11:14:50.624 SUBDB produce done
   Jun 27 11:14:50.624 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 11:15:03.692 UTC

A    2.1.99.1/32 is directly connected, 00:00:13, Bundle-Ether201.99.ip2
A    15.0.0.0/24 [1/0] via 2.1.99.1, 00:00:13
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Fri Jun 27 11:17:02.962 UTC

Routing entry for 15.0.0.0/24
Known via "subscriber", distance 1, metric 0
  Installed Jun 27 11:14:50.614 for 00:02:12
  Routing Descriptor Blocks
    2.1.99.1, from 0.0.0.0
      Route metric is 0
  No advertising protos.
```

2) prefix and netmask with 0.0.0.0 as next hop , all in default vrf

```
a857.4e06.4f47  Cleartext-Password := "cisco"
    Framed-Route = "15.0.0.0 255.255.255.0 0.0.0.0"
```

Please be noted that the the next-hop is 0.0.0.0 in the attribute and BNG use the address assigned by DHCP to the client as the next-hop in it's routing table, identical to scenario 1).

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jun 27 11:25:09.387 UTC
Interface:                Bundle-Ether201.99.ip3
IPv4 Address:             2.1.99.1, VRF: default
—snippet—
User Profile received from AAA:
 Attribute List: 0x500f96bc
```

```
1:  route           len= 30  value= 15.0.0.0 255.255.255.0 0.0.0.0
Services:
  Name         : S99_DT_DHCPV4_MIN
  Service-ID   : 0x4000084
  Type         : Template
  Status       : Applied
------------------------
[Event History]
   Jun 27 11:25:00.160 IPv4 Start
   Jun 27 11:25:01.568 SUBDB produce done
   Jun 27 11:25:01.568 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 11:25:18.396 UTC

A    2.1.99.1/32 is directly connected, 00:00:17, Bundle-Ether201.99.ip3
A    15.0.0.0/24 [1/0] via 2.1.99.1, 00:00:17
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Fri Jun 27 11:25:28.251 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 1, metric 0
  Installed Jun 27 11:25:01.532 for 00:00:26
  Routing Descriptor Blocks
    2.1.99.1, from 0.0.0.0
      Route metric is 0
  No advertising protos.
```

3) prefix and netmask with specific next hop and AD and tag , no VRF specified.

```
a857.4e06.4f47  Cleartext-Password := "cisco"
    Framed-Route = "15.0.0.0 255.255.255.0 3.3.3.3 5 tag 11”
```

Please be noted that in this case, the the next-hop is 3.3.3.3 which is indicated in the attribute , rather than the address assigned by DHCP to the client. Also see the AD and tag works as expected.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jun 27 11:32:15.504 UTC
Interface:               Bundle-Ether201.99.ip4

IPv4 Address:            2.1.99.1, VRF: default

User Profile received from AAA:
 Attribute List: 0x500f9728
1:  route           len= 39  value= 15.0.0.0 255.255.255.0 3.3.3.3 5 tag 11


RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 11:32:24.054 UTC

A    2.1.99.1/32 is directly connected, 00:00:19, Bundle-Ether201.99.ip4
A    15.0.0.0/24 [5/0] via 3.3.3.3, 00:00:19
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Fri Jun 27 11:32:33.887 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 5, metric 0
  Tag 11
  Installed Jun 27 11:32:04.565 for 00:00:29
  Routing Descriptor Blocks
    3.3.3.3, from 0.0.0.0
      Route metric is 0
  No advertising protos.
```

4) prefix and net mask with specific next hop in another explicit vrf (vrf INTERNET)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
     Framed-Route = "15.0.0.0 255.255.255.0 vrf INTERNET 3.3.3.3 5 tag 11"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jun 27 11:39:32.715 UTC
Interface:               Bundle-Ether201.99.ip5
IPv4 Address:            2.1.99.1, VRF: default
—display snippet—
User Profile received from AAA:
 Attribute List: 0x500f974c
1:  route           len= 52  value= 15.0.0.0 255.255.255.0 vrf INTERNET 3.3.3.3 5
tag 11

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 11:39:39.932 UTC

A    2.1.99.1/32 is directly connected, 00:00:25, Bundle-Ether201.99.ip5
A    15.0.0.0/24 [5/0] via 3.3.3.3 (nexthop in vrf INTERNET), 00:00:25

RP/0/RSP0/CPU0:Roy_BNG_1#sh route  15.0.0.0/24
Fri Jun 27 11:39:47.635 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 5, metric 0
  Tag 11
  Installed Jun 27 11:39:14.464 for 00:00:33
  Routing Descriptor Blocks
    3.3.3.3, from 0.0.0.0
      Nexthop in Vrf: "INTERNET", Table: "default", IPv4 Unicast, Table Id:
0xe0000021
      Route metric is 0
  No advertising protos.
```

5) prefix and net mask without specific next hop address, but nexhop in another vrf (vrf INTERNET)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
      Framed-Route = "15.0.0.0 255.255.255.0 vrf INTERNET 5 tag 11"
```

```
Fri Jun 27 11:46:27.479 UTC

A    2.1.99.1/32 is directly connected, 00:00:15, Bundle-Ether201.99.ip6
A    15.0.0.0/24 [5/0] via 2.1.99.1 (nexthop in vrf INTERNET), 00:00:15
```

6) session in default vrf, prefix in another vrf(vrf S99_VRF) , next hop in the third VRF.(vrf INTERNET)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
      Framed-Route = "vrf S99_VRF 15.0.0.0 255.255.255.0 vrf INTERNET 5 tag 11"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de  internal
Fri Jun 27 11:53:40.233 UTC
Interface:               Bundle-Ether201.99.ip7

IPv4 Address:            2.1.99.1, VRF: default

User Profile received from AAA:
 Attribute List: 0x500f9758
1:  route           len= 56  value= vrf S99_VRF 15.0.0.0 255.255.255.0 vrf INTERNET
5 tag 11

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 11:53:47.874 UTC

A    2.1.99.1/32 is directly connected, 00:01:43, Bundle-Ether201.99.ip7


RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Fri Jun 27 11:53:57.602 UTC

A    15.0.0.0/24 [5/0] via 2.1.99.1 (nexthop in vrf INTERNET), 00:01:53



RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF 15.0.0.0/24
Fri Jun 27 11:54:21.123 UTC

Routing entry for 15.0.0.0/24
  Known via "subscriber", distance 5, metric 0
  Tag 11
  Installed Jun 27 11:52:04.384 for 00:02:16
  Routing Descriptor Blocks
    2.1.99.1, from 0.0.0.0
      Nexthop in Vrf: "INTERNET", Table: "default", IPv4 Unicast, Table Id:
0xe0000021
      Route metric is 0
  No advertising protos.
```

7) session and prefix in one vrf(vrf S99_VRF) , next hop in another VRF.(vrf INTERNET)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
     Framed-Route = "vrf S99_VRF 15.0.0.0 255.255.255.0 vrf INTERNET 5 tag 11",
        Cisco-avpair += “primary-dns=222.8.8.8",   <— it dose not work! don’t get confused
     Cisco-avpair += "ipv4-unnumbered=Loopback2199",
     Cisco-avpair += "dhcp-class=CLASS_VPN",
     Cisco-avpair += “vrf-id=S99_VRF"   <— specify the session vrf
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al  de internal
Fri Jun 27 13:26:20.320 UTC
Interface:                Bundle-Ether201.99.ip9
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Fri Jun 27 13:24:17 2014
IPv4 Address:             2.1.99.1, VRF: S99_VRF

User Profile received from AAA:
 Attribute List: 0x500f9878
1:  route           len= 56  value= vrf S99_VRF 15.0.0.0 255.255.255.0 vrf INTERNET
5 tag 11
2:  primary-dns     len=  4  value= 222.8.8.8
3:  ipv4-unnumbered len= 12  value= Loopback2199
4:  dhcp-class      len=  9  value= CLASS_VPN
5:  ip-vrf          len=  7  value= S99_VRF
Services:
  Name         : S99_DT_DHCPV4_MIN
  Service-ID   : 0x4000084
  Type         : Template
  Status       : Applied
-------------------------
[Event History]
   Jun 27 13:24:16.896 IPv4 Start
   Jun 27 13:24:17.664 SUBDB produce done
   Jun 27 13:24:17.664 IPv4 Up


RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF sub
Fri Jun 27 13:26:53.354 UTC

A    2.1.99.1/32 is directly connected, 00:02:35, Bundle-Ether201.99.ip9
A    15.0.0.0/24 [5/0] via 2.1.99.1 (nexthop in vrf INTERNET), 00:02:35
```

8) session in one specific VRF, prefix without explicitly defined vrf , next hop in another VRF.(vrf INTERNET)

```
a857.4e06.4f47  Cleartext-Password := "cisco"
     Framed-Route = "15.0.0.0 255.255.255.0 vrf INTERNET 5 tag 11",
     Cisco-avpair += "primary-dns=222.8.8.8",
     Cisco-avpair += "ipv4-unnumbered=Loopback2199",
```

```
    Cisco-avpair += "dhcp-class=CLASS_VPN",
    Cisco-avpair += "vrf-id=S99_VRF"   <— specify the session vrf
```

here the prefix VRF will follow the session vrf.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jun 27 13:33:43.731 UTC
Interface:               Bundle-Ether201.99.ip10
IPv4 Address:            2.1.99.1, VRF: S99_VRF

User Profile received from AAA:
 Attribute List: 0x500f9854
1:  route           len= 44  value= 15.0.0.0 255.255.255.0 vrf INTERNET 5 tag 11
2:  primary-dns     len=  4  value= 222.8.8.8
3:  ipv4-unnumbered len= 12  value= Loopback2199
4:  dhcp-class      len=  9  value= CLASS_VPN
5:  ip-vrf          len=  7  value= S99_VRF



RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 13:33:52.124 UTC

% No matching routes found

RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Fri Jun 27 13:34:03.284 UTC

A    2.1.99.1/32 is directly connected, 00:00:29, Bundle-Ether201.99.ip10
A    15.0.0.0/24 [5/0] via 2.1.99.1 (nexthop in vrf INTERNET), 00:00:29
RP/0/RSP0/CPU0:Roy_BNG_1#
```

9)session in one specific VRF, prefix without explicitly defined vrf , next hop without explicitly defined VRF either.

```
a857.4e06.4f47  Cleartext-Password := "cisco"
    Framed-Route = "15.0.0.0 255.255.255.0 5 tag 11",
    Cisco-avpair += "primary-dns=222.8.8.8",
    Cisco-avpair += "ipv4-unnumbered=Loopback2199",
    Cisco-avpair += "dhcp-class=CLASS_VPN",
    Cisco-avpair += "vrf-id=S99_VRF"
```

here both the prefix vrf and next hop will follow the session vrf (VRF S99_VRF),

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Fri Jun 27 13:37:10.782 UTC

A    2.1.99.1/32 is directly connected, 00:00:19, Bundle-Ether201.99.ip11
A    15.0.0.0/24 [5/0] via 2.1.99.1, 00:00:19
```

10)session in one specific VRF(S99_VRF), both prefix and next hop in default vrf with explicitly definition

```
a857.4e06.4f47  Cleartext-Password := "cisco"
    Framed-Route = "vrf default 15.0.0.0 255.255.255.0 vrf default 3.3.3.3 5 tag 11",

    Cisco-avpair += “primary-dns=222.8.8.8",
    Cisco-avpair += "ipv4-unnumbered=Loopback2199",
    Cisco-avpair += "dhcp-class=CLASS_VPN",
    Cisco-avpair += "vrf-id=S99_VRF"
```

Use the key word “ vrf default” to put the prefix/nexthop to default routing domain.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al  de internal
Fri Jun 27 13:40:47.848 UTC
Interface:               Bundle-Ether201.99.ip12

IPv4 Address:            2.1.99.1, VRF: S99_VRF

User Profile received from AAA:
 Attribute List: 0x500f9884
1:  route           len= 63  value= vrf default 15.0.0.0 255.255.255.0 vrf default
3.3.3.3 5 tag 11
2:  primary-dns     len=  4  value= 222.8.8.8
3:  ipv4-unnumbered len= 12  value= Loopback2199
4:  dhcp-class      len=  9  value= CLASS_VPN
5:  ip-vrf          len=  7  value= S99_VRF

RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 13:40:52.848 UTC

A    15.0.0.0/24 [5/0] via 3.3.3.3, 00:00:19

RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Fri Jun 27 13:41:15.815 UTC

A    2.1.99.1/32 is directly connected, 00:00:42, Bundle-Ether201.99.ip12
```

11)session in one specific VRF(S99_VRF), prefix has explicitly defined default vrf and next hop come without explicitly vrf definition

```
a857.4e06.4f47  Cleartext-Password := "cisco"
    Framed-Route = "vrf default 15.0.0.0 255.255.255.0 3.3.3.3 5 tag 11",
    Cisco-avpair += "primary-dns=222.8.8.8",
    Cisco-avpair += "ipv4-unnumbered=Loopback2199",
    Cisco-avpair += "dhcp-class=CLASS_VPN",
    Cisco-avpair += "vrf-id=S99_VRF"
```

you can see the route is installed in the default routing table, but the next hop follows the session's vrf (S99_VRF).

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh route vrf S99_VRF subscriber
Fri Jun 27 13:47:22.167 UTC

A    2.1.99.1/32 is directly connected, 00:02:14, Bundle-Ether201.99.ip13
RP/0/RSP0/CPU0:Roy_BNG_1#sh route subscriber
Fri Jun 27 13:47:26.668 UTC

A    15.0.0.0/24 [5/0] via 3.3.3.3 (nexthop in vrf S99_VRF), 00:02:19
```

NO. 12 - IPV4 MTU FOR DHCP TRIGGERED SESSION

———

Function

To specify the IPv4 MTU for the DHCP triggered IPoE session interface.

Attributes

```
Cisco-avpair = "ipv4-mtu=1200"
```

(IETF attribute "Framed-MTU = 1200" does not work since the lack of distinguishing between v4 and v6)

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  ipsub TEST ipv4 mtu 1200
```

Notes

- *Applicable for DHCP session*
- *Be careful about the IP fragmenting caused when specify a small MTU. ASR9K BNG does not forward the fragmented packet via a session to a subscriber.*
- *This approach has no impact on the MTU on the CPE.*
- *Use following CLI to check the ipv4 MTU for a session interface.*

```
RP/0/RSP0/CPU0:Roy_BNG_1#  sh ipv4 interface  Bundle-Ether201.99.ip3
Tue May 13 15:47:18.046 UTC
Bundle-Ether201.99.ip3 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Interface is unnumbered.  Using address of Loopback2099 (2.1.99.254/24)
  MTU is 1500 (1200 is available to IP)
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is disabled
  ICMP redirects are never sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  Table Id is 0xe0000000
```

NO. 13 - VRF-ID

———

Function

To specify the vrf for a PPPoE/IPoE session. It's session type independent.

Attributes

```
Cisco-AVPair = "vrf-id=S99_VRF"
```

Referred configuration on BNG

```
vrf  S99_VRF
 address-family ipv4 unicast
 !
 address-family ipv6 unicast
```

Equivalent configuration in dynamic-template

dynamic-template type service TEST vrf S99_VRF

Notes

- *Applicable for PPPoE PTA, DHCP triggered IPoE, PKT triggered IPoE, static session.*
- *Never include this attribute in the access-accept for a LAC session.*
- *VRF transferring is not supported in IOS XR based BNG.*
- *This attributes is also used together with addr in a CoA request message as session key.*

- *Don't include it explicitly if the session is in default VRF .*
- *the session vrf-id could be different against the vrf configured in the access-interface.*

NO. 14 - V4 ACL

———————————————————————————————————————

Function

To specify the name of in/out security IPv4 ACL or in/out IPv4 ABF(ACL based forwarding) applied to a session. It's session type independent.

Attributes

```
Cisco-avpair = "outacl=S99_ACL_out"
Cisco-avpair = "inacl=S99_ACL_in"
```

or

```
Filter-ID = "S99_ACL_out"
```

(no equivalent for inacl)

Referred configuration on BNG

```
ipv4 access-list S99_ACL_out
 10 permit ipv4 any any

ipv4 access-list S99_ACL_in
 10 deny ipv4 1.1.99.0/24 host 172.18.88.224
 20 permit ipv4 any any
```

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST ipv4 access-group S99_ACL_in
ingress
dynamic-template type  service  TEST ipv4 access-group S99_ACL_out
egress
```

Notes

- *Applicable for all kinds of v4 sessions or DS sessions.*
- *It's not support to download the content of a ACL from radius.*

- *Same method /attribute to enable ABF(ACL Based Forwarding) for session traffic, which is kinds of PBR in context of IOS XR. in ABF case, the ACL should be defined with next hop like following example.*

```
ipv4 access-list ABF1
 10 permit ipv4 20.0.0.0/8 any nexthop1 vrf ivrf ipv4 1.1.1.2
nexthop2 vrf ivrf2 ipv4 1.1.5.2
```

!

NO. 15 - QOS POLICY-MAP

———

Function

To specify the name of in/out QoS policy-map applied to a session or multiple session for SPI. It's session type independent.

Attributes

```
Cisco-AVPair = "sub-qos-policy-in=S99_IN_POLICING_256K",
Cisco-AVPair = "sub-qos-policy-out=S99_OUT_POLICING_512K"
```

or

```
Cisco-AVPair = "sub-qos-policy-out=S99_OUT_SHAPING_512K shared-policy-instance
instance_ID_1"
```

This is for SPI- share the same QoS policy across multiple sessions with the same AVPair applied and effect the aggregate traffic. only support egress shaping .

Referred configuration on BNG

```
policy-map S99_IN_POLICING_256K
 class class-default
  police rate 256 kbps
  end-policy-map
!


policy-map S99_OUT_POLICING_512K
 class class-default
  police rate 512 kbps
```

```
  !
 end-policy-map


policy-map S99_OUT_SHAPING_512K
 class class-default
  shape average 512 kbps
```

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST  service-policy  input
S99_IN_POLICING_256K
dynamic-template type  service  TEST  service-policy  output
S99_OUT_POLICING_512K
```

or

```
dynamic-template type  service  TEST  service-policy  output
S99_OUT_SHAPING_512K  shared-policy-instance instance_ID_1.
```

Notes

- *Applicable for all kinds of sessions, it's pure data plane feature*
- *no separate AVPare for V4/V6 respectively, since we use single Policy-map to handle V4 and V6 traffic.*
- *BNG ingress QoS could not be queueing based.*
- *SPI only works for multiple sessions on same access-interface.*
- *use "show policy-map applied interface …" to check the qos applied, and use "show policy-map interface … to check the counter for the policer or shaper.*

NO. 16 - PARAMETER QOS (P-QOS)

———

Function

To create/modify a QoS policy-map to a session with it's parameter specified from RADIUS server. In this way you do not need to define the Policy-map in the BNG locally. Please not the different between this AVpair and "sub-qos-policy-in"/"sub-qos-policy-out". It's session type independent.

Attributes

Addition/ Modification	in	AVPair:"ip:**qos-policy-in**=**add-class**(**sub**,(*<class-list>*),*<qos-actions-list>*)
	out	AVPair:"ip:**qos-policy-out**=**add-class**(**sub**, (*<class-list>*),*<qos-actions-list>*)
Removal	in	AVPair:"ip:**qos-policy-in**=**remove-class**(**sub**,(*<class-list>*))
	out	AVPair:"ip:**qos-policy-out**=**remove-class**(**sub**, (*<class-list>*))

sub*: indicates AVPair targets MQC policy on a subscriber session*

<class-list>*: identifies class to be added/removed or modified in the MQC policy.*
Multiple classes may be specified to modify classification in a nested (child) MQC policy

<qos-action-list>*: policy actions to be added/overwritten in targeted class in MQC policy*

Supported QoS features*:*

- *Shaping rate and percentage*
- *Policing rate and percentage*
- *Marking (CoS, DSCP, IP Prec)*
- *Queueing (minBW, BW remaining, priority, WRED, queue-limit)*

Here list the actions format could be used in P-QoS AVPair

Shaping
shape(<rate-in-kbps>)

shape-rpct(<rate-in-pct>)

Policing
police-rpct(<conform-rate-in-pct>,<conform-burst-in-us>,<exceed-rate-in-pct>,<exceed-burst-in-us>, <conform-action>,<exceed-action>, <violate-action>)

police(<conform-rate-in-kbps>,<conform-burst-in-kBytes>,<exceed-rate-in-kbps>,<exceed-burst-in-kbytes>, <conform-action>,<exceed-action>, <violate-action>)

Marking
set-cos(<cos-val>)

set-ip-dscp(<dscp-val>)

set-ip-prec(<precedence>)

Queuing
pri-level(<priority-level>)

bw-rpct(<pct>)

bw-rratio(<ratio>)

bw-abs(<bw-in-kbps>)

bw-pct(<bw-in-pct>)

queue-limit(<qlimit-in-packets>)

queue-limit-us(<qlimit-in-us>)

random-detect-dscp(<dscp>)

random-detect-prec(<precedence>)

Following is a example of egress H-QoS created using P-QoS.

user-profile in radius server

```
cisco-avpair += “ip:qos-policy-out=add-class(sub,(class-default),shape(106496))”,

cisco-avpair += “ip:qos-policy-out=add-class(sub,(class-default,voip),pri-
level(1),police(13600,9216,transmit,drop),queue-limit(8),set-cos(5))",

cisco-avpair +=  "ip:qos-policy-out=add-class(sub,(class-default,video),bw-pct(44),queue-
limit(16),set-cos(1))",

cisco-avpair +=  “ip:qos-policy-out=add-class(sub,(class-default,gaming),bw-pct(28),queue-
limit(16),set-cos(1))”,

cisco-avpair +=  "ip:qos-policy-out=add-class(sub,(class-default,hd),bw-pct(28),queue-
limit(32),set-cos(0))"
```

Display of “show policy-map applied to Bundle-Ether4.1.ip9” which shows the session policy-map created by the above AVPair:

```
  policy-map __sub_327effffffc75d   <—the name of the policy-map is created by
system
   class class-default
    service-policy __sub_327effffffc75d_child1
    shape average 106496 kbps
   !

Child policy-map(s) of policy-map __sub_327effffffc75d:
```

```
policy-map __sub_327effffffc75d_child1
 class voip
  priority level 1
  police rate 13600 kbps burst 9216 kbytes
   conform-action transmit
   exceed-action drop
  !
  queue-limit 8 packets
  set cos 5
 !
 class video
  bandwidth percent 44
  queue-limit 16 packets
  set cos 1
 !
 class gaming
  bandwidth percent 28
  queue-limit 16 packets
  set cos 1
 !
 class hd
  bandwidth percent 28
  queue-limit 32 packets
  set cos 0
 !
 class class-default
 !
 end-policy-map
!
```

Referred configuration on BNG

You need to configure the class-map referred by the P-QoS attributes on the box

Equivalent configuration in dynamic-template

n/a

Notes

- *downloaded in an access-accept or CoA request(account-update)*
- *P-QoS approaching does not support SPI.*
- *no separate AVPare for V4/V6 respectively, since we use single Policy-map to handle V4 and V6 traffic*
- *BNG ingress QoS could not be queueing based.*
- *class-map must be predefined on BNG box.*

- *use "show policy-map applied interface …" to check the qos applied, and use "show policy-map interface … to check the counter for the policer or shaper.*

NO. 17 - SESSION ACCOUNTING LIST

———

Function

To turn on the session accounting with AAA method list specified. It's session type independent.

Attributes

Cisco-avpair = "accounting-list=S99_AAA_list"

Referred configuration on BNG

```
aaa accounting subscriber S99_AAA_list broadcast group S99_GRP1 group
S99_GRP2
aaa group server radius S99_GRP1
 server 172.18.88.221 auth-port 1812 acct-port 1813
 source-interface Loopback99
!
aaa group server radius S99_GRP2
 server 172.18.88.223 auth-port 1812 acct-port 1813
 source-interface Loopback99

radius-server host 172.18.88.221 auth-port 1812 acct-port 1813
 key 7 060506324F41584B56
!
radius-server host 172.18.88.223 auth-port 1812 acct-port 1813
 key 7 110A1016141D5A5E57
```

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST accounting  aaa list
S99_AAA_list type  session
```

Notes

- *Applicable for all kinds of sessions.*
- *no separate AVPare for V4/V6 respectively, since we use single accounting message to report for V4 and V6 traffic belong to one session.*

NO. 18 - SESSION ACCOUNTING INTERIM INTERVAL

———

Function

To turn on the interim accounting with update interval specified. It's session type independent.

Attributes

Acct-Interim-Interval = 600

or

Cisco-avpair = "acct-interval=600"

note: in second

Referred configuration on BNG
n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST accounting  aaa list
S99_AAA_list type  session   periodic-interval 10
```

note: in munite

Notes

- *Applicable for all kinds of sessions.*
- *no separate AVPare for V4/V6 respectively, since we use single accounting message to report for V4 and V6 traffic belong to one session.*
- *normally go together with Cisco-avpair += "accounting-list=S99_AAA_list"*

NO. 19 - SESSION ACCOUNTING DUAL STACK DELAY

———

Function

To turn on the Dual stack session accounting delay feature with delayed time specified. It's session type independent.

Attributes

```
Cisco-avpair = "dual-stack-delay=10"
```

note: in second , max is 30 seconds

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST accounting  aaa list
S99_AAA_list type  session dual-stack-delay 10
```

note: in second, max is 30 seconds

Notes

- *Applicable for all kinds of sessions.*
- *used for dual stack sessions. Meaningless for single stack sessions.*

NO. 20 - SERVICE ACCOUNTING LIST

Function

To turn on the service accounting with AAA method list specified. It's session type independent.

Attributes

Cisco-avpair = "service-acct-list=S99_AAA_list"

Referred configuration on BNG

```
aaa accounting service S99_AAA_list broadcast group S99_GRP1 group
S99_GRP2

aaa group server radius S99_GRP1
 server 172.18.88.221 auth-port 1812 acct-port 1813
 source-interface Loopback99
!
aaa group server radius S99_GRP2
 server 172.18.88.223 auth-port 1812 acct-port 1813
 source-interface Loopback99

radius-server host 172.18.88.221 auth-port 1812 acct-port 1813
 key 7 060506324F41584B56
!
radius-server host 172.18.88.223 auth-port 1812 acct-port 1813
 key 7 110A1016141D5A5E57
```

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST accounting  aaa list
S99_AAA_list type  service
```

Notes

- *service level accounting is not the same to session level accounting.*
- *Applicable for all kinds of sessions.*

- *no separate AVPare for V4/V6 respectively, since we use single accounting message to report for V4 and V6 traffic belong to one session.*
- *see more detail information in later chapter for service-accounting*

NO. 21 - SESSION-TIMEOUT

———

Function

To absolute session timeout for a PPPoE session.It's session type independent.

Attributes

```
Session-Timeout = 3600
```

note: in soconds

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type ppp TEST  ppp timeout  absolute  60
```

note:
RP/0/RSP0/CPU0:Roy_BNG_1(config)#dynamic-template type ppp TEST ppp timeout absolute ?
<0-35000000> Minutes
RP/0/RSP0/CPU0:Roy_BNG_1(config)#dynamic-template type ppp TEST ppp timeout absolute 60 ?
<0-59> Seconds
<cr>

Notes

- *Applicable for PPPoE only*
- *when session timeout timer fires, the session will be torn down.*

NO. 22 - IDLE TIMEOUT THRESHOLD AND DIRECTION

———

Function

To specify idle-timeout timer and the threshold and direction of idle timeout for a PPPoE/ IPoE session

Attributes

```
Cisco-avpair = "idlethreshold=2"  ( in minutes, optional)

Cisco-avpair = "idle-timeout-direction=both"  ( or inbound/outbound, optional)

idle-timeout=300 (in seconds)
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type  PPP  TEST timeout idle 300  threshold 2
traffic both
```

or

```
dynamic-template type  ipsub  TEST timeout idle 300  threshold 2
traffic both
```

Notes

- *Applicable for PPPoE/IPoE*
- *when idle timer fires, the session will be torn down.*
- *default direction is inbound if no specification.*
- *Duration of threshold in minute(s) per packet - should be less than idle duration*

NO. 23 - LAWFUL INTERCEPT

———————————————————————————————————————

Function

To enable LI for a session via radius download or CoA pushing. It's session type independent.

Attributes

RADIUS based LI can be activated via user profile (Access-Accept) or via CoA request. Below first 4 attributes are required for LI activation/deactivation. Please note that, BNG do not process LI attributes without enabling 'aaa intercept'. These attributes can either send via normal cisco-avpair or cisco-enc (encrypted VSA – vendor-type 36)

md-port

This represents UDP port number of the mediation device that receives the intercepted packets.
Ex: Cisco-AVpair = "md-port=1000"

intercept-id
This is eight digits Unique identifier for LI operation, each request should be tagged with unique intercept-id otherwise the request will be rejected.
Ex: Cisco-AVpair = "intercept-id=12341111"

md-ip-addr

This attribute specifies ip address of mediation device.
Ex: Cisco-AVpair = "md-ip-addr=14.14.14.14"

li-action

Action can be 0 or 1 or 2.
0 -> Remove the intercept from subscriber
1 -> Activate the intercept to the subscriber
2 -> Dummy action to check whether LI is active on session.

md-dscp

This helps setting DSCP values for tapped packets. And it is supported only on IOS XR.
Ex: Cisco-Avpair="md-dscp=3"

Referred configuration on BNG

aaa intercept

Equivalent configuration in dynamic-template

n/a

Notes

A verified LI config

######BNG config#####

```
aaa intercept
```

######user profile in radius server #######

```
test1@gsta Auth-Type := Local, User-Password == "cisco"
        Cisco-AVPair = "sub-qos-policy-out=HQOS1",
        Cisco-AVPair += "intercept-id=20001002",
        Cisco-AVPair += "li-action=1",
        Cisco-AVPair += "md-ip-addr=33.0.0.2",
        Cisco-AVPair += "md-port=1000",
        Cisco-AVPair += “md-dscp=23"
```

#radius server debug####

```
auth: type Local
auth: user supplied User-Password matches local User-Password
Login OK: [test1@gsta/cisco] (from client private-network-2 port 0)
  Processing the post-auth section of radiusd.conf
modcall: entering group post-auth for request 0
radius_xlat:  '../var/log/radius/radacct/1.0.0.2/reply-detail-20130325.log'
rlm_detail: ../var/log/radius/radacct/%{Client-IP-Address}/reply-detail-%Y%m%d.l
og expands to ../var/log/radius/radacct/1.0.0.2/reply-detail-20130325.log
  modcall[post-auth]: module "reply_log" returns ok for request 0
modcall: leaving group post-auth (returns ok) for request 0
Sending Access-Accept of id 111 to 1.0.0.2 port 57537
        Cisco-AVPair = "sub-qos-policy-out=HQOS1"
        Cisco-AVPair += "intercept-id=20001002"
        Cisco-AVPair += "li-action=1"
        Cisco-AVPair += "md-ip-addr=33.0.0.2"
        Cisco-AVPair += "md-port=1000"
        Cisco-AVPair += "md-dscp=23"
```

NO. 24 - V4 URPF

Function

To enable ipv4 strict mode uRPF checking for subscriber packet. It's session type independent.

Attributes

Cisco-avpair = "strict-rpf=1"

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type service  TEST ipv4 verify unicast  source
reachable-via rx
```

Notes

- *Applicable for PPPoE/IPoE*
- *only strict mode supported, and no matter the value is 0 or 1 , this AVPair will enable the strict mode uRPF on the session interface.*
- *by default , no uRPF enabled on the session interface.*

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Wed Jul  9 16:20:28.896 UTC
Interface:                Bundle-Ether201.99.ip6
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Wed Jul  9 16:20:06 2014
IPv4 Address:             2.1.99.1, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000033
Nas-Port:                 3372271872
User name:                3c07.545f.c041
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x00000072
Created:                  Wed Jul  9 16:20:05 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
```

```
Ifhandle:                0x00001920
Session History ID:      14
Access-interface:        Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Wed Jul  9 16:20:05 2014]
    class type control subscriber S99_DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f98e8
1:  ipv4-unnumbered len= 12  value= Loopback2099
2:  primary-dns     len=  4  value= 222.8.8.8
3:  secondary-dns   len=  4  value= 222.9.9.9
4:  sub-qos-policy-out len=  9  value= SET_DSCP0
5:  ipv4-mtu        len=  4  value= 1200(4b0)
6:  netmask         len=  4  value= 255.0.0.0
7:  strict-rpf      len=  4  value= 0(0)
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000085
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1
  Service-ID  : 0x400002c
  Type        : Multi Template
  Status      : Applied
-------------------------
[Event History]
   Jul  9 16:20:05.248 IPv4 Start
   Jul  9 16:20:06.656 SUBDB produce done
   Jul  9 16:20:06.656 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1# sh ipv4 int Bundle-Ether201.99.ip6
Wed Jul  9 16:21:26.936 UTC
Bundle-Ether201.99.ip6 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Interface is unnumbered.  Using address of Loopback2099 (2.1.99.254/24)
  MTU is 1500 (1200 is available to IP)
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is disabled
  ICMP redirects are never sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  Table Id is 0xe0000000
IP unicast RPF check is enabled
RPF mode strict
```

NO. 25 - IPV4-ICMP-UNREACHABLE

Function

To enable/disable ipv4 unreachable for subscriber session. It's session type independent.

Attributes

```
Cisco-avpair = "ipv4-icmp-unreachable=1"
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type service  TEST ipv4 unreachables disable
```

Notes

- *Applicable for PPPoE/IPoE.*
- *By default , ipv4 icmp unreachables is always sent on the session interface.*
- *No matter the value is 0 or 1, downloading this avpair cause the ipv4 icmp unreachables disabled on the session interface.*

Example

user-profile in radius server

```
3c07.545f.c041  Cleartext-Password := "cisco"
      Cisco-avpair = "ipv4-unnumbered=Loopback2099",
     Cisco-avpair += "primary-dns=222.8.8.8",
      Cisco-avpair += "secondary-dns=222.9.9.9",
      Cisco-AVPair += "sub-qos-policy-out=SET_DSCP0",
     Cisco-avpair += "ipv4-mtu=1200",
     Cisco-avpair += "sa=HTTPRDRT_TPL_1",
     Framed-IP-Netmask += 255.0.0.0,
      Cisco-avpair += "strict-rpf=0",
      Cisco-avpair += "ipv4-icmp-unreachable=1"
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al  de internal
Wed Jul  9 16:42:53.224 UTC
Interface:               Bundle-Ether201.99.ip7
```

```
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Wed Jul  9 16:42:41 2014
IPv4 Address:             2.1.99.1, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              3c07.545f.c041
Account-Session Id:       0000004f
Nas-Port:                 3372271872
User name:                3c07.545f.c041
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x0000004d
Created:                  Wed Jul  9 16:42:30 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001a60
Session History ID:       12
Access-interface:         Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Wed Jul  9 16:42:30 2014]
    class type control subscriber S99_DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f990c
1:  ipv4-unnumbered len= 12  value= Loopback2099
2:  primary-dns     len=  4  value= 222.8.8.8
3:  secondary-dns   len=  4  value= 222.9.9.9
4:  sub-qos-policy-out len=  9  value= SET_DSCP0
5:  ipv4-mtu        len=  4  value= 1200(4b0)
6:  netmask         len=  4  value= 255.0.0.0
7:  strict-rpf      len=  4  value= 0(0)
8:  ipv4-icmp-unreachable len=  4  value= 1(1)
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000085
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1
  Service-ID  : 0x400002c
  Type        : Multi Template
  Status      : Applied
-------------------------
[Event History]
   Jul  9 16:42:30.144 IPv4 Start
   Jul  9 16:42:41.664 SUBDB produce done
   Jul  9 16:42:41.792 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1# sh ipv4 int Bundle-Ether201.99.ip7
Wed Jul  9 16:43:11.855 UTC
Bundle-Ether201.99.ip7 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Interface is unnumbered.  Using address of Loopback2099 (2.1.99.254/24)
  MTU is 1500 (1200 is available to IP)
  Helper address is not set
```

```
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  access list is not set
  Proxy ARP is disabled
  ICMP redirects are never sent
  ICMP unreachables are never sent
  ICMP mask replies are never sent
  Table Id is 0xe0000000
IP unicast RPF check is enabled
RPF mode strict
```

NO. 26 - DOUBLE DIP

——

Function

Double dip means when a session comes in ,BNG does the first authorization/ authentication to wholesaler's AAA. the wholesaler's radius server includes this AVPair in the access-accept to indicate the BNG to put the session into a retailer's VRF and do second authorization/authentication to the retailer's AAA. It's session type independent.

Attributes

Cisco-avpair = "redirect-vrf=RETAILER1"

Referred configuration on BNG

there is a example config and it's debug output in the cisco internal link of http://iwe.cisco.com/web/view-post/post/-/posts?postId=459000116

Equivalent configuration in dynamic-template

n/a

Notes

- *Applicable for PPPoE/IPoE*
- *see more detail in http://iwe.cisco.com/web/view-post/post/-/posts?postId=459000116*

NO. 27 - ENABLE HTTP REDIRECT

Function

To use a radius AVPair to enable a HTTP redirect policy to a session. It's session type independent.

Attributes

Cisco-avpair = "sub-pbr-policy-in=HTTPR"

Referred configuration on BNG

you need to configure a policy-map type pbr with same name locally on the box.

```
policy-map type pbr HTTPR
 class type traffic Portal
  transmit
 !
 class type traffic HTTPRDRT
  http-redirect http://172.18.88.224
 !
 class type traffic class-default
  drop
 !
class-map type traffic match-any Portal
 match access-group ipv4 Portal
 end-class-map
!

class-map type traffic match-any HTTPRDRT
 match access-group ipv4 HTTPRDRT_ACL
 end-class-map

ipv4 access-list Portal
 10 permit icmp any any
 20 permit ipv4 any host 172.18.88.224
 30 permit ipv4 any host 172.18.88.228
!

ipv4 access-list HTTPRDRT_ACL
 10 permit tcp any any eq www
```

Equivalent configuration in dynamic-template

```
dynamic-template
 type service HTTPRDRT_TPL
  service-policy type pbr HTTPR

policy-map type pbr HTTPR
 class type traffic Portal
  transmit
 !
 class type traffic HTTPRDRT
  http-redirect http://172.18.88.224
 !
 class type traffic class-default
  drop
 !
class-map type traffic match-any Portal
 match access-group ipv4 Portal
 end-class-map
!

class-map type traffic match-any HTTPRDRT
 match access-group ipv4 HTTPRDRT_ACL
 end-class-map

ipv4 access-list Portal
 10 permit icmp any any
 20 permit ipv4 any host 172.18.88.224
 30 permit ipv4 any host 172.18.88.228
!

ipv4 access-list HTTPRDRT_ACL
 10 permit tcp any any eq www
```

Notes

- *Applicable for PPPoE/IPoE*
- *use sh policy-map type pbr to check the use of pbr policy.*

NO. 28 - DHCPV4 SESSION LIMIT

———

Function

To Specify the max session could be brought up for subscriber with a particular circurt-id.

Attributes

Cisco-avpair = “session-limit=1”

Referred configuration on BNG

example of DHCPv4 server, Proxy is similar.

```
dhcp ipv4
 profile dhcp-server server
  class dhcp-hgw-vobb
   lease 0 2 0
   pool pool-hgw-vobb
   dns-server 172.17.230.231
  !
  limit lease per-circuit-id 2     ! <— this number could be overrode
by the AVPair
  relay information authenticate inserted
 !
 interface Bundle-Ether9.1 server information option format-type
circuit-id format-string "KAOLAB4301 bubdle-ether %s vlan-id %s"
physical-port outer-vlan-id
```

Equivalent configuration in dynamic-template

no dynamic-template equivalence, but you can define the session limit per circuit-id in the dhcp ipv4 config block.

```
dhcp ipv4 profile  PROXY  proxy  limit  lease  per-circuit-id  1
```

Notes

- *Applicable for DHCP triggered IPoEv4 only*
- *work for both dhcp server mode and dhcp proxy mode.*
- *the circuit-id could be inserted by access-node or inserted by BNG itself.*

NO. 29 - DHCPV4 CLASS

——

Function

To Specify the DHCP class whose configuration would be used for dhcp address assignment to a session. In this way, the radius server is involved to influence the behaviour of DHCP server.

Attributes

Cisco-avpair = "dhcp-class=dhcp-hgw-vobb"

Referred configuration on BNG

example of DHCPv4 server, Proxy is similar.

```
dhcp ipv4
 profile dhcp-server server
  class dhcp-hgw-vobb
   lease 0 2 0
   pool pool-hgw-vobb
   dns-server 172.17.230.231

  class OTHER
   lease 0 2 0
   pool OTHER
   dns-server 172.17.230.44

  !
 interface Bundle-Ether9.1 server information option format-type
circuit-id format-string "KAOLAB4301 bubdle-ether %s vlan-id %s"
physical-port outer-vlan-id
```

Equivalent configuration in dynamic-template

No dynamic-template equivalence, but you can define DHCP class with matching conditions using vrf or other DHCP option.

```
dhcp ipv4
 profile dhcp-server server
  class dhcp-hgw-vobb
   match  option ?
  124         Match option 124 vendor-identifying vendor class
  125         Match option 125 vendor-indentifying vendor-specific
info
  60          Match option 60 vendor class id
  77          Match option 77 user class
  circuitid   Match circuit id of option 82 Relay-agent specific class
  remoteid    Match remote id of option 82 Relay-agent specific class
```

Notes

- *Applicable for DHCP triggered IPoEv4 only.*
- *To use this radius attribute to influence the selection of DHCP class on ASR9K, ASR9K must work on dhcp server mode. but, locally definition of the matching category for the class is supported in both proxy mode and server mode.*

An example of DHCP-class

Here a single access-interface is used to terminate two type of IPoE session, ASR9K works as a DHCPv4 server under the influence of radius (so called DHCP server radius proxy mode).

For some sessions(saying session from PC) , they need to be put into the default vrf, and get ip address from 2.1.99.0/24 subnet .

for other sessions, (saying session from STB), they need to be put into a different vrf (S99_VRF in this case), and get ip address from 2.1.99.0/24 subnet .

In the dhcp ipv4 config block , besides the regular config (pool, subnet-mask, default-router etc) , there is another sub-block of config under a class named "CLASS_VPN",a different pool and lease time are defined.

```
pool vrf S99_VRF ipv4 S99_POOL_DHCPV4_VRF
 network 20.1.99.0/24 default-router 20.1.99.254
 exclude 20.1.99.2 20.1.99.253
!
pool vrf default ipv4 S99_POOL_DHCPV4
 network 2.1.99.0/24 default-router 2.1.99.254
 exclude 2.1.99.2 2.1.99.253

dhcp ipv4
 profile S99_SERVER_PROFILE server
  lease 0 0 10
  class CLASS_VPN
   lease 0 0 20
   pool S99_POOL_DHCPV4_VRF
   default-router 20.1.99.254
  !
  pool S99_POOL_DHCPV4
  subnet-mask 255.255.255.255
  default-router 2.1.99.254

 interface Bundle-Ether201.99 server profile S99_SERVER_PROFILE

interface Bundle-Ether201.99
 description student-99 DHCPv4 session
 service-policy output SET_DSCP0
 ipv4 point-to-point
 ipv4 unnumbered Loopback2099
 service-policy type control subscriber S99_CP_DHCPV4_BASIC
 ipsubscriber ipv4 l2-connected
  initiator dhcp
 !
 encapsulation ambiguous dot1q 201 second-dot1q 99-100
```

```
policy-map type control subscriber S99_CP_DHCPV4_BASIC
 event session-start match-first
  class type control subscriber S99_DHCPv4 do-until-failure
   10 activate dynamic-template S99_DT_DHCPV4_MIN
   20 authorize aaa list S99_AAA_list identifier source-address-mac
password cisco
  !
 !
 end-policy-map
!
dynamic-template
 type ipsubscriber S99_DT_DHCPV4_MIN
  ipv4 unnumbered Loopback2099
 !
interface Loopback2099
 ipv4 address 2.1.99.254 255.255.255.0
!
interface Loopback2199
 vrf S99_VRF
 ipv4 address 20.1.99.254 255.255.255.0
```

PC's session in default vrf

```
a857.4e06.4f47  Cleartext-Password := "cisco"
```

the user profile could be empty, nothing needed to be downloaded to bring up a session in default vrf since the dynamic-template takes care of the needed config.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all detail  internal
Fri Jun 27 14:44:17.521 UTC
Interface:                Bundle-Ether201.99.ip18
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Fri Jun 27 14:44:13 2014
IPv4 Address:             2.1.99.1, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              a857.4e06.4f47
Account-Session Id:       0000001e
Nas-Port:                 3372271872
User name:                a857.4e06.4f47
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x0000005d
Created:                  Fri Jun 27 14:44:12 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001960
Session History ID:       3
Access-interface:         Bundle-Ether201.99
Policy Executed:
```

```
  event Session-Start match-first [at Fri Jun 27 14:44:12 2014]
    class type control subscriber S99_DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA: None
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000084
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jun 27 14:44:12.032 IPv4 Start
   Jun 27 14:44:13.312 SUBDB produce done
   Jun 27 14:44:13.568 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh dhcp  ipv4 server  binding
Fri Jun 27 14:44:21.394 UTC

                                          Lease
 MAC Address      IP Address      State    Remaining       Interface          VRF
Sublabel
--------------  --------------  ---------  ---------  -------------------
---------  ----------
a857.4e06.4f47  2.1.99.1        BOUND      591        BE201.99            default
0x5d
```

STB' session

```
a857.4e06.4f47  Cleartext-Password := "cisco"
     Cisco-avpair += "ipv4-unnumbered=Loopback2199",
     Cisco-avpair += "dhcp-class=CLASS_VPN",
     Cisco-avpair += "vrf-id=S99_VRF"
```

Use dhcp-class=CLASS_VPN to indicate the 9K follow the dhcp config under that named class.

The AVPair vrf-id and ipv4-unnumbered are needed as well, aligning with the pool's vrf , to override the config in the dyunamic-template.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all detail  internal
Fri Jun 27 14:40:02.360 UTC
Interface:                Bundle-Ether201.99.ip16
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Fri Jun 27 14:39:40 2014
IPv4 Address:             20.1.99.1, VRF: S99_VRF
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              a857.4e06.4f47
Account-Session Id:       0000001c
Nas-Port:                 3372271872
```

```
User name:                a857.4e06.4f47
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x0000005b
Created:                  Fri Jun 27 14:39:39 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x000018e0
Session History ID:       9
Access-interface:         Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Fri Jun 27 14:39:39 2014]
    class type control subscriber S99_DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9780
1:  ipv4-unnumbered len= 12  value= Loopback2199
2:  dhcp-class      len=  9  value= CLASS_VPN
3:  ip-vrf          len=  7  value= S99_VRF
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000084
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jun 27 14:39:39.264 IPv4 Start
   Jun 27 14:39:40.288 SUBDB produce done
   Jun 27 14:39:40.416 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh dhcp  ipv4 server  binding
Fri Jun 27 14:40:30.367 UTC

                                          Lease
 MAC Address      IP Address      State    Remaining       Interface          VRF
Sublabel
--------------  --------------  ---------  ---------  -------------------
---------  ----------
a857.4e06.4f47  20.1.99.1       BOUND      1149       BE201.99           S99_VRF
0x5b
```

NO. 30 - CLASS (IETF ATTRIBUTE 25)

———

Function

To include an attributes downloaded in an access-accept on authentication into accounting-request without modification. This string is defined in the user-profile in radius server , so it could be per subscriber basis. It's session type independent.

Attributes

Class = "CLASS_NAME"

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- *Applicable for all kinds of session.*
- *the attribute CLASS will be included into accounting-start, accounting-interim and accounting-stop.*
- *see debug information from radius server.*

```
Sending Access-Accept of id 27 to 192.168.88.99 port 52217
        Cisco-AVPair = "ipv4-unnumbered=Loopback9299"
        Cisco-AVPair += "accounting-list=S99_AAA_list"
        Acct-Interim-Interval += 600
        Framed-Route += "199.168.2.0 255.255.255.0"
        Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K"
        Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
        Cisco-AVPair += "sub-pbr-policy-in=HTTPRDRT_PBR_1"
        Cisco-AVPair += "vrf-id=FREE_PRODUCT"
        Class += 0x434c4153535f4e414d45
        Cisco-AVPair += "echo-string-1=BLUE"
        Cisco-AVPair += "echo-string-2=RED"
        Cisco-AVPair += "echo-string-3=GREEN"
        Cisco-AVPair += "echo-string-4=YELLOW"
rad_recv: Accounting-Request packet from host 192.168.88.99 port 52217, id=31, l
ength=387
        Acct-Interim-Interval = 600
        Acct-Status-Type = Start
        Event-Timestamp =
        NAS-Port-Type = 44
        Framed-IP-Address = 9.1.99.4
        Cisco-AVPair = "client-mac-address=3c07.545f.c041"
        Acct-Session-Id = "00000009"
        NAS-Port = 2231600384
```

```
        NAS-Port-Id = "0/0/901/99.901"
        Cisco-NAS-Port = "0/0/901/99.901"
        Called-Station-Id = "99"
        Calling-Station-Id = "3c07.545f.c041"
        User-Name = "9.1.99.4"
        Cisco-AVPair = "vrf-id=FREE_PRODUCT"
        Cisco-AVPair = "echo-string-1=BLUE"
        Cisco-AVPair = "echo-string-2=RED"
        Cisco-AVPair = "echo-string-3=GREEN"
        Cisco-AVPair = "echo-string-4=YELLOW"
        Class = 0x434c4153535f4e414d45
        Service-Type = Outbound-User
```

NO. 31 - ECHO-STRING (CISCO AVPAIR)

———

Function

To include multiple(up to 4) attributes downloaded in an access-accept on authentication into accounting-request whiteout modification. This string is defined in the user-profile in radius server , so it could be per subscriber basis.

In some case only one attribute is not enough for this purpose, so we give you more AVPair to achieve the same goal.

please be noted, ASR9K BNG do not support AVPair duplication , that's the reason why you see here we use 4 different AVPair with different value portion.

Attributes

```
Cisco-AVPair += "echo-string-1=BLUE"
Cisco-AVPair += "echo-string-2=RED"
Cisco-AVPair += "echo-string-3=GREEN"
Cisco-AVPair += "echo-string-4=YELLOW"
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- *Applicable for all kinds of session*
- *the attribute CLASS will be included into accounting-start, accounting-interim and accounting-stop.*
- *see debug information from radius server.*

```
Sending Access-Accept of id 27 to 192.168.88.99 port 52217
        Cisco-AVPair = "ipv4-unnumbered=Loopback9299"
        Cisco-AVPair += "accounting-list=S99_AAA_list"
        Acct-Interim-Interval += 600
        Framed-Route += "199.168.2.0 255.255.255.0"
        Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K"
        Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
        Cisco-AVPair += "sub-pbr-policy-in=HTTPRDRT_PBR_1"
        Cisco-AVPair += "vrf-id=FREE_PRODUCT"
        Class += 0x434c4153535f4e414d45
        Cisco-AVPair += "echo-string-1=BLUE"
        Cisco-AVPair += "echo-string-2=RED"
        Cisco-AVPair += "echo-string-3=GREEN"
        Cisco-AVPair += "echo-string-4=YELLOW"
rad_recv: Accounting-Request packet from host 192.168.88.99 port 52217, id=31, l
ength=387
        Acct-Interim-Interval = 600
        Acct-Status-Type = Start
        Event-Timestamp =
        NAS-Port-Type = 44
        Framed-IP-Address = 9.1.99.4
        Cisco-AVPair = "client-mac-address=3c07.545f.c041"
        Acct-Session-Id = "00000009"
        NAS-Port = 2231600384
        NAS-Port-Id = "0/0/901/99.901"
        Cisco-NAS-Port = "0/0/901/99.901"
        Called-Station-Id = "99"
        Calling-Station-Id = "3c07.545f.c041"
        User-Name = "9.1.99.4"
        Cisco-AVPair = "vrf-id=FREE_PRODUCT"
        Cisco-AVPair = "echo-string-1=BLUE"
        Cisco-AVPair = "echo-string-2=RED"
        Cisco-AVPair = "echo-string-3=GREEN"
        Cisco-AVPair = "echo-string-4=YELLOW"
        Class = 0x434c4153535f4e414d45
        Service-Type = Outbound-User
```

NO. 32 - V6 ENABLE

Function

To enable IPv6 address family for a session

Attributes

Cisco-AVPair = ”ipv6-enable=1”

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

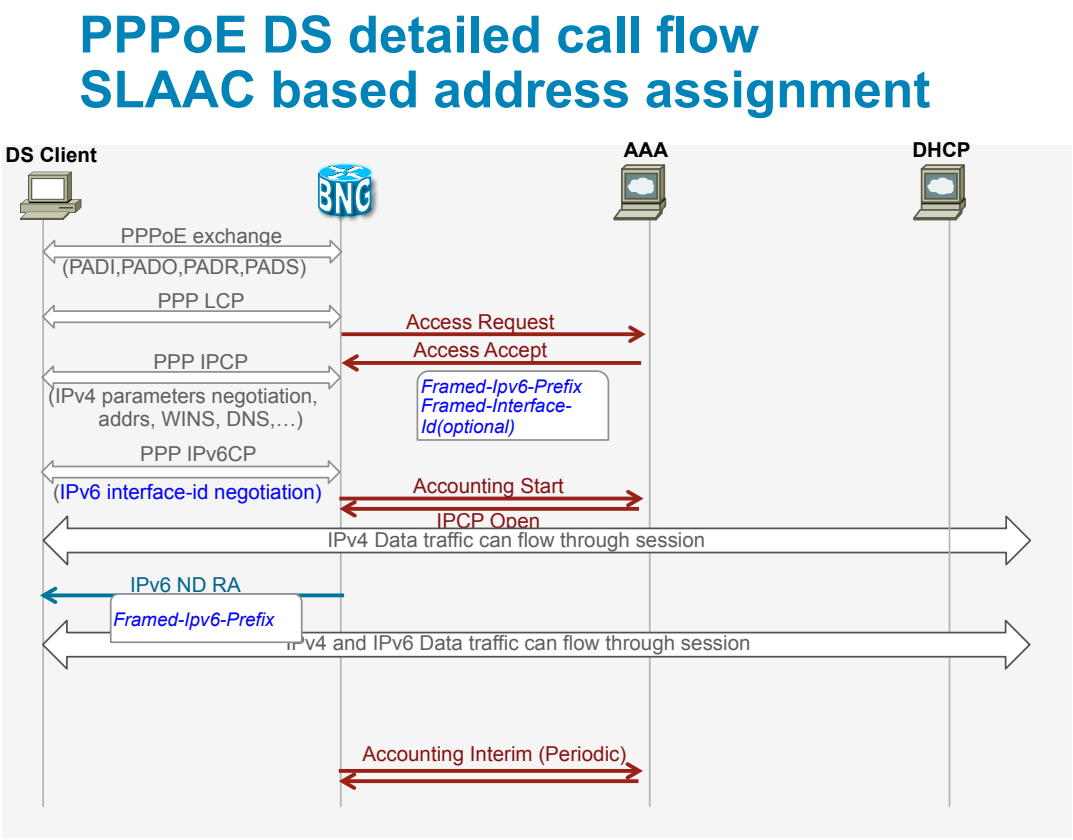
```
dynamic-template type ppp TEST ipv6 enable
```

or

```
dynamic-template type ipsubscriber TEST ipv6 enable
```

Notes

- *Applicable for PPPoE PTA, DHCP triggered IPoE, PKT triggered IPoE, static session. Never include this attribute in the access-accept for a LAC session.*



- *This is the attribute to enable IPv6 address family for a session, it's the counterpart of Cisco-AVPair "ipv4-unnumbered" , but v6 session do not need to unnumbered to any interface.*

NO. 33 - V6 PREFIX FOR PPPOE PTA SESSION USING SLAAC

Function

To specify the IPv6 prefix assigned to a PPPoE client using SLAAC.

Attributes

Framed-Ipv6-Prefix = FEC0:0000:0000:0000:0000:0000:0000:0000/64

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- *The net mask must be present, and currently only supported one is /64.*
- *Applicable for PPPoEv6 or DS PTA session using SLAAC(or called ND) for V6 addressing.*
- *A subscriber route will be created in the v6 routing table for this prefix automatically.*
- *Never include this attribute in the access-accept for a LAC session.*
- *For SLAAC, apart from the V6 prefix, the client need the ipv6 interface-id as well to build the complete V6 address. The IPv6 interface-id is negotiated between the BNG and the client over IPv6CP protocol during the PPP stage, the adopted interface-id by default is based on the client's MAC address information. Optionally, it's allow to specify the interface-id in radius user-profile or defined it in dynamic-template.*

```
IPv6 Prefix:     FEC0:0000:0000:0000:0000:0000:0000:0000/64
IPv6 Interface ID:    0260:08FF:FEFF:FFFF
IPv6 Address:    FEC0:0000:0000:0000:0260:08FF:FEFF:FFFF
```

- *framed-ipv6-prefix — could be specified from radius, and BNG will negotiate it to Client using ICMPv6 protocol RA message*
- *framed-interface-id— could be specified from radius optionally, and negotiate to Client using PPP IPv6CP protocol, or let the client to determine it's interface-id by itself.*

Example of V6 SLAAC using attribute framed-ipv6-prefix

BNG config

```
interface Bundle-Ether301.99
 service-policy type control subscriber S99_CP_PTA_NO_LOCAL_FEATURE
 pppoe enable
 encapsulation dot1q 301 second-dot1q 99
!

policy-map type control subscriber S99_CP_PTA_NO_LOCAL_FEATURE
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
  !
 !
 end-policy-map
!

dynamic-template
 type ppp S99_DT_LCP
  ppp authentication pap chap
```

Radius server user profile

```
V6PPP1@S99      Cleartext-Password := "cisco"
    Cisco-avpair = "ipv6-enable=1",
    Framed-Ipv6-Prefix += FEC0:0000:0000:0000:0000:0000:0000:0000/64
```

Radius server debug for authentication

```
Mon Jun 30 11:38:01 2014 : Info: Ready to process requests.
rad_recv: Access-Request packet from host 192.168.88.99 port 28597, id=53, lengt
h=245
        Cisco-AVPair = "client-mac-address=3c07.545f.c041"
        Acct-Session-Id = "0000000c"
        NAS-Port = 755051788
        NAS-Port-Id = "0/0/301/99.301"
```

```
        Cisco-NAS-Port = "0/0/301/99.301"
        User-Name = "V6PPP1@S99"
        Service-Type = Framed-User
        User-Password = "cisco"
        X-Ascend-Connect-Progress = LCP-Opened
        Cisco-AVPair = "connect-progress=LCP Open"
        Framed-Protocol = PPP
        NAS-Port-Type = 37
        Called-Station-Id = "99"
        Calling-Station-Id = "3c07.545f.c041"
        Event-Timestamp =
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99
Mon Jun 30 13:37:01 2014 : Info: # Executing section authorize from file ../etc/
raddb/sites-enabled/default


Sending Access-Accept of id 53 to 192.168.88.99 port 28597
        Cisco-AVPair = "ipv6-enable=1"
        Framed-IPv6-Prefix += fec0::/64
Mon Jun 30 13:37:01 2014 : Info: Finished request 13.
```

Session display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all
Mon Jun 30 11:36:36.123 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     Subscriber IP Addr / Prefix
                                               LNS Address (Vrf)
------------------------------------------------------------------------------
PPPoE:PTA    BE301.99.pppoe11         AC        -
                                               fec0::/64 (default)

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de  internal
Mon Jun 30 11:36:43.248 UTC
Interface:                Bundle-Ether301.99.pppoe11
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Down, Mon Jun 30 11:36:23 2014
IPv6 State:               Up, Mon Jun 30 11:36:27 2014
Framed IPv6 Prefix:       fec0::/64, VRF: default
IPv6 Interface ID:        >.T.._.A (3e 07 54 ff fe 5f c0 41)
IPv6 Up helpers:          0x00100020 {PPP,ND}
IPv6 Up requestors:       0x00100020 {PPP,ND}
Mac Address:              3c07.545f.c041
Account-Session Id:       0000000b
Nas-Port:                 755051787
User name:                V6PPP1@S99
Outer VLAN ID:            301
Inner VLAN ID:            99
Subscriber Label:         0x00000045
Created:                  Mon Jun 30 11:36:23 2014
State:                    Activated
Authentication:           authenticated
```

```
Authorization:            unauthorized
Ifhandle:                 0x00001620
Session History ID:       4
Access-interface:         Bundle-Ether301.99
Policy Executed:

  event Session-Start match-first [at Mon Jun 30 11:36:23 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Mon Jun 30 11:36:26 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f994c
1:  ipv6-enable     len=  4  value= 1(1)
2:  prefix          len= 18  value= fec0::/64
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
[Last IPv4 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   Jun 30 11:36:27.264 SUBDB produce done [many]
   Jun 30 11:36:27.264 IPv6 Up [many]

RP/0/RSP0/CPU0:Roy_BNG_1#sh route ipv6
Mon Jun 30 11:36:50.692 UTC

A    fec0::/64 is directly connected,
      00:00:23, Bundle-Ether301.99.pppoe11

RP/0/RSP0/CPU0:Roy_BNG_1#sh route ipv6  fec0::/64 detail
Mon Jun 30 11:37:06.288 UTC

Routing entry for fec0::/64
  Known via "subscriber", distance 2, metric 0 (connected)
  Installed Jun 30 11:36:27.229 for 00:00:39
  Routing Descriptor Blocks
    directly connected, via Bundle-Ether301.99.pppoe11
      Route metric is 0
      Label: 0x12e0 (4832)
      Tunnel ID: None
      Extended communities count: 0
      NHID:0x0(Ref:0)
  Route version is 0x1 (1)
  No local label
  IP Precedence: Not Set
  QoS Group ID: Not Set
  Route Priority: RIB_PRIORITY_RECURSIVE (8) SVD Type RIB_SVD_TYPE_LOCAL
 Download Priority 3, Download Version 1
  No advertising protos.
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh pool ipv6
Mon Jun 30 11:37:17.523 UTC

              Allocation Summary
-------------------------------------------------

Used: 0
Excl: 0
Free: 196606
Total: 196606
Utilization: 0%


 Pool Name    Pool ID      VRF      Used    Excl    Free   Total
-----------  ---------  ---------  ------  ------  ------ -------
   PD_pool     46     default           0       0  65536  65536
pppoe_poolv6     48     default           0       0  65536  65536
 v6_pool_1     47     default           0       0  65534  65534
```

ipv6cp negotiation(debug ppp negotiation)

```
RP/0/RSP0/CPU0:Jun 30 13:35:32.174 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Initial]: I CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:35:32.174 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Initial]: Conf-Req packet stalled
RP/0/RSP0/CPU0:Jun 30 13:35:32.174 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Initial]:    Interface-Id 3e07:54ff:fe5f:c041 (0x010a3e0754fffe5fc041)
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Initial]: Open Event
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Initial]: Change to state Starting
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]: Report This-Layer-Started
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]: Up Event
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]: Initialize-Restart-Counter
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]: O CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]:    Interface-Id e6c7:22ff:fe3a:d1f8 (0x010ae6c722fffe3ad1f8)
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]: Restarting stalled Conf-Req packet
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]: I CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12:
[Starting]: Change to state Req-Sent
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]:    Interface-Id 3e07:54ff:fe5f:c041 (0x010a3e0754fffe5fc041)
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]: O CONFACK id 1 len 14 - packet STALLED
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]:    Interface-Id 3e07:54ff:fe5f:c041 (0x010a3e0754fffe5fc041)
RP/0/RSP0/CPU0:Jun 30 13:35:32.176 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe12: [Req-
Sent]: Change to state Ack-Sent
RP/0/RSP0/CPU0:Jun 30 13:35:32.177 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Ack-Sent]: I CONFACK id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:35:32.177 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Ack-Sent]:    Interface-Id e6c7:22ff:fe3a:d1f8
(0x010ae6c722fffe3ad1f8)
RP/0/RSP0/CPU0:Jun 30 13:35:32.177 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Ack-Sent]: Initialize-Restart-Counter
RP/0/RSP0/CPU0:Jun 30 13:35:32.177 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Ack-Sent]: Change to state Open
RP/0/RSP0/CPU0:Jun 30 13:35:32.177 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Open]: Report This-Layer-Up
```

```
RP/0/RSP0/CPU0:Jun 30 13:35:32.182 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Open]: O CONFACK id 1 len 14 - after DELAY
RP/0/RSP0/CPU0:Jun 30 13:35:32.182 : PPP-MA[363]: IPv6CP: Bundle-
Ether301.99.pppoe12: [Open]:    Interface-Id 3e07:54ff:fe5f:c041
(0x010a3e0754fffe5fc041)
```

NO. 34 - V6 FRAMED-INTERFACE-ID FOR PPPOE PTA SESSION USING SLAAC

Function

To specify the IPv6 framed-interface-id assigned to a PPPoE client using SLAAC.

Attributes

```
Framed-Interface-Id = 0260:08FF:FEFF:FFFF
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template  type  ppp TEST ppp ipv6cp peer-interface-id  ?
  WORD  64-bit Peer Interface-ID (hex value without leading 0x)
```

Notes

- *The Framed-Interface-Id Attribute indicates the IPv6 interface identifier to be configured for the user. It MAY be used in Access-Accept packets.*
- *See detail usage in "No. 33 V6 prefix for PPPoE PTA session using SLAAC"*

Example of interface-id with V6 prefix

user profile in radius server

```
V6PPP3@S99      Cleartext-Password := "cisco"
    Cisco-avpair = "ipv6-enable=1",
    Framed-Interface-Id += 0260:08FF:FEFF:FFFF,
    Framed-Ipv6-Prefix += FEC0:0000:0000:0000:0000:0000:0000:0000/64
```

radius server log

```
rad_recv: Access-Request packet from host 192.168.88.99 port 28597, id=62, lengt
h=245
        Cisco-AVPair = "client-mac-address=3c07.545f.c041"
        Acct-Session-Id = "00000011"
        NAS-Port = 755051793
        NAS-Port-Id = "0/0/301/99.301"
        Cisco-NAS-Port = "0/0/301/99.301"
        User-Name = "V6PPP3@S99"
        Service-Type = Framed-User
        User-Password = "cisco"
        X-Ascend-Connect-Progress = LCP-Opened
        Cisco-AVPair = "connect-progress=LCP Open"
        Framed-Protocol = PPP
        NAS-Port-Type = 37
        Called-Station-Id = "99"
        Calling-Station-Id = "3c07.545f.c041"
        Event-Timestamp =
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99
Mon Jun 30 14:04:39 2014 : Info: # Executing section authorize from file ../etc/

Sending Access-Accept of id 62 to 192.168.88.99 port 28597
        Cisco-AVPair = "ipv6-enable=1"
        Framed-Interface-Id += 260:8ff:feff:ffff
        Framed-IPv6-Prefix += fec0::/64
Mon Jun 30 14:04:39 2014 : Info: Finished request 0.
```

BNG session display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de internal
Mon Jun 30 14:03:25.068 UTC
Interface:                Bundle-Ether301.99.pppoe17
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Down, Mon Jun 30 14:03:10 2014
IPv6 State:               Up, Mon Jun 30 14:03:10 2014
Framed IPv6 Prefix:       fec0::/64, VRF: default
IPv6 Interface ID:        .`..... (02 60 08 ff fe ff ff ff)
IPv6 Up helpers:          0x00100020 {PPP,ND}
IPv6 Up requestors:       0x00100020 {PPP,ND}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000011
Nas-Port:                 755051793
User name:                V6PPP3@S99
Outer VLAN ID:            301
Inner VLAN ID:            99
Subscriber Label:         0x0000004b
Created:                  Mon Jun 30 14:03:10 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x000017a0
Session History ID:       7
Access-interface:         Bundle-Ether301.99
Policy Executed:

  event Session-Start match-first [at Mon Jun 30 14:03:10 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
```

```
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Mon Jun 30 14:03:10 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f997c
1:  ipv6-enable     len=  4  value= 1(1)
2:  Interface-Id    len=  8  value= 02 60 08 ff fe ff ff ff
3:  prefix          len= 18  value= fec0::/64
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
[Last IPv4 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   Jun 30 14:03:10.592 SUBDB produce done [many]
   Jun 30 14:03:10.592 IPv6 Up [many]

RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh route ipv6 subscriber
Mon Jun 30 14:03:34.239 UTC

A    fec0::/64 is directly connected,
      00:00:23, Bundle-Ether301.99.pppoe17
```

IPC6CP negotiation (debug ppp negotiation)

```
RP/0/RSP0/CPU0:Jun 30 13:54:45.641 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Initial]: I CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:54:45.641 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Initial]:    Interface-Id 3e07:54ff:fe5f:c041 (0x010a3e0754fffe5fc041)
RP/0/RSP0/CPU0:Jun 30 13:54:45.641 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Initial]: Conf-Req packet stalled
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Initial]: Open Event
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Initial]: Change to state Starting
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]: Report This-Layer-Started
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]: Up Event
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]: Initialize-Restart-Counter
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]:    Interface-Id e6c7:22ff:fe3a:d1f8 (0x010ae6c722fffe3ad1f8)
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]: Change to state Req-Sent
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: Restarting stalled Conf-Req packet
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: I CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]:    Interface-Id 3e07:54ff:fe5f:c041 (0x010a3e0754fffe5fc041)
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: O CONFNAK id 1 len 14
```

```
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]:    Interface-Id 0260:08ff:feff:ffff (0x010a026008fffeffffff)
RP/0/RSP0/CPU0:Jun 30 13:54:45.646 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16:
[Starting]: O CONFREQ id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:54:45.647 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: I CONFACK id 1 len 14
RP/0/RSP0/CPU0:Jun 30 13:54:45.647 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]:    Interface-Id e6c7:22ff:fe3a:d1f8 (0x010ae6c722fffe3ad1f8)
RP/0/RSP0/CPU0:Jun 30 13:54:45.647 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: Initialize-Restart-Counter
RP/0/RSP0/CPU0:Jun 30 13:54:45.647 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Req-
Sent]: Change to state Ack-Rcvd
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Ack-
Rcvd]: I CONFREQ id 2 len 14
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Ack-
Rcvd]:    Interface-Id 0260:08ff:feff:ffff (0x010a026008fffeffffff)
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Ack-
Rcvd]: O CONFACK id 2 len 14 - packet STALLED
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Ack-
Rcvd]: Change to state Open
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Ack-
Rcvd]:    Interface-Id 0260:08ff:feff:ffff (0x010a026008fffeffffff)
RP/0/RSP0/CPU0:Jun 30 13:54:45.649 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Open]:
Report This-Layer-Up
RP/0/RSP0/CPU0:Jun 30 13:54:45.654 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Open]:
O CONFACK id 2 len 14 - after DELAY
RP/0/RSP0/CPU0:Jun 30 13:54:45.654 : PPP-MA[363]: IPv6CP: Bundle-Ether301.99.pppoe16: [Open]:
Interface-Id 0260:08ff:feff:ffff (0x010a026008fffeffffff
```

NO. 35 - V6 FRAMED-IPV6-POOL FOR PPPOE PTA SESSION USING SLAAC

Function

To specify the IPv6 prefix pool from which to assign a v6 prefix to a PPPoE client using SLAAC.

Attributes

```
Cisco-avpair = “ipv6-addr-pool= pppoe_poolv6”
```

or

```
Framed-Ipv6-Pool = pppoe_poolv6
```

Referred configuration on BNG

```
pool vrf default ipv6 pppoe_poolv6
 prefix-length 64
 prefix-range 20:1:1:: 20:1:1:3fff::
```

Equivalent configuration in dynamic-template

```
dynamic-template type ppp TEST ipv6 nd  framed-prefix-pool
pppoe_poolv6
```

Notes

- *Applicable for PPPoEv6 or DS PTA session using SLAAC(or called ND) for V6 addressing.*
- *For SLAAC, apart from the V6 prefix, the client also need to learn the prefix length and the framed-interface-id to build the complete V6 address. Usually they are downloaded from radius server on authenticaiton.*
  - *framed-ipv6-prefix — could be specified from radius, and BNG will negotiate it to Client using ICMPv6 protocol RA message.*
  - *framed-prefix-lenth— could be specified from radius. BNG will negotiate it to Client using ICMPv6 protocol RA message.*
  - *framed-interface-id— could be specified from radius and negotiate to Client using PPP IPv6CP protocol, or let the client to determine it's interface-id by itself.*
- *By downloading Framed-Ipv6-Pool from radius, you need to have the v6 pool predefined on the BNG with perfix-length and prefix-ranged defined. On receiving the attribute, BNG will pick a prefix from the local defined pool and negotiate the prefix and prefix-length using ICMPv6 RA to the client. you don't need to download the prefix-len from radius server since it's already defined in the v6 pool. And the interface-id is optional here.*
- *A subscriber route will be created in the v6 routing table for this prefix.*
- *Never include this attribute in the access-accept for a LAC session.*

Example of framed-ipv6-pool

user-profile in radius server

```
V6PPP4@S99        Cleartext-Password := "cisco"
     Cisco-avpair = "ipv6-enable=1",
     Framed-Ipv6-Pool += pppoe_poolv6
```

session information

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Wed Jul  9 10:48:40.079 UTC
Interface:               Bundle-Ether101.99.pppoe5
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    PPPoE:PTA
IPv4 State:              Up, Wed Jul  9 10:48:31 2014
IPv4 Address:            1.1.99.3, VRF: default
IPv4 Up helpers:         0x00000020 {PPP}
```

```
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Up, Wed Jul  9 10:48:31 2014
Framed IPv6 Prefix:       20:1:1::/64, VRF: default
IPv6 Interface ID:        >.T.._.A (3e 07 54 ff fe 5f c0 41)
IPv6 Up helpers:          0x00100020 {PPP,ND}
IPv6 Up requestors:       0x00100020 {PPP,ND}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000005
Nas-Port:                 1694524677
User name:                V6PPP4@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000044
Created:                  Wed Jul  9 10:48:28 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x000014a0
Session History ID:       5
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Wed Jul  9 10:48:28 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Wed Jul  9 10:48:31 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9a80
1:  ipv6-enable     len=  4  value= 1(1)
2:

Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005a
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul  9 10:48:31.872 SUBDB produce done [many]
   Jul  9 10:48:31.872 IPv4 Up
   Jul  9 10:48:31.872 IPv6 Up [many]

RP/0/RSP0/CPU0:Roy_BNG_1#sh pool ipv6
Wed Jul  9 10:48:49.255 UTC

              Allocation Summary
-------------------------------------------------

Used: 1
Excl: 0
Free: 196605
Total: 196606
```

```
Utilization: 0%


 Pool Name    Pool ID      VRF      Used    Excl    Free   Total
-----------  ---------  ---------  ------  ------  ------ -------
   PD_pool     46     default           0       0  65536  65536
pppoe_poolv6     48     default           1       0  65535  65536
 v6_pool_1     47     default           0       0  65534  65534


RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh route ipv6 subscriber
Wed Jul  9 10:49:22.332 UTC

A    20:1:1::/64 is directly connected,
      00:00:50, Bundle-Ether101.99.pppoe5
RP/0/RSP0/CPU0:Roy_BNG_1#
```

No. 36 - V6 framed-route for PPP and IPoE

———

Function

To specify the IPv6 route associated to a session.

Attributes

```
Framed-IPv6-Route += "45:1:1:1:2:3:4:5/128 :: 4 tag 5"
```

The syntax is

Framed-Route = “vrf <prefix VRF> <prefix> <prefix mask> vrf <next hop vrf> <next hop prefix> <AD> tag <tag id>”

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

n/a

Notes

- For PPPoE and IPoE, this attribute is supported from 5.2.0 (got some bug which will be fixed in 520 release)
- There are some feature disparities between PPPoE and IPoE
- PPPoE
  - Cross VRF route is not supported, which means that the session, the prefix and next-hop of the route must be in the same VRF, the route will be installed into the VRF to which the session belong (the vrf specified by dyamic-template or Avpair vrf-id coming along with the framed-route on authentication).
  - COA pushing is not supported.
  - To install a framed-ipv6-route into a VRF (for example VRF_1) where the session is reside in , you can download following attribute from the radius

```
Cisco-AVpair="vrf-id=VRF_1"
Framed-IPv6-Route += "45:1:1:1:2:3:4:5/128 :: 4 tag 5"
```

The route 45:1:1:1:2:3:4:5/128 will be installed to vrf VRF_1

- IPoE
  - Cross VRF route is supported. The session and prefix could be in one VRF, the next-hop could be in another vrf.
  - COA pushing is supported for IPoE session.
- Never include this attribute in the access-accept for a LAC session.

NO. 37 - FRAMED-IPV6-ADDRESS FOR DHCPV6 FOR BOTH PPPOE AND IPOE

———

Function

To specify the IPv6 address (with /128) assigned to a DHCPv6 client for IA-NA. This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-NA when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).

Attributes

Cisco-avpair = "addrv6= FEC0:0000:0000:0000:0260:08FF:FEFF:FFFF"

or

Framed-Ipv6-Address = FEC0:0000:0000:0000:0260:08FF:FEFF:FFFF

Note: The IETF attribute Framed-Ipv6-Address has not been supported yet since when the V6 RADIUS is developed on ASR9K , the RFC defined this attribute was still a draft. it will be supported in 5.2.2 release. Including this one, we have totally DHCPv6 related IETF attributes get alternative Cisco AVpair before 5.2.2.

IETF	cisco AVPair
Framed-ipv6-Address	"addrv6=<ipv6 address>"
Stateful-IPv6-Address-Pool	"stateful-ipv6-address-pool=<name>"
Delegated-IPv6-Prefix-Pool	"delegated-ipv6-pool=<name>"
DNS-Server-IPv6-Address	"ipv6-dns-servers-addr=<ipv6 address>"

Referred configuration on BNG

PPPoE DHCPv6

```
dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
 !
 interface subscriber-pppoe profile SERVER
```

or

IPoE DHCPv6

```
dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
 !
 interface Bundle-Ether200.301 server profile SERVER
```

Equivalent configuration in dynamic-template

n/a

Notes

- *This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-NA when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).*
- *Here the ASR9K must act as a DHCPv4 server, this is part of the so called DHCP radius proxy feature..*
- *The ipv4 address will be negotiate with client via DHCPv6. protocol as IA-NA, only /128 v6 address could be assigned in this way.*
- *A subscriber route will be created in the v6 routing table for this v6 address.*
- *Note, the RADIUS specified address assigned to subscriber is not reflected in the usage of local IPv6 pool. In fact, with specific ipv6 address assigned by radius, you do not even need an IPv6 pool configured locally in this case, but you can still find the dhcp binding entry for that session.*

NO. 38 - STATEFUL-IPV6-ADDRESS-POOL FOR DHCPV6 FOR BOTH PPPOE AND IPOE

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Function

To specify the IPv6 address pool for IA-NA from which a ipv6 address (with /128) is assigned to a DHCPv6 client for IA-NA. This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-NA when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).

Attributes

Cisco-avpair = "stateful-ipv6-address-pool= v6_pool_1"

or

Stateful-IPv6-Address-Pool = v6_pool_1

Note: The IETF attribute Stateful-IPv6-Address-Pool has not been supported yet since when the V6 RADIUS is developed on ASR9K , the RFC defined this attribute was still a draft. it will be supported in 5.2.2 release. Including this one, we have totally DHCPv6 related IETF attributes get alternative Cisco AVpair before 5.2.2.

IETF	cisco AVPair
Framed-ipv6-Address	"addrv6=<ipv6 address>"

IETF	cisco AVPair
Stateful-IPv6-Address-Pool	“stateful-ipv6-address-pool=<name>”
Delegated-IPv6-Prefix-Pool	“delegated-ipv6-pool=<name>”
DNS-Server-IPv6-Address	“ipv6-dns-servers-addr=<ipv6 address>”

Referred configuration on BNG

PPPoE DHCPv6

```
pool vrf default ipv6 v6_pool_1
 address-range 2001::2 2001::ffff

dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
  address-pool v6_pool_1
 !
 interface subscriber-pppoe profile SERVER
```

or

IPoE DHCPv6

```
pool vrf default ipv6 v6_pool_1
 address-range 2001::2 2001::ffff


dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
  address-pool v6_pool_1
 !
 interface Bundle-Ether200.301 server profile SERVER
```

Equivalent configuration in dynamic-template

```
dynamic-template type ppp TEST dhcpv6 address-pool v6_pool_1
```

or

```
dynamic-template type ipsub TEST dhcpv6 address-pool v6_pool_1
```

Notes

- *This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-NA when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).*
- *Here the ASR9K must act as a DHCPv6 server, this is part of the so called DHCP radius proxy feature..*
- *The ipv6 address will be negotiate with client via DHCPv6 protocol as IA-NA, only /128 v6 address could be assigned in this way.*
- *You can still find the dhcp binding entry for that session, and use "show pool ipv6" to check the usage of v6 pool.*

NO. 39 - DELEGATED-IPV6-PREFIX-POOL FOR DHCPV6 FOR BOTH PPPOE AND IPOE

———

Function

To specify the IPv6 pool for IA-PD, from which a ipv6 prefix is assigned to a DHCPv6 client for IA-PD. This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-PD when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).

Attributes

Cisco-avpair = "delegated-ipv6-pool= PD_pool"

or

Delegated-IPv6-Prefix-Pool = PD_pool

Note: The IETF attribute Delegated-IPv6-Prefix-Pool has not been supported yet since when the V6 RADIUS is developed on ASR9K , the RFC defined this attribute was still a draft. it will be supported in 5.2.2 release. Including this one, we have totally DHCPv6 related IETF attributes get alternative Cisco AVpair before 5.2.2.

IETF	cisco AVPair
Framed-ipv6-Address	"addrv6=<ipv6 address>"
Stateful-IPv6-Address-Pool	"stateful-ipv6-address-pool=<name>"
Delegated-IPv6-Prefix-Pool	"delegated-ipv6-pool=<name>"

IETF	cisco AVPair
DNS-Server-IPv6-Address	“ipv6-dns-servers-addr=<ipv6 address>”

Referred configuration on BNG

PPPoE DHCPv6

```
pool vrf default ipv6 PD_pool
 prefix-length 64
 prefix-range 2002:1:1:: 2002:1:1:ffff::


dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
  prefix-pool PD_pool
 !
 interface subscriber-pppoe profile SERVER
```

or

IPoE DHCPv6

```
pool vrf default ipv6 PD_pool
 prefix-length 64
 prefix-range 2002:1:1:: 2002:1:1:ffff::



dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
  domain-name cisco.com
  prefix-pool PD_pool
 !
 interface Bundle-Ether200.301 server profile SERVER
```

Equivalent configuration in dynamic-template

```
dynamic-template type ppp TEST dhcpv6 delegated-prefix-pool PD_pool
```

or

```
dynamic-template type ipsub TEST dhcpv6 delegated-prefix-pool PD_pool
```

Notes

- *This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 IP-NA when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).*
- *Here the ASR9K must act as a DHCPv6 server, this is part of the so called DHCP radius proxy feature..*
- *The ipv6 prefix will be negotiated with client via DHCPv6 protocol as IA-PD.*
- *A subscriber route will be created in the v6 routing table for this v6 delegated prefix.*
- *You can still find the dhcp binding entry for that session, and use "show pool ipv6" to check the usage of v6 pool.*

NO. 40 - V6 DNS SERVER FOR DHCPV6 FOR BOTH PPPOE AND IPOE

———

Function

To specify the IPv6 DNS server address. This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 DNS(so called stateless DHCPv6 for PPPoE) when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).

Attributes

Cisco-avpair = "ipv6-dns-servers-addr=2002::1"

or

DNS-Server-IPv6-Address = 2002::1

Note: The IETF attribute DNS-Server-IPv6-Address has not been supported yet since when the V6 RADIUS is developed on ASR9K , the RFC defined this attribute was still a draft. it will be supported in 5.2.2 release. Including this one, we have totally DHCPv6 related IETF attributes get alternative Cisco AVpair before 5.2.2.

IETF	cisco AVPair
Framed-ipv6-Address	"addrv6=<ipv6 address>"
Stateful-IPv6-Address-Pool	"stateful-ipv6-address-pool=<name>"
Delegated-IPv6-Prefix-Pool	"delegated-ipv6-pool=<name>"
DNS-Server-IPv6-Address	"ipv6-dns-servers-addr=<ipv6 address>"

Referred configuration on BNG

PPPoE DHCPv6

```
dhcp ipv6
 profile SERVER server
  lease 4
  domain-name cisco.com
 !
 interface subscriber-pppoe profile SERVER
```

or

IPoE DHCPv6

```
dhcp ipv6
 profile SERVER server
  lease 4
  domain-name cisco.com
 !
 interface Bundle-Ether200.301 server profile SERVER
```

Equivalent configuration in dynamic-template

```
dhcp ipv6
 profile SERVER server
  lease 4
  dns-server 2011::1
```

Notes

- *This is applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain v6 DNS server address when ASR9K BNG act as a DHCPv6 server influenced by RADIUS server(DHCPv6 radius proxy mode).*
- *Here the ASR9K must act as a DHCPv6 server, this is part of the so called DHCP radius proxy feature..*
- *The ipv6 DNS will be negotiated with client via DHCPv6 protocol.*

NO. 41 - DHCPV6 CLASS

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Function

To Specify the DHCP class under which you can specify the customised information. In this case, the radius server is involved to influence the behaviour of DHCPv6 server.

Attributes

```
Cisco-avpair = "dhcpv6-class=dhcp-hgw-vobb"
```

Referred configuration on BNG

Similar to DHCPv4 counterpart.

Equivalent configuration in dynamic-template

```
dynamic-template type ppp TEST dhcpv6 class-name dhcp-hgw-vobb
```

or

```
dynamic-template type ipsub TEST dhcpv6 class-name dhcp-hgw-vobb
```

Notes

- *Applicable for DHCPv6 triggered IPoE session , and PPP session using DHCPv6 to obtain IA-NA/IA-PD or v6 DNS server information.*
- *Here the ASR9K must act as a DHCPv6 server, this is part of the so called DHCP radius proxy feature..*

NO. 42 - V6 ACL

———————————————————————————————————————

Function

To specify the name of in/out security IPv6 ACL or in/out IPv6 ABF(ACL based forwarding) applied to a session.

Attributes

```
Cisco-avpair = “ipv6_outacl=S99_ACL_out_v6"
Cisco-avpair = “ipv6_inacl=S99_ACL_in_v6"
```

Referred configuration on BNG

Similar to it’s v4 counterpart

Equivalent configuration in dynamic-template

```
dynamic-template type  service  TEST ipv6 access-group S99_ACL_in_v6
ingress
dynamic-template type  service  TEST ipv6 access-group S99_ACL_out_v6
egress
```

Notes

- *Applicable for all kinds of v6 sessions or DS sessions*
- *Same method for ABF*

NO. 43 - IPV6-UNREACHABLE

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Function

To enable ipv6 ipv6-unreachable for subscriber session

Attributes

```
Cisco-avpair = “ipv6-unreachable=0”
```

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type service  TEST ipv6  unreachables disable
```

Notes

- *Applicable for PPPoE/IPoE*
- *Ipv6 ICMP unreachables are enabled by default on the session interface (sh ipv6 int Bundle-Ether101.99.pppoe13 to check).*
- *The value of this AVPair could be 0 or 1 or whatever other mumber(tried 2 and 21 in person and both work as well), end in disabling the ipv6 ICMP unreachables. You can use 0 to make it more meaningful.*

NO. 44 - IPV6 URPF

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Function

To enable ipv6 uRPF checking for subscriber packet

Attributes

```
Cisco-avpair = “ipv6-strict-rpf=1”  or Cisco-avpair = “ipv6-strict-rpf=0”
```

1 is for strict mode and 0 is for loose mode.

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

```
dynamic-template type service  TEST ipv6 verify unicast  source
reachable-via rx
```

Notes

- *Applicable for PPPoE/IPoE*
- *by default the urpf is disabled on the session interface, ipv6-strict-rpf=1 turns on strict mode urpf and ipv6-strict-rpf=0 turns on loose mode urpf.*

A comprehensive example includes multiple v6 radius attributes.

user profile on RADIUS server

```
V6PPP10@S99      Cleartext-Password := "cisco"
     Cisco-avpair = "ipv6-enable=1",
     Framed-Interface-Id += 0260:08FF:FEFF:FFFF,
     Framed-Ipv6-Prefix += FEC0:0000:0000:0000:0000:0000:0000:0000/64,
     Cisco-avpair += "ipv6-strict-rpf=1",
```

```
Cisco-avpair += "ipv6-unreachable=1",
Cisco-avpair += "ipv6_outacl=S99_ACL_out_v6",
Cisco-avpair += "ipv6_inacl=S99_ACL_in_v6"
```

radius server log

```
Sending Access-Accept of id 16 to 192.168.88.99 port 62805
        Cisco-AVPair = "ipv6-enable=1"
        Framed-Interface-Id += 260:8ff:feff:ffff
        Framed-IPv6-Prefix += fec0::/64
        Cisco-AVPair += "ipv6-strict-rpf=1"
        Cisco-AVPair += "ipv6-unreachable=1"
        Cisco-AVPair += "ipv6_outacl=S99_ACL_out_v6"
        Cisco-AVPair += "ipv6_inacl=S99_ACL_in_v6"
Wed Jul 09 14:24:27 2014 : Info: Finished request 0.
```

BNG session information

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Wed Jul  9 14:23:31.875 UTC
Interface:                Bundle-Ether101.99.pppoe10
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Wed Jul  9 14:23:13 2014
IPv4 Address:             1.1.99.4, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Up, Wed Jul  9 14:23:13 2014
Framed IPv6 Prefix:       fec0::/64, VRF: default
IPv6 Interface ID:        .`..... (02 60 08 ff fe ff ff ff)
IPv6 Up helpers:          0x00100020 {PPP,ND}
IPv6 Up requestors:       0x00100020 {PPP,ND}
Mac Address:              3c07.545f.c041
Account-Session Id:       0000000a
Nas-Port:                 1694524682
User name:                V6PPP10@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000049
Created:                  Wed Jul  9 14:23:09 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x000015e0
Session History ID:       6
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Wed Jul  9 14:23:09 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Wed Jul  9 14:23:12 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
```

```
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9d38
1:  ipv6-enable     len=  4  value= 1(1)
2:  Interface-Id    len=  8  value= 02 60 08 ff fe ff ff ff
3:  prefix          len= 18  value= fec0::/64
4:  ipv6-strict-rpf len=  4  value= 1(1)
5:  ipv6-unreachable len=  4  value= 1(1)
6:  ipv6_outacl     len= 14  value= S99_ACL_out_v6
7:  ipv6_inacl      len= 13  value= S99_ACL_in_v6
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005a
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul  9 14:23:13.280 SUBDB produce done [many]
   Jul  9 14:23:13.280 IPv6 Up [many]
   Jul  9 14:23:13.280 IPv4 Up

RP/0/RSP0/CPU0:Roy_BNG_1#sh route ipv6 subscriber
Wed Jul  9 14:23:48.543 UTC

A    fec0::/64 is directly connected,
      00:00:35, Bundle-Ether101.99.pppoe10


RP/0/RSP0/CPU0:Roy_BNG_1#sh ipv6 int  Bundle-Ether101.99.pppoe10
Wed Jul  9 14:24:01.471 UTC
Bundle-Ether101.99.pppoe10 is Up, ipv6 protocol is Up, Vrfid is default
(0x60000000)
  IPv6 is enabled, link-local address is fe80::e6c7:22ff:fe3a:d1f3
  No global unicast address is configured
  Joined group address(es): ff02::1:ff3a:d1f3 ff02::2 ff02::1
  MTU is 1500 (1492 is available to IPv6)
  ICMP redirects are disabled
  ICMP unreachables are disabled
  ND DAD is disabled, number of DAD attempts 0
  ND reachable time is 0 milliseconds
  ND cache entry limit is 1000000000
  ND advertised retransmit interval is 0 milliseconds
  ND router advertisements are sent every 160 to 240 seconds
  ND router advertisements live for 1800 seconds
  Hosts use stateless autoconfig for addresses.
  Outgoing access list is not set
  Inbound  access list is not set
  Table Id is 0xe0800000
IP unicast RPF check is enabled
RPF mode strict
  Complete protocol adjacency: 0
  Complete glean adjacency: 0
  Incomplete protocol adjacency: 0
  Incomplete glean adjacency: 0
```

```
  Dropped protocol request: 0
  Dropped glean request: 0


RP/0/RSP0/CPU0:Roy_BNG_1#sh access-lists ipv6 interface Bundle-Ether101.99.pppoe10
Wed Jul  9 14:25:33.804 UTC
Input ACL (common): N/A (interface): S99_ACL_in_v6
Output ACL: S99_ACL_out_v6
RP/0/RSP0/CPU0:Roy_BNG_1#
```

NO. 45 - SERVICE-ACTIVATE

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Function

To enable a service defined locally on the ASR9K BNG as a dynamic-template.

Attributes

Cisco-avpair = "sa=S99_SERVICE_2"

Here the "sa" stand for service activate. The string follows "=" is the name of the service which must match the name of the dynamic-template defined on the BNG box.

Referred configuration on BNG

```
dynamic-template
 type service S99_SERVICE_2 !<- the type could also be ppp or ipsub
  service-policy input S99_IN_POLICING_1M
  service-policy output S99_OUT_SHAPING_9M_H
  ipv4 access-group S99_ACL_in_2 ingress
  ipv4 access-group S99_ACL_out_2 egress

policy-map S99_IN_POLICING_1M
 class class-default
  police rate 1 mbps
  !
 !
 end-policy-map
!

policy-map S99_OUT_SHAPING_9M_H
 class class-default
  service-policy S99_OUT_SHAPING_9M_CHILD
  shape average 9 mbps
 !
 end-policy-map
!
```

```
policy-map S99_OUT_SHAPING_9M_CHILD
 class CM_VIDEO_IPP
  priority level 1
  police rate 8 mbps
  !
 !
 class class-default
 !
 end-policy-map
!

ipv4 access-list S99_ACL_in_2
 20 permit ipv4 any any
!

ipv4 access-list S99_ACL_out_2
 10 permit ipv4 any any
```

Equivalent configuration in dynamic-template

This is not to apply an individual feature, instead, it's to apply an service as a whole, so the equivalent configuration on box is not on the dynamic-template level, instead, the right way is to activate a dynamic-template in the control policy which is attached to a access-interface and effective to all of the session nested under that access-interface.

```
policy-map type control subscriber S99_CP_PTA_BASIC
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 activate dynamic-template S99_SERVICE_2
```

Notes

- *Applicable for PPPoE/IPoE.*
- *A user profile with only AVPair "sa=<service-name> " dose not work, a workaround is to add a dummy attribute, for example, a "service-type"*

```
###This profile does not work##
PPP3@S99   Cleartext-Password := "cisco"
      Cisco-avpair += "sa=HTTPRDRT_TPL_1",
      Cisco-avpair += "sa=S99_SERVICE_2"


####following profile works###
```

```
PPP3@S99   Cleartext-Password := "cisco"
      Service-Type = framed,
     Cisco-avpair += "sa=HTTPRDRT_TPL_1",
      Cisco-avpair += "sa=S99_SERVICE_2"
```

- *Multiple Cisco-avpair = "sa=<service-name>" could be included in the same access-accept, to activate multiple dynamic-template in one time on authentication.*
- *A dynamic-template with the same <service-name> must be configured on the ASR9K BNG so that the Cisco-avpair = "sa=<service-name>" can call that dynamic-template. To trigger a service authorization (sending access request with username of <service-name> to download a service-profile from radius server) is not supported as of now (5.1.1 release).*
- *Service activation is able to coexist with individual feature enablement by downloading other radius attributes.*
- *To enable some particular feature on a session , configuration can only come from a dynamic-template and there is no equivalent radius attribute, for example, session based SPAN (traffic mirroring). The approach of radius based service activating give you the flexibility to enable those feature on a per session basis.*

Example of service activate

user profile in radius server

```
PPP3@S99   Cleartext-Password := "cisco"
      Cisco-avpair = "ipv4-unnumbered=Loopback1099",
      Cisco-avpair += "addr-pool=S99_POOL_PPPV4",
      Cisco-avpair += "sa=HTTPRDRT_TPL_1",
      Cisco-avpair += "sa=S99_SERVICE_2"
```

radius server log

```
Sending Access-Accept of id 163 to 192.168.88.99 port 62805
        Cisco-AVPair = "ipv4-unnumbered=Loopback1099"
        Cisco-AVPair += "addr-pool=S99_POOL_PPPV4"
        Cisco-AVPair += "sa=HTTPRDRT_TPL_1"
        Cisco-AVPair += "sa=S99_SERVICE_2"
```

BNG session information

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh run policy-map t c s S99_CP_PTA_BASIC
policy-map type control subscriber S99_CP_PTA_BASIC
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
```

```
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 activate dynamic-template S99_DT_PTA_MIN
  !
RP/0/RSP0/CPU0:Roy_BNG_1# sh run dynamic-template t ppp S99_DT_LCP
Fri Jul 11 11:14:29.902 UTC
dynamic-template
 type ppp S99_DT_LCP
  ppp authentication pap chap
  ppp mru ignore
  ppp ipcp mask 255.255.0.0
  ipv4 mtu 700
 !
!

RP/0/RSP0/CPU0:Roy_BNG_1# sh run dynamic-template t ppp  S99_DT_PTA_MIN
Fri Jul 11 11:15:26.564 UTC
dynamic-template
 type ppp S99_DT_PTA_MIN
  ppp ipcp peer-address pool S99_POOL_PPPV4
  ipv4 unnumbered Loopback1099
 !


RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jul 11 11:12:35.900 UTC
Interface:                Bundle-Ether101.99.pppoe25
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Fri Jul 11 11:07:36 2014
IPv4 Address:             1.1.99.14, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Down, Fri Jul 11 11:07:36 2014
Mac Address:              3c07.545f.c041
Account-Session Id:       00000054
Nas-Port:                 1694524697
User name:                PPP3@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000052
Created:                  Fri Jul 11 11:07:36 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x00001ba0
Session History ID:       19
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Fri Jul 11 11:07:36 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Fri Jul 11 11:07:36 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
```

```
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:<— the AVpair “sa=xxx” is not listed here as a
attribute
 Attribute List: 0x500f9e70
1:  ipv4-unnumbered len= 12  value= Loopback1099
2:  addr-pool       len= 14  value= S99_POOL_PPPV4
Services:
  Name        : S99_DT_LCP <-this is the dynamic-template called by the control
policy
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1 <—instead, it’s reflected as a service activated
  Service-ID  : 0x400002c
  Type        : Multi Template
  Status      : Applied
-------------------------
  Name        : S99_SERVICE_2 <—instead, it’s reflected as a service activated
  Service-ID  : 0x400002a
  Type        : Multi Template
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN <-this is the dynamic-template called by the control
policy
  Service-ID  : 0x400005a
  Type        : Template
  Status      : Applied
-------------------------
[Last IPv6 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_DEFAULT (0)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   Jul 11 11:07:36.576 SUBDB produce done [many]
   Jul 11 11:07:36.576 IPv4 Up


RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber running-config  subscriber-label 0x00000052
Fri Jul 11 11:13:21.842 UTC
!!!this is a display for 5.1.1 release!!!
Subscriber Label: 0x52
dynamic-template
 type ppp S99_DT_LCP
  ipv4 mtu 700
 !
!

dynamic-template
 type service HTTPRDRT_TPL_1
  service-policy type pbr HTTPRDRT_PBR_1
 !
!

dynamic-template
 type service S99_SERVICE_2
  ipv4 access-group S99_ACL_in_2 ingress
 !
!
```

```
dynamic-template
 type service S99_SERVICE_2
  ipv4 access-group S99_ACL_out_2 egress
 !
!

dynamic-template
 type ppp S99_DT_LCP
  ppp ipcp mask 255.255.0.0
 !
!

dynamic-template
 type ppp S99_DT_LCP
  ppp authentication pap chap
 !
!

dynamic-template
 type ppp S99_DT_LCP
  ppp mru ignore
 !
!

dynamic-template
 type service S99_SERVICE_2
  service-policy input S99_IN_POLICING_1M
 !
!

dynamic-template
 type service S99_SERVICE_2
  service-policy output S99_OUT_SHAPING_9M_H
 !
!
```

NO. 46 - SERVICE-DEACTIVATE

———

Function

To disable a service which has been activated before.

Attributes

Cisco-avpair = “sd= HTTPRDRT_TPL”

Here the “sd" stand for service deactivate. The string follows “=“ is the name of the service which must match the name of a dynamic-template or service activated on the BNG.

Referred configuration on BNG

n/a

Equivalent configuration in dynamic-template

This is to deactivate dan service as a whole, so the equivalent configuration on box is not on the dynamic-template level, instead, the right way is teo activate a dynamic-template in the control policy which is attached to a access-interface and effective to all of the session nested under that access-interface.

```
policy-map type control subscriber IPoE_WLAN
 event session-start match-first
  class type control subscriber IP do-until-failure
   10 activate dynamic-template UNAUTH_TPL
   20 authorize aaa list IPoE_WLAN format USERNAME password cisco
  !
 !
 event authorization-failure match-first
  class type control subscriber IP do-until-failure
   10 activate dynamic-template HTTPRDRT_TPL
   20 set-timer UNAUTH_TMR 3
  !
 !
 event account-logon match-first
  class type control subscriber IP do-until-failure
   10 authenticate aaa list IPoE_WLAN
   20 deactivate dynamic-template HTTPRDRT_TPL
  !
 !
 event timer-expiry match-first
  class type control subscriber UNAUTH_TMR_CM do-until-failure
   10 disconnect
  !
 !
 end-policy-map
!
```

Notes

- *Applicable for PPPoE/IPoE.*
- *The service need to be deactivate must be present on the session, use "show subs sess detail internal" to check what services are applied.*
- *Not all of the service could be deactivate , for example, it's not possible to deactivate a service defined the VRF-ID, or the authentication protocol.*

NO. 47 - L2TP LAC/VPDN RELATED ATTRIBUTES

Function

The attributes to specify the parameters for L2TP LAC functionality.
For more detail on how to configure L2TP LAC on ASR9000 BNG , please visit
http://www.cisco.com/c/en/us/td/docs/routers/asr9000/software/asr9k_r5-2/bng/configuration/guide/b-bng-cg52xasr9k/b-bng-cg52xasr9k_chapter_0101.html#concept_A9F34995A4C54E73909CD490BC9F27A8

Attributes

Following table lists all of the supported Cisco-VSA(AVPair) and it's equivalent IETF attributes as of 5.1.1 release.

Cisco-VSA	IETF Radius Attribute	Respective Local Config	Description
Cisco-avpair = "vpdn:tunnel-type=l2tp"	Tunnel-Type 64 (integer)	"protocol l2tp"	Tunneling protocol to be used. We will support only l2tp as the option.
Cisco-avpair = "vpdn:ip-addresses=1.1.1.1,2.2.2.2/5.5.5.5,6.6.6.6"	Tunnel-Server-Endpoint 67 (string)	"ipv4 destination <address>"	LNS address. VSA: comma ',' is for load balancing, / defines failover groups
Cisco-avpair = "vpdn: ip-address-limits=10 20 30 40"	N/A	"ipv4 destination <address> limit <value>"	Should be in the same order as ip-addresses and each value is delimited by a space.
Cisco-avpair = "vpdn:source-ip=10.10.0.2"	Tunnel-Client-Endpoint 68 (string)	"source ipv4 <address>"	Source address for the L2TP Tunnels.
Cisco-avpair = "vpdn:tunnel-id=LAC1"	Tunnel-Client-Auth-ID 90 (string)	"local name <string>"	Local name for Tunnel Authentication. If not configured default to hostname.

Cisco-avpair = "vpdn:l2tp-tunnel-password=cisco"	Tunnel-Password 69 (string)	“password 0 cisco” in l2tp-class.	Password for L2TP tunnel authentication.
Cisco-avpair=”vpdn:tunnel-medium-type=1”	Tunnel-Medium-Type 65 (integer)	N/A (by default it is IPv4)	We only support IPv4 for this field, essentially this field could be ignored.
Cisco-avpair=”vpdn: tunnel-preference=10”	Tunnel-Preference 83 (integer)	N/A	Provides load balance and failover capability between different groups of LNS.
N/A	Tunnel-Assignment-ID 82 (string)	N/A	Used to groups sessions from different vpdn-groups/domain profiles under the same tunnel.
Cisco-avpair=”gw-name=LNS1”	Tunnel-Server-Auth-ID 91 (string)	N/A	It is same as remote-name and is used for Tunnel authentication
Cisco-avpair=”vpdn: tunnel-tos-reflect=yes”	N/A	ip tos reflect	When reflect option is enabled, tos from inner ip header is copied to the L2TP tunnel IP header.
Cisco-Avpair = “vpdn: l2tp-tunnel-authen=yes”,	N/A	l2tp tunnel authentication	To enable tunnel authentication.
Cisco-avpair = "vpdn:vpn-id=<value>”	N/A	vpn id <value>	VPN ID to be used to reach the LNS/peers in this vpdn-group. By default global-vrf will be used.

Cisco-avpair = "vpdn:vpn-vrf=<value>”	N/A	vpn vrf <name>	VPN VRF name to be used to reach the LNS/ peers in this vpdn-group. By default global-vrf will be used.
Cisco-avpair=”vpdn: tunnel-tos-setting=2”	N/A	ip tos <value>	TOS setting for data-plane.
Cisco-avpair=”vpdn: vpdn-template=<value>”	N/A	source vpdn-template <value>	to set the tos of l2tp packet, default is 0.
Cisco-avpair="vpdn:dsl-line-info-forwarding=1"	N/A	dsl-line-info-forwarding	enable the L2TP Forwarding of PPPoE Tag Information,allowing transfering of DSL line information from the L2TP access concentrator (LAC) to the L2TP network server (LNS)
Cisco-avpiar=”vpdn: l2tp-clid-mask-method=<value>”	N/A	l2tp attribute clid mask-method remove	the <value> could be set to “remove” to suppress L2TPv2 Calling Station ID
Cisco-avpiar=”vpdn: l2tp-tx-speed=<value>”	N/A	l2tp tx-speed <config-string>	see detail for the usage in following table
Cisco-avpiar=”vpdn: l2tp-rx-speed=<value>”	N/A	l2tp rx-speed <config-string>	see detail for the usage in following table

Following table summarizes the values which can be configured though the attributes of tx/rx speed. These radius downloaded values will not have any effect on the QoS policy/HW rates. They are way to tell what need to be sent to LNS.When neither CLI nor user-profile contains tx/rx speed configuration options, then we will

send the PPPoE Tag line rates. If PPPoE tag not available then random value will be send to LNS.

usage of AVPair tx/rx speed		
Config Mode A	l2tp-tx-speed=value	<value> will be in kbps to be sent to LNS
	l2tp-rx-speed=value	
Config Mode B	l2tp-tx-speed=ancp	ANCP actual upstream downstream line rate. If ANCP values not available, send PPPoE Tag value.
	l2tp-rx-speed=ancp	
Config Mode C	l2tp-tx-speed=ancp, **value**	ANCP line rate value if available or else specified <**value**> from radius.
	l2tp-rx-speed=ancp, **value**	

Notes:

Local authorization is not supported for IOS XR based L2TP at this stage , another words, all of the LNS information need to be downloaded from radius server or called as part of a dynamic-template activated by a control policy. VPDN-group configuration is not supported.

The IETF attribute "Service-type=Outbound-User" must be included in the user-profile for a L2TP LAC session, so that the BNG knows it's a L2TP session and initiate the session to the LNS. BTW, for IPoE or PPPoE PTA session , the service-type in access-accept is not mandatory.

If the PTA and LAC session are mixed under the same access-interface, be careful to build the control policy. LAC session fails if IPv4/IPv6 is enabled during session-start for L2TP session.

- *This could happen if you want to accommodate both PTA and LAC session in a common access-interace using a single control policy and rely on the access-accept from RADIUS server to tell if a session need to be treated as PTA or LAC session .*
- *If there is a dynamic-template with IPv4/V6 enabled by including a "ipv4 unnumbered" or "IPv6 enable" or other feature related to L3 forwarding activated upon session-start, and during session-activate your radius server*

indicates that this session is a L2TP session and need to be tunnelled to a LNS, the L2TP session will fail to establish since and IPv4/V6 is not allowed for a LAC session. Please don't include any attributes related to the L3 forwarding parameter to a the access-accept for a L2TP session, such as ipv4-unnumbered, ipv6-enable, framed-route, vrf-id,etc.

Here is a example to handle the situation that LAC and PTA session are terminated in the same access interface if some PTA related feature need to be applied from dynamic-template.

```
aaa attribute format vpdn_domain
 username-strip prefix-delimiter @
!

dynamic-template
 type ppp LCP_FEATURE
  ppp timeout retry 3
  ppp authentication pap
  ppp timeout authentication 5


 type ppp PTA
  ppp ipcp dns 204.124.107.131 204.124.107.133
  ppp ipcp peer-address pool POOL_TELMEX
  accounting aaa list RADIUS type session periodic-interval 1 dual-
stack-delay 5
  ipv4 mtu 1492
  ipv4 verify unicast source reachable-via rx
  ipv4 unnumbered Loopback200


!
policy-map type control subscriber POLICY_PTA_LAC
 event session-start match-first
  class type control subscriber CLASS_PPP do-until-failure
   10 activate dynamic-template LCP_FEATURE
  !
 event session-activate match-first
  class type control subscriber CLASS_LAC do-until-failure
   10 authorize aaa list RADIUS format vpdn_domain password cisco

  class type control subscriber CLASS_PPP do-until-failure
   10 authenticate aaa list RADIUS
   20 activate dynamic-template PTA

class-map type control subscriber match-all CLASS_PPP
 match protocol ppp
 end-class-map


class-map type control subscriber match-all CLASS_LAC
```

```
  match domain retailer.com format vpdn_domain                    <-
this is an example, means you want to check the domain part of
username and if it match the retailer.com, do LAC, otherwise do PTA

!
interface Bundle-Ether1201.200
 service-policy type control subscriber POLICY_PTA_LAC
 pppoe enable
 encapsulation dot1q 200
```

IETF tagged LAC attribtues on LAC (RFC 2868) are supported from 4.3.1 release, before that, the only way to achieve RADIUS based tunnel preference for load balancing and fail-over is the use of a Cisco proprietary Vendor Specific Attribute (VSA).

```
Service-type = Outbound-User,
cisco:avpair = “vpdn:tunnel-type=l2tp",
cisco:avpair = “vpdn:ip-addresses=1.1.1.1,2.2.2.2/3.3.3.3,4.4.4.4/5.5.5.5,6.6.6.6",
cisco:avpair = "vpdn:l2tp-tunnel-password=hello"
```

This configuration is interpreted as:

tunnel endpoints 1.1.1.1 and 2.2.2.2 are in Priority Group 1

tunnel endpoints 3.3.3.3 and 4.4.4.4 are in Priority Group 2

tunnel endpoints 5.5.5.5 and 6.6.6.6 are in Priority Group 3

Following is the equivalent IETF tagged attributes for the same purpose.

```
Service-type=Outbound-User,
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"

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"
```

Some example of user profile for L2TP LAC

```
VPDN30161 Auth-type := Local, User-Password == "cisco"
    Framed-Protocol=PPP,
    Service-type=Outbound-User,
    Cisco-AVPair += "vpdn:ip-addresses=60.0.4.161",
    Cisco-AVPair += "vpdn:source-ip=80.0.0.25",
    Cisco-AVPair += "vpdn:tunnel-password=spirent",
    Cisco-AVPair += "vpdn:tunnel-medium-type=1",
    Cisco-AVPair += "vpdn:tunnel-type=l2tp"
```

```
cisco.com Password = "secret"
  Service-Type = Outbound-User,
  cisco-avpair = "vpdn:tunnel-id=LAC",
  cisco-avpair = "vpdn:tunnel-type=l2tp",
  cisco-avpair = "vpdn:ip-addresses=10.0.0.1",
  cisco-avpair = "vpdn:source-ip=224.1.0.1",
  Cisco-avpair = “vpdn:tunnel-session-limit=1000”,
```

```
cisco-avpair = “vpdn:dsl-line-info-forwarding=1"
```

```
cisco.com Password = "secret"
  Service-Type = Outbound-User,
  cisco-avpair = "vpdn:tunnel-id=LAC",
  cisco-avpair = "vpdn:tunnel-type=l2tp",
  cisco-avpair = "vpdn:tunnel-passsword=password",
  cisco-avpair = "vpdn:ip-addresses=10.0.0.1",
  cisco-avpair = "vpdn:source-ip=10.0.0.9",
  Cisco-avpair = “vpdn:tunnel-session-limit=1000”,
  Cisco-avpair = "vpdn:vpn-vrf=vrf_1"
```

6. Chapter 6, CoA and PoD

6.1.CoA/PoD overview

Change of Authorization (CoA)and Pacekt of disconnect (PoD) are both extension to the RADIUS standard , they are defined in RFC 5176 “Dynamic Authorization Extensions to Remote Authentication Dial In User Service (RADIUS) ”. These extension method allow for asynchronous messages to be sent from external component to BNG. In the context of CoA/PoD , the BNG is acting as a CoA server or dynamic authorization server-use the term in RFC 5176 , and the external components is acting as a CoA client or dynamic authorization client . Note that a CoA client could be different from the RADIUS servers that are used for subscriber authentication/authorization and accounting.

PoD(Also known as DM-disconnect message) and CoA use the same UDP port and share the same packet format, but with different code for request , ACK and NAK respectively, read the RFC for more detail.

The prime reason for CoA/PoD on ASR9K BNG is to allow dynamic authorization client to

- disconnect a session.

- change behavior for a subscriber session that has already been authorized.
- send subscriber session credential to a BNG.
- trigger the service update which effect to the service definition for the whole BNG rather than a particular session.

6.2.restriction of ASR9K CoA/PoD implementation

- One CoA/PoD request can only target to one session.
- Before 5.2.0 release, one CoA request can only take one action , multi-action CoA is supported from 5.2.0 release onwards.
- CoA query request is not supported in IOS XR based BNG, although it's supported in IOS based ISG.

6.3.key component in a CoA message

A CoA message initiated from a CoA client normally comprise three kinds of key information.

6.3.1.Session key (mandatory)

The presence of session key or session identifier lets the BNG know against what session an action is needed to take. There are several way to identify a session in a CoA/PoD request， one of following attributes of combination of attributes must be present in PoD/CoA request.

- acct-session-id (IETF attribute 44)
- framed-ip-address (IETF attribute 8) + cisco AVpair vrf-id. vrf-id is not needed when the session is in the default vrf.

- User-Name(IETF atttibute 1）, with the assumption that the user-name is system-widen unique. If there is duplicated username , the CoA request will be dropped.
- framed-ipv6-address or cisco AVpair “addrv6” + cisco AVpair vrf-id. vrf-id is not needed when the session is in the default vrf. the framed-ipv6-address must be /128, this attribute only present for a session using DHCPv6 to assign IA-NA to client.
- framed-ipv6-prefix + cisco AVpair vrf-id not supported at this release due to CSCun94385, it’s in roadmap of 5.2.2 release. When the PPPoE client get a V6 prefix via SLACC, this is the right session key to use.

6.3.2.CoA command(mandatory with some exception)

CoA command indicates what action the CoA request want to take.

CoA command is present as a Cisco AVpair, 5 kind of CoA command are supported at this moment.

Account Logon

Account Logon request is sent from a CoA portal to trigger an account-logon event on the BNG. The account-logon event is generally used by as a signal to authenticate a session. The Account Logon request contains the user credentials that were collected at the portal.

vsa cisco generic 1 string “subscriber:command=account-logon"

Account Logoff

Account logoff request is sent from a CoA portal to remove a session on the BNG. This can be done for administrative reasons, if the user disconnects from a portal.

vsa cisco generic 1 string “subscriber:command=account-logoff”

Service Activate

Service Activate request is sent from a CoA portal to activate a service for the identified session. The parameters include the session identification attributes and name of the service that has to be activated on the session.

vsa cisco generic 1 string “subscriber:command=activate-service"

Service Deactivate

Service Deactivate request is sent from a CoA portal to deactivate a service on a session. The parameters include the session identification attributes and name of the service that has to be activated on the session.

vsa cisco generic 1 string “subscriber:command=deactivate-service"

Account Update

Apart from above listed subscriber commands, BNG supporst configuration change CoA requests, these requests will not have a subscriber command but have attributes that change or apply certain configuration parameters on the BNG. Even though config-change CoA request from the portal won’t have subscriber command attribute, CoA module on the BNG will insert the attribute with “account-update” as the value before handing the request over to command –handler for further processing. Lawful Intercept, Parameterized QoS are some know features that will use config-change CoA requests.

BTW, it works as well if there is a Cisco-avpair=”subscriber:command=account-update” included in the CoA request.

6.3.3.RADIUS attributes (optional)

RADIUS attributes may be included in some CoA request but not all, indicating what the new attributes need to be applied to a session (in case of account-update) or what is the credential information need to provide to BNG for further authentication (in case of account-logon).

6.3.4.session-BNG address mapping

Besides above information carried by the CoA message, an additional thing the CoA client must know is the IP address of the BNG on which the target session is terminated, so that it can use that IP as the destination IP in its IP packet header of CoA request message.

In IOS based ISG, PBHK feature is used to translate the source IP of a subscriber to the BNG address but this feature is not supported by IOS XR based BNG implementation. So other ways are needed to enable the CoA client to realise what's the BNG IP address to send CoA request to- either it maintain a database with mapping information between subscriber and it's BNG, or let the http packet reach out to a CoA client to carry the IP address of the according BNG.

Freeradius software can work as a CoA client, and another cool CoA client developed by Xander Thuijs @cisco is and its user guide is available here https://supportforums.cisco.com/document/64681/using-coa-change-authorization-access-and-bng-platforms)

Following example are collected with using Xander's CoA client.

6.4.PoD (DM) and different session key

Here are some examples of PoD, the various Scenarios also explain how to use different session key for PoD (same to CoA).

6.4.1.Example of a failed POD

Scenario

There is a pppoe session established with acct-session-id 0x0000000e, but we use a wrong acct-session-id (0x0000000d) in the PoD request.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  detail
Fri Jul 18 13:45:27.596 UTC
Interface:               Bundle-Ether101.99.pppoe14
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    PPPoE:PTA
IPv4 State:              Up, Fri Jul 18 13:45:20 2014
IPv4 Address:            1.1.99.13, VRF: default
Mac Address:             3c07.545f.c041
Account-Session Id:      0000000e
```

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -d -k cisco123 -1 44,000
0000d

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using POD with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

POD: NAS did not honour our request! (ID 140)
```

ASR9K show/debug display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh debug
Fri Jul 18 13:47:34.281 UTC

####  debug flags set from tty 'vty0'  ####
radius basic flag is ON


RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 18 13:47:48.046 : radiusd[1117]:
RADIUS: Received from id 176 172.18.88.223, POD Request, len 30
RP/0/RSP0/CPU0:Jul 18 13:47:48.046 : radiusd[1117]:  RADIUS:  authenticator 94 E2
DD 9D F7 8C 5A 99 - CD 8F 5D 97 7D CE 56 88
RP/0/RSP0/CPU0:Jul 18 13:47:48.046 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      0000000d
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS: Send Disconnect Nack
Response to 172.18.88.223 id 176, len 93
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS:  authenticator C6 8C
91 82 DF EA 8D FF - 13 10 02 44 5F D7 57 76
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      0000000d
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    9
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS:  Dynamic-Author-Error-
Cause[101]   6       Session Context Not Found[0]
```

```
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]:  RADIUS:  Reply-Message
[18]    48      No sessions found matching identities provided
RP/0/RSP0/CPU0:Jul 18 13:47:48.048 : radiusd[1117]: Updating last used server
```

Packet capture from wireshark

PoD request packt

```
No.     Time           Source                Destination           Protocol Length Info
   5358 8715.816737000 172.18.88.223         172.18.88.230         RADIUS   72     Disconnect-
Request(40) (id=140, l=30)

Frame 5358: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 31468 (31468), Dst Port: mps-raft (1700)
    Source port: 31468 (31468)
    Destination port: mps-raft (1700)
    Length: 38
    Checksum: 0x1bca [validation disabled]
Radius Protocol
    Code: Disconnect-Request (40)
    Packet identifier: 0x8c (140)
    Length: 30
    Authenticator: 38d643fb4b291c2499d8bc789f216922
    [The response to this request is in frame 5359]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 0000000d
```

PoD NAK packet

```
No.     Time           Source                Destination           Protocol Length Info
   5359 8715.822643000 172.18.88.230         172.18.88.223         RADIUS   135    Disconnect-
NAK(42) (id=140, l=93)

Frame 5359: 135 bytes on wire (1080 bits), 135 bytes captured (1080 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 31468 (31468)
    Source port: mps-raft (1700)
    Destination port: 31468 (31468)
    Length: 101
    Checksum: 0xdaea [validation disabled]
Radius Protocol
    Code: Disconnect-NAK (42)
    Packet identifier: 0x8c (140)
    Length: 93
    Authenticator: 4eed8a0c9ffbe62602fb07d98bac1e9f
    [This is a response to a request in frame 5358]
    [Time from request: 0.005906000 seconds]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 0000000d
            Acct-Session-Id: 0000000d
        AVP: l=9  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=3 t=Cisco-Command-Code(252): X
                Cisco-Command-Code: X
        AVP: l=6  t=Error-Cause(101): Session-Context-Not-Found(503)
            Error-Cause: Session-Context-Not-Found (503)
        AVP: l=48  t=Reply-Message(18): No sessions found matching identities provided
            Reply-Message: No sessions found matching identities provided
```

Note

- Acct-session-id here is used as a session key and it's the only attribute needed in the CoA request in this case. alternatively, you can use framed-ip-address plus AVpair vrf-id as session key.
- Note this is a PoD (code 40), rather than a CoA request, although CoA "account-logoff" command can also be used to disconnect a session.
- When BNG fails to take the action requested by the PoD, IETF attribute "Erroe-Cause"(101) and "reply-message" (18) are included in the PoD NAK message to inform the CoA client the reason of failure. the string in those two attributes are predefined in the code, not configurable.

6.4.2.Example of PoD using acct-session-id as session key

Scenario

There is a pppoe session established with acct-session-id 0x0000000e, a PoD request with correct acct-session-id is sent to BNG to disconnect the session.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  detail
Fri Jul 18 13:45:27.596 UTC
Interface:                Bundle-Ether101.99.pppoe14
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Fri Jul 18 13:45:20 2014
IPv4 Address:             1.1.99.13, VRF: default
Mac Address:              3c07.545f.c041
Account-Session Id:       0000000e
```

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -d -k cisco123 -1 44,000
0000e

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using POD with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

POD: Request was accepted! (ID 196)
```

ASR9K show/debug display

```
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 18 14:08:27.153 : radiusd[1117]:
RADIUS: Received from id 196 172.18.88.223, POD Request, len 30
RP/0/RSP0/CPU0:Jul 18 14:08:27.153 : radiusd[1117]:  RADIUS:  authenticator 81 9A
44 25 4B 77 C3 E9 - E4 48 57 29 1F 61 3C 82
RP/0/RSP0/CPU0:Jul 18 14:08:27.153 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      0000000e
RP/0/RSP0/CPU0:Jul 18 14:08:27.481 : radiusd[1117]:  RADIUS: Send Disconnect Ack
Response to 172.18.88.223 id 196, len 20
RP/0/RSP0/CPU0:Jul 18 14:08:27.481 : radiusd[1117]:  RADIUS:  authenticator 58 3A
C7 9F 61 11 D3 12 - 3B D3 65 12 87 11 DF B6
RP/0/RSP0/CPU0:Jul 18 14:08:27.482 : radiusd[1117]: Updating last used server



RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  disconnect-history  unique
Fri Jul 18 14:14:14.681 UTC

[ IEDGE DISCONNECT HISTORY UNIQUE EVENTS ]

 Location: 0/RSP0/CPU0

Disconnect Reason:        CoA Session-Disconnect
Disconnect Cause:         AAA_DISC_CAUSE_SESSION_DISC (1)
Abort Cause:              AAA_AV_ABORT_CAUSE_RADIUS_DISC (51)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_ADMIN_RESET (6)
Disconnect Count:         3
Last Time Disconnected:   2014:07:18 14:08:27
Client:                   [iEdge internal]
Last Subscriber Label:    0x0000004d
Last Interface:           BE101.99.pppoe14

[ Last Session Info ]

Interface:                Unknown
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Fri Jul 18 13:45:20 2014
IPv4 Address:             1.1.99.13, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Down, Fri Jul 18 13:45:16 2014
Mac Address:              3c07.545f.c041
Account-Session Id:       0000000e
Nas-Port:                 1694524686
User name:                PPP3@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x0000004d
Created:                  Fri Jul 18 13:45:16 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x000016e0
Session History ID:       1
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Fri Jul 18 13:45:16 2014]
```

```
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Fri Jul 18 13:45:20 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
[cerr: No error][aaa: Success]
      30 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Fri Jul 18 14:08:27 2014
COA Request  Attribute List: 0x50100ea8
1:  command         len= 19  value= session-disconnect <- there is no any
AVpair="Command=session-disconnct" included in the PoD request, the reason you find
this line displayed here is that this is the internal AAA attributes rather than a
radius attribute, when a PoD request is received, AAA code interpret it as there is
a AAA attribute of command ="session-disconnect", "debug aaa-subs all" can show you
what happened.


Last COA response: Result NACK
CoA response Attribute List: None
User Profile received from AAA:
 Attribute List: 0x501010b8
1:  service-type    len=  4  value= Framed
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : S99_SERVICE_2
  Service-ID  : 0x400002a
  Type        : Multi Template
  Status      : Applied
-------------------------
  Name        : DOWNLOADING_SERVICE_1
  Service-ID  : 0x4000086
  Type        : Profile
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005a
  Type        : Template
  Status      : Applied
-------------------------
[Last IPv6 down]
Disconnect Reason:
Disconnect Cause:         AAA_DISC_CAUSE_SESSION_DISC (1)
Abort Cause:              AAA_AV_ABORT_CAUSE_NO_REASON (0)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_NONE (0)
Disconnect called by:     [iEdge internal]
[Event History]
   Jul 18 13:45:20.256 SUBDB produce done [many]
   Jul 18 13:45:20.256 IPv4 Up
   Jul 18 14:08:27.136 CoA request
```

Packet capture from wireshark

PoD request packet

```
No.     Time           Source                Destination           Protocol Length Info
   6304 9929.047017000 172.18.88.223         172.18.88.230         RADIUS   72     Disconnect-
Request(40) (id=196, l=30)

Frame 6304: 72 bytes on wire (576 bits), 72 bytes captured (576 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30048 (30048), Dst Port: mps-raft (1700)
    Source port: 30048 (30048)
    Destination port: mps-raft (1700)
    Length: 38
    Checksum: 0xf75a [validation disabled]
Radius Protocol
    Code: Disconnect-Request (40)
    Packet identifier: 0xc4 (196)
    Length: 30
    Authenticator: 819a44254b77c3e9e44857291f613c82
    [The response to this request is in frame 6307]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 0000000e
            Acct-Session-Id: 0000000e
```

PoD ACK packet

```
No.     Time           Source                Destination           Protocol Length Info
   6307 9929.377922000 172.18.88.230         172.18.88.223         RADIUS   62     Disconnect-
ACK(41) (id=196, l=20)

Frame 6307: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 30048 (30048)
    Source port: mps-raft (1700)
    Destination port: 30048 (30048)
    Length: 28
    Checksum: 0xf442 [validation disabled]
Radius Protocol
    Code: Disconnect-ACK (41)
    Packet identifier: 0xc4 (196)
    Length: 20
    Authenticator: 583ac79f6111d3123bd365128711dfb6
    [This is a response to a request in frame 6304]
    [Time from request: 0.330905000 seconds]
```

Note

- there is not any attributes included in a PoD ACK message.

6.4.3.Example of PoD using framed-ip-address as session key

Scenario

Use IETF attribute framed-ip-address (8) as session key to send PoD to disconnect a session.

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -d -k cisco123 -1 8,IP1.
1.99.14

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using POD with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

POD: Request was accepted! (ID 5)

C:\COA\coa_w32.exe>
```

ASR9K debug/show display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh debug
Fri Jul 18 15:00:07.950 UTC

####  debug flags set from tty 'vty0'  ####
radius basic flag is ON
aaabase all flag is ON

RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]:  RADIUS: Received
from id 5 172.18.88.223, POD Request, len 26
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]:  RADIUS:  authenticator 54 CB DD AA 3D 7F
41 80 - 66 CE FE 13 07 E1 02 6C
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]:  RADIUS:  Framed-IP-Address   [8]     6
1.1.99.14
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 5013cd5c, 5005f17c
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_request_init: Setting the req param for req type 1073735768
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_context: Setting the context structure for the aaa req
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_callback: Setting the callback function for the req
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]   Attribute List --   1:
addr            len=  4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.14  2:  co
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_send:
Sending the req request from Client to Server
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_api: AAA Base Server Pulse handler-Received 10 msg type
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:20
RP/0/RSP0/CPU0:Jul 18 14:57:51.905 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: Added req in hash table id 28
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: First Server group selected
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x5005f2d0
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:generic]  1:  addr
len=  4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.14
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:generic]  2:  command
len= 18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
```

```
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 10
Application id 1
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_send:
sent msg ipc_send passed buf_len: 128
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 10 App type 1 id 28
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 50c876a4, 50d60e8c
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c87be4
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic]  1:  addr            len=
4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.14
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic]  2:  command         len=
18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:22
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 14:57:51.906 : iedged[246]: [AAA_BASE:fsm]  aaa_base_handle_aaa_msg:
Invoking call back function for app type 1
RP/0/RSP0/CPU0:Jul 18 14:57:52.108 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 14:57:52.108 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 128
RP/0/RSP0/CPU0:Jul 18 14:57:52.261 : iedged[246]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 14:57:52.261 : iedged[246]: [AAA_BASE:client]   Attribute List --
RP/0/RSP0/CPU0:Jul 18 14:57:52.261 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_api:
AAA Base Server Pulse handler-Received 11 msg type
RP/0/RSP0/CPU0:Jul 18 14:57:52.261 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_received: FSM State: G RECEIVED Event:21
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c87be4
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_send: sent
msg ipc_send passed buf_len: 37
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : iedged[246]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 50c876a4, 50d60e8c
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_handle_aaa_base_msg: Received IPC message Type 11 App type 1
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:error]
aaa_base_aipc_handle_aaa_base_msg: req_handle is successfully removed from hash table. id 28
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x5005f2d0
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: FSM State: G SENT Event:23
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: Received PASS status
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 5013cd5c, 5005f17c
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]:  RADIUS: Send Disconnect Ack Response to
172.18.88.223 id 5, len 20
RP/0/RSP0/CPU0:Jul 18 14:57:52.262 : radiusd[1117]:  RADIUS:  authenticator 52 E1 7F 9E 4E 28
89 4F - 6B 95 68 51 51 87 57 04
RP/0/RSP0/CPU0:Jul 18 14:57:52.263 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 18 14:57:52.464 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 14:57:52.464 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 37
```

Packet capture from Wireshark

PoD request packet

```
No.     Time           Source                Destination           Protocol Length Info
```

```
   8418 12893.756324000 172.18.88.223         172.18.88.230         RADIUS   68
Disconnect-Request(40) (id=5, l=26)

Frame 8418: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30337 (30337), Dst Port: mps-raft (1700)
    Source port: 30337 (30337)
    Destination port: mps-raft (1700)
    Length: 34
    Checksum: 0xc3c0 [validation disabled]
Radius Protocol
    Code: Disconnect-Request (40)
    Packet identifier: 0x5 (5)
    Length: 26
    Authenticator: 54cbddaa3d7f418066cefe1307e1026c
    [The response to this request is in frame 8421]
    Attribute Value Pairs
        AVP: l=6  t=Framed-IP-Address(8): 1.1.99.14
```

6.4.4.Example of PoD using framed-ip-address plus AVPair vrf-id as session key

Scenario

when the session is in a non-default vrf, Use IETF attribute framed-ip-address (8) plus cisco AVpair vrf-id as session key to send PoD to disconnect a session.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de
Fri Jul 18 15:42:46.820 UTC
Interface:                Bundle-Ether101.99.pppoe17
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Fri Jul 18 15:42:38 2014
IPv4 Address:             1.1.99.2, VRF: S99_VRF
Mac Address:              3c07.545f.c041
Account-Session Id:       00000011
```

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -d -k cisco123 -1 8,IP1.
1.99.2 -2 26,9,1,"vrf-id=S99_VRF"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using POD with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)
```

```
POD: Request was accepted! (ID 80)
```

ASR9K debug/show display

```
####  debug flags set from tty 'vty0'  ####
radius basic flag is ON
aaabase all flag is ON


RP/0/RSP0/CPU0:Roy_BNG_1#ter moni
Fri Jul 18 15:43:39.152 UTC
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 18 15:43:41.497 : radiusd[1117]:  RADIUS: Received
from id 180 172.18.88.223, POD Request, len 48
RP/0/RSP0/CPU0:Jul 18 15:43:41.497 : radiusd[1117]:  RADIUS:  authenticator 08 F4 EF 19 05 79
6F 32 - 87 07 2A D6 81 5B 78 68
RP/0/RSP0/CPU0:Jul 18 15:43:41.497 : radiusd[1117]:  RADIUS:  Framed-IP-Address   [8]     6
1.1.99.2
RP/0/RSP0/CPU0:Jul 18 15:43:41.497 : radiusd[1117]:  RADIUS:   Vendor-Specific    [26]    22
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: vrfnametoidlookup for vrf S99_VRF - No
error
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_request_init: Setting the req param for req type 1073735768
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_context: Setting the context structure for the aaa req
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_callback: Setting the callback function for the req
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 5013cd5c, 5005f17c
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]   Attribute List --   1:
addr            len=  4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.2  2:  vrf
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_send:
Sending the req request from Client to Server
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:20
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: Added req in hash table id 30
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: First Server group selected
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x5005f2d0
RP/0/RSP0/CPU0:Jul 18 15:43:41.498 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_api: AAA Base Server Pulse handler-Received 10 msg type
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic]  1:  addr
len=  4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.2
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic]  2:  vrf-id
len=  4  svc<0> prot<0> tag<0> mand<1> client<0x0>1610612753(60000011)
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic]  4:  command
len= 18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 10
Application id 1
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic]  3:  ip-vrf
len=  7  svc<0> prot<0> tag<0> mand<1> client<0x0>S99_VRF
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 10 App type 1 id 30
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 50c876a4, 50d60e8c
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_send:
sent msg ipc_send passed buf_len: 172
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:generic]  1:  addr            len=
4  svc<0> prot<0> tag<0> mand<0> client<0x0>1.1.99.2
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:generic]  2:  vrf-id          len=
4  svc<0> prot<0> tag<0> mand<1> client<0x0>1610612753(60000011)
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:generic]  3:  ip-vrf          len=
7  svc<0> prot<0> tag<0> mand<1> client<0x0>S99_VRF
RP/0/RSP0/CPU0:Jul 18 15:43:41.499 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c87be4
RP/0/RSP0/CPU0:Jul 18 15:43:41.500 : iedged[246]: [AAA_BASE:generic]  4:  command         len=
18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
RP/0/RSP0/CPU0:Jul 18 15:43:41.500 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:22
RP/0/RSP0/CPU0:Jul 18 15:43:41.500 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
```

```
RP/0/RSP0/CPU0:Jul 18 15:43:41.500 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 15:43:41.500 : iedged[246]: [AAA_BASE:fsm]  aaa_base_handle_aaa_msg:
Invoking call back function for app type 1
RP/0/RSP0/CPU0:Jul 18 15:43:41.701 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 15:43:41.701 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 172
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:client]   Attribute List --
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_api:
AAA Base Server Pulse handler-Received 11 msg type
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_received: FSM State: G RECEIVED Event:21
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c87be4
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_send: sent
msg ipc_send passed buf_len: 37
RP/0/RSP0/CPU0:Jul 18 15:43:42.042 : iedged[246]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 50c876a4, 50d60e8c
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_handle_aaa_base_msg: Received IPC message Type 11 App type 1
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:error]
aaa_base_aipc_handle_aaa_base_msg: req_handle is successfully removed from hash table. id 30
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x5005f2d0
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: FSM State: G SENT Event:23
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: Received PASS status
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 5013cd5c, 5005f17c
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]:  RADIUS: Send Disconnect Ack Response to
172.18.88.223 id 180, len 20
RP/0/RSP0/CPU0:Jul 18 15:43:42.043 : radiusd[1117]:  RADIUS:  authenticator 84 10 5D 88 6E 3A
3A 3B - 26 B0 9A D4 0A 68 C5 5B
RP/0/RSP0/CPU0:Jul 18 15:43:42.044 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 18 15:43:42.245 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 15:43:42.245 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 37
```

Packet capture from Wireshark

PoD request packet

```
No.     Time           Source                Destination           Protocol Length Info
  10199 15643.309185000 172.18.88.223         172.18.88.230         RADIUS   90
Disconnect-Request(40) (id=180, l=48)

Frame 10199: 90 bytes on wire (720 bits), 90 bytes captured (720 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30768 (30768), Dst Port: mps-raft (1700)
    Source port: 30768 (30768)
    Destination port: mps-raft (1700)
    Length: 56
    Checksum: 0x401a [validation disabled]
Radius Protocol
    Code: Disconnect-Request (40)
    Packet identifier: 0xb4 (180)
    Length: 48
    Authenticator: 08f4ef1905796f3287072ad6815b7868
    [The response to this request is in frame 10202]
    Attribute Value Pairs
        AVP: l=6  t=Framed-IP-Address(8): 1.1.99.2
```

```
        AVP: l=22  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=16 t=Cisco-AVPair(1): vrf-id=S99_VRF
```

Note

-The reason that VRF is needed is to handle the situation with IP address overlapping among VRFs.

-When the session is in default vrf, no need to include vrf-id

-When use acct-session-id as session key , even the session is in a non-default vrf, the vrf-id is not needed since the acct-session-id is a system-widen unique value.

-vrf-id + framed-ip-address as session key even works for a dual stack session.

6.4.5.Example of PoD using username as session key

Scenario

Use IETF attribute User-Name (1) as session key to send PoD to disconnect a session -even a dual stack session.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  ses all  de
Fri Jul 18 16:15:50.751 UTC
Interface:                Bundle-Ether101.99.pppoe18
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Fri Jul 18 15:54:56 2014
IPv4 Address:             1.1.99.15, VRF: default
IPv6 State:               Up, Fri Jul 18 15:54:56 2014
Framed IPv6 Prefix:       20:1:1::/64, VRF: default
IPv6 Interface ID:        >.T.._.A (3e 07 54 ff fe 5f c0 41)
Mac Address:              3c07.545f.c041
Account-Session Id:       00000012
Nas-Port:                 1694524690
User name:                V6PPP4@S99
```

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -d -k cisco123 -1 1,V6PP
P4@S99

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using POD with :
NAS: ac1258e6
Port: 1700
```

```
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

POD: Request was accepted! (ID 242)
```

ASR9K debug/show display

```
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]:  RADIUS: Received from id 242
172.18.88.223, POD Request, len 32
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]:  RADIUS:  authenticator 80 5D 63 EF E5 97
A3 CC - E6 4F E9 0C AD 1F D7 93
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 50147898, 50147dd8
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]:  RADIUS:  User-Name           [1]     12
V6PPP4@S99
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_request_init: Setting the req param for req type 1073735768
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_context: Setting the context structure for the aaa req
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_callback: Setting the callback function for the req
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]   Attribute List --   1:
username        len= 10  svc<0> prot<0> tag<0> mand<0> client<0x0>V6PPP4@S99  2:  c
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_send:
Sending the req request from Client to Server
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_api: AAA Base Server Pulse handler-Received 10 msg type
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:20
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: Added req in hash table id 3
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: First Server group selected
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x50147f2c
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:generic]  1:  username
len= 10  svc<0> prot<0> tag<0> mand<0> client<0x0>V6PPP4@S99
RP/0/RSP0/CPU0:Jul 18 16:17:22.138 : radiusd[1117]: [AAA_BASE:generic]  2:  command
len= 18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 10
Application id 1
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 10 App type 1 id 3
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : radiusd[1117]: [AAA_BASE:generic] aaa_base_aipc_send:
sent msg ipc_send passed buf_len: 135
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c89534
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic]  1:  username        len=
10  svc<0> prot<0> tag<0> mand<0> client<0x0>V6PPP4@S99
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic]  2:  command         len=
18  svc<0> prot<38> tag<0> mand<1> client<0x0>session-disconnect
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:22
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 50adc308, 50d80e80
RP/0/RSP0/CPU0:Jul 18 16:17:22.139 : iedged[246]: [AAA_BASE:fsm]  aaa_base_handle_aaa_msg:
Invoking call back function for app type 1
RP/0/RSP0/CPU0:Jul 18 16:17:22.341 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 16:17:22.341 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 135
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:client]   Attribute List --
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:generic]  aaa_base_handle_aaa_api:
AAA Base Server Pulse handler-Received 11 msg type
```

```
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_received: FSM State: G RECEIVED Event:21
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:generic] Attribute List:
0x50c89534
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 50adc308, 50d80e80
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_handle_aaa_base_msg: Received IPC message Type 11 App type 1
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:error]
aaa_base_aipc_handle_aaa_base_msg: req_handle is successfully removed from hash table. id 3
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:generic] Attribute List:
0x50147688
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: FSM State: G SENT Event:23
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: Received PASS status
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]: [AAA_BASE:client]  aaa_base_req_free:
Freeing the aaa base req structure 50147898, 50147dd8
RP/0/RSP0/CPU0:Jul 18 16:17:22.600 : iedged[246]: [AAA_BASE:generic] aaa_base_aipc_send: sent
msg ipc_send passed buf_len: 37
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]:  RADIUS:  authenticator DE 49 30 D6 0D 15
69 AB - C0 83 6C CD 9A B6 6A CA
RP/0/RSP0/CPU0:Jul 18 16:17:22.601 : radiusd[1117]:  RADIUS: Send Disconnect Ack Response to
172.18.88.223 id 242, len 20
RP/0/RSP0/CPU0:Jul 18 16:17:22.602 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 18 16:17:22.803 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec94e9dc
RP/0/RSP0/CPU0:Jul 18 16:17:22.803 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success msg_len= 37
```

Packet capture from Wireshark

PoD request packet

```
No.     Time           Source                Destination           Protocol Length Info
  11895 17663.920466000 172.18.88.223         172.18.88.230         RADIUS   74
Disconnect-Request(40) (id=242, l=32)

Frame 11895: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 31347 (31347), Dst Port: mps-raft (1700)
    Source port: 31347 (31347)
    Destination port: mps-raft (1700)
    Length: 40
    Checksum: 0x1875 [validation disabled]
Radius Protocol
    Code: Disconnect-Request (40)
    Packet identifier: 0xf2 (242)
    Length: 32
    Authenticator: 805d63efe597a3cce64fe90cad1fd793
    [The response to this request is in frame 11899]
    Attribute Value Pairs
        AVP: l=12  t=User-Name(1): V6PPP4@S99
```

Note

-It works for both V4 and V6 session and Dual stack session.

-No matter what vrf the session is in , no need to include vrf-id

-Be aware of the risk that in some deployment user-name is not unique system widen, in this case a PoD/CoA with user-name as session key will not be processed and NAK will be sent to the client, see following example.

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  session  all username
Fri Jul 18 16:32:37.721 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     User name

------------------------------------------------------------------------------
PPPoE:PTA    BE101.99.pppoe20         AC        PPP6@S99
PPPoE:PTA    BE101.99.pppoe21         AC        PPP6@S99


RP/0/RSP0/CPU0:Roy_BNG_1#debug radius
Fri Jul 18 16:34:28.732 UTC
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 18 16:34:41.458 : radiusd[1117]:
RADIUS: Received from id 150 172.18.88.223, POD Request, len 30
RP/0/RSP0/CPU0:Jul 18 16:34:41.458 : radiusd[1117]:  RADIUS:  authenticator 1F D4
9C E7 00 B0 AE D8 - 6C 71 FD 40 59 D7 D3 9C
RP/0/RSP0/CPU0:Jul 18 16:34:41.458 : radiusd[1117]:  RADIUS:  User-Name
[1]     10      PPP6@S99
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS: Send Disconnect Nack
Response to 172.18.88.223 id 150, len 99
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS:  authenticator 5F 86
03 4D 70 40 85 54 - 48 7F A1 48 5B D9 E7 37
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS:  User-Name
[1]     10      PPP6@S99
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    9
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS:  Dynamic-Author-Error-
Cause[101]   6       Session Context Not Found[0]
RP/0/RSP0/CPU0:Jul 18 16:34:41.459 : radiusd[1117]:  RADIUS:  Reply-Message
[18]    54      Multiple sessions found matching identities provided
RP/0/RSP0/CPU0:Jul 18 16:34:41.460 : radiusd[1117]: Updating last used server

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  session  all username
Fri Jul 18 16:34:51.899 UTC
Codes: IN - Initialize, CN - Connecting, CD - Connected, AC - Activated,
       ID - Idle, DN - Disconnecting, ED - End

Type         Interface                State     User name

------------------------------------------------------------------------------
PPPoE:PTA    BE101.99.pppoe20         AC        PPP6@S99
PPPoE:PTA    BE101.99.pppoe21         AC        PPP6@S99

RP/0/RSP0/CPU0:Roy_BNG_1#
```

6.5.Account-logoff

Here are some examples of CoA account-logoff, BNG disconnect a session on the reception of a CoA account-logoff request as it does on the reception of a PoD request.

6.5.1.Example of basic CoA account-logoff

Scenario

There is a pppoe session established with acct-session-id 0x00000001 and use cisco AVPair “command=account-logoff” to disconnect it, watching the difference comparing to PoD. Note, no event of account-logoff is configured in the configure of the control policy.

```
policy-map type control subscriber S99_CP_PTA_SERVICE_DOWNLOAD
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
   30 activate dynamic-template S99_DT_PTA_MIN
```

CoA client command

```
C:\COA\coa_w32.exe>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,000000
01 -2 26,9,1,"command=account-logoff"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 1)
```

ASR9K show/debug display

```
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]:
RADIUS: Received from id 1 172.18.88.223, CoA Request, len 60
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]:  RADIUS:  authenticator 5D FA
06 05 A1 03 57 13 - B1 14 C6 0E 41 C6 CB E2
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      00000001
```

```
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    30
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 5013cdb4, 5013ab58
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_request_init: Setting the req param for req type 1073735768
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_context: Setting the context structure for the aaa req
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_set_callback: Setting the callback function for the req
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]   Attribute
List --   1:  string-session-id len=  8  svc<0> prot<0> tag<0> mand<0>
client<0x0>00000001  2:  c
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_send: Sending the req request from Client to Server
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_api: AAA Base Server Pulse handler-Received 10 msg type
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:20
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: Added req in hash table id 5
RP/0/RSP0/CPU0:Jul 21 14:42:33.769 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: First Server group selected
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : radiusd[1117]: [AAA_BASE:generic] Attribute
List: 0x5013acac
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : radiusd[1117]: [AAA_BASE:generic]  1:  string-
session-id len=  8  svc<0> prot<0> tag<0> mand<0> client<0x0>00000001
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : radiusd[1117]: [AAA_BASE:generic]  2:  command
len= 14  svc<0> prot<0> tag<0> mand<1> client<0x0>account-logoff
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_marshall_aaa_base_req_request_parameters: Marshalling req Message type 10
Application id 1
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_send: sent msg ipc_send passed buf_len: 129
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_handle_protocol_base_msg: Received IPC message Type 10 App type 1 id
5
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:client]
aaa_base_req_alloc:Allocated aaa base req structure 50d564fc, 50dace4c
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic] Attribute
List: 0x50d2a134
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic]  1:  string-
session-id len=  8  svc<0> prot<0> tag<0> mand<0> client<0x0>00000001
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic]  2:  command
len= 14  svc<0> prot<0> tag<0> mand<1> client<0x0>account-logoff
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_init: FSM State: INIT Event:22
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 21 14:42:33.770 : iedged[246]: [AAA_BASE:fsm]
aaa_base_handle_aaa_msg: Invoking call back function for app type 1
RP/0/RSP0/CPU0:Jul 21 14:42:33.978 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec7139dc
RP/0/RSP0/CPU0:Jul 21 14:42:33.978 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success
msg_len= 129
RP/0/RSP0/CPU0:Jul 21 14:42:34.045 : iedged[246]: [AAA_BASE:client]
aaa_base_req_add_attr_list: Setting the attribute list for the req
```

```
RP/0/RSP0/CPU0:Jul 21 14:42:34.045 : iedged[246]: [AAA_BASE:client]   Attribute
List --
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : iedged[246]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_received: FSM State: G RECEIVED Event:21
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : iedged[246]: [AAA_BASE:generic] Attribute
List: 0x50d2a134
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_send: sent msg ipc_send passed buf_len: 37
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : iedged[246]: [AAA_BASE:client]
aaa_base_req_free: Freeing the aaa base req structure 50d564fc, 50dace4c
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_aipc_handle_aaa_base_msg: Received IPC message Type 11 App type 1
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:error]
aaa_base_aipc_handle_aaa_base_msg: req_handle is successfully removed from hash
table. id 5
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:generic] Attribute
List: 0x5013a948
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: FSM State: G SENT Event:23
RP/0/RSP0/CPU0:Jul 21 14:42:34.045 : iedged[246]: [AAA_BASE:generic]
aaa_base_handle_aaa_api: AAA Base Server Pulse handler-Received 11 msg type
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:fsm]
aaa_base_req_handle_fsm_state_g_sent: Received PASS status
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:AAA Base Client Handler...
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:generic]
aaa_base_handle_aaa_msg:Calling client call back function
RP/0/RSP0/CPU0:Jul 21 14:42:34.046 : radiusd[1117]: [AAA_BASE:client]
aaa_base_req_free: Freeing the aaa base req structure 5013cdb4, 5013ab58
RP/0/RSP0/CPU0:Jul 21 14:42:34.047 : radiusd[1117]:  RADIUS: Send CoA Ack Response
to 172.18.88.223 id 1, len 20
RP/0/RSP0/CPU0:Jul 21 14:42:34.047 : radiusd[1117]:  RADIUS:  authenticator FB 9F
14 C3 20 C7 98 C0 - E3 6E 32 E9 20 CD 07 83
RP/0/RSP0/CPU0:Jul 21 14:42:34.047 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 21 14:42:34.248 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler client context:  ec7139dc
RP/0/RSP0/CPU0:Jul 21 14:42:34.248 : iedged[246]: [AAA_BASE:generic]
aaa_base_aipc_client_handler: IPC_NOTIFY_SENDSTATUS ipc_release_buffer success
msg_len= 37

RP/0/RSP0/CPU0:Roy_BNG_1#sh debug
Mon Jul 21 14:43:06.261 UTC

####  debug flags set from tty 'vty0'  ####
radius basic flag is ON
aaabase all flag is ON


RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  disconnect-history  unique
summary
Mon Jul 21 14:49:15.264 UTC

[ IEDGE DISCONNECT HISTORY UNIQUE EVENTS ]

 Location: 0/RSP0/CPU0

Count  Last Interface          Last Time Disconnected  Disconnect reason
=====  ==============         ======================  =================

1      BE101.99.pppoe1         2014:07:21 14:42:33     Subscriber disconnect on
                                                       Account-Logoff policy
                                                       event, DC: 3 AC: 52 TC:
```

```
                                                        6

 Location: 0/0/CPU0

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  disconnect-history  unique
Mon Jul 21 14:49:21.384 UTC

[ IEDGE DISCONNECT HISTORY UNIQUE EVENTS ]

 Location: 0/RSP0/CPU0

Disconnect Reason:          Subscriber disconnect on Account-Logoff policy event
Disconnect Cause:           AAA_DISC_CAUSE_ACC_LOGOFF (3)
Abort Cause:                AAA_AV_ABORT_CAUSE_LOCAL_ADMIN_DISC (52)
Terminate Cause:            AAA_AV_TERMINATE_CAUSE_ADMIN_RESET (6)
Disconnect Count:           1
Last Time Disconnected:     2014:07:21 14:42:33
Client:                     [iEdge internal]
Last Subscriber Label:      0x00000040
Last Interface:             BE101.99.pppoe1

[ Last Session Info ]

Interface:                  Unknown
Circuit ID:                 Unknown
Remote ID:                  Unknown
Type:                       PPPoE:PTA
IPv4 State:                 Up, Mon Jul 21 14:30:21 2014
IPv4 Address:               1.1.99.1, VRF: default
IPv4 Up helpers:            0x00000020 {PPP}
IPv4 Up requestors:         0x00000020 {PPP}
IPv6 State:                 Up, Mon Jul 21 14:30:21 2014
IPv6 Interface ID:          >.T.._.A (3e 07 54 ff fe 5f c0 41)
IPv6 Up helpers:            0x00100020 {PPP,ND}
IPv6 Up requestors:         0x00100020 {PPP,ND}
Mac Address:                3c07.545f.c041
Account-Session Id:         00000001
Nas-Port:                   1694524673
User name:                  V6PPP9@S99
Outer VLAN ID:              101
Inner VLAN ID:              99
Subscriber Label:           0x00000040
Created:                    Mon Jul 21 14:30:21 2014
State:                      Activated
Authentication:             authenticated
Authorization:              unauthorized
Ifhandle:                   0x000013a0
Session History ID:         1
Access-interface:           Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Mon Jul 21 14:30:21 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Mon Jul 21 14:30:21 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
[cerr: No error][aaa: Success]
      30 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Mon Jul 21 14:42:33 2014
```

```
COA Request  Attribute List: 0x500fe4bc
1:  command          len= 15  value= account-logoff<—different to the PoD
Last COA response: Result ACK
COA Response  Attribute List: 0x500fe6cc
User Profile received from AAA:
 Attribute List: 0x500fe8dc
1:  ipv6-enable     len=  4  value= 1(1)
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : DOWNLOADING_SERVICE_1
  Service-ID  : 0x4000087
  Type        : Profile
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005b
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul 21 14:30:21.696 SUBDB produce done [many]
   Jul 21 14:30:21.696 IPv4 Up
   Jul 21 14:30:21.696 IPv6 Up [many]
   Jul 21 14:42:33.728 CoA request [many]

 Location: 0/0/CPU0
```

Packet capture from wireshark

PoD request packt

```
No.     Time           Source                Destination           Protocol Length Info
 111610 271171.686994000 172.18.88.223         172.18.88.230         RADIUS   102    CoA-
Request(43) (id=1, l=60)

Frame 111610: 102 bytes on wire (816 bits), 102 bytes captured (816 bits) on interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30286 (30286), Dst Port: mps-raft (1700)
    Source port: 30286 (30286)
    Destination port: mps-raft (1700)
    Length: 68
    Checksum: 0xe521 [validation disabled]
Radius Protocol
    Code: CoA-Request (43)
    Packet identifier: 0x1 (1)
    Length: 60
    Authenticator: 5dfa0605a1035713b114c60e41c6cbe2
    [The response to this request is in frame 111614]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 00000001
            Acct-Session-Id: 00000001
        AVP: l=30  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=24 t=Cisco-AVPair(1): command=account-logoff
```

CoA ACK packet

```
No.     Time           Source                Destination           Protocol Length Info
 111614 271171.966868000 172.18.88.230         172.18.88.223         RADIUS   62     CoA-
ACK(44) (id=1, l=20)

Frame 111614: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 30286 (30286)
    Source port: mps-raft (1700)
    Destination port: 30286 (30286)
    Length: 28
    Checksum: 0x4431 [validation disabled]
Radius Protocol
    Code: CoA-ACK (44)
    Packet identifier: 0x1 (1)
    Length: 20
    Authenticator: fb9f14c320c798c0e36e32e920cd0783
    [This is a response to a request in frame 111610]
    [Time from request: 0.279874000 seconds]
```

Note

- Acct-session-id here is used as a session key, alternatively, you can use framed-ip-address plus AVpair vrf-id as session key or User-Name
- the Cisco AVPair “command=account-logoff” is also included in the CoA request, which is equivalent to “subscriber:command=account-logoff”.
- Note this is a CoA request (code 43), rather than a PoD request.
- When an account-logoff command is received, if their is no action configured in a “policy-map type control subscriber XXX event account-logoff”, the session will be disconnected immediately.

6.5.1.Example of CoA account-logoff with explicit actions in control policy

Scenario

There is a pppoe session established , and there is an event of account-logoff configured with action of activating a service. In this case, when a account-logoff request is received(same as the request message used in previous scenario) , the session is not disconnected, instead, the service is activated as expected, and the session is mark as “unauthentiacated”.

```
policy-map type control subscriber S99_CP_PTA_SERVICE_DOWNLOAD
```

```
 event session-start match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template S99_DT_LCP
  !
 !
 event session-activate match-first
  class type control subscriber S99_PTA do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
   30 activate dynamic-template S99_DT_PTA_MIN
  !
 !
 event account-logoff match-first
  class type control subscriber S99_PTA do-until-failure
   10 activate dynamic-template HTTPRDRT_TPL_1
  !
 !
 end-policy-map
```

ASR9K show/debug display

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Mon Jul 21 15:08:12.320 UTC
Interface:                Bundle-Ether101.99.pppoe2
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     PPPoE:PTA
IPv4 State:               Up, Mon Jul 21 15:07:44 2014
IPv4 Address:             1.1.99.2, VRF: default
IPv4 Up helpers:          0x00000020 {PPP}
IPv4 Up requestors:       0x00000020 {PPP}
IPv6 State:               Up, Mon Jul 21 15:07:44 2014
IPv6 Interface ID:        >.T.._.A (3e 07 54 ff fe 5f c0 41)
IPv6 Up helpers:          0x00100020 {PPP,ND}
IPv6 Up requestors:       0x00100020 {PPP,ND}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000002
Nas-Port:                 1694524674
User name:                V6PPP9@S99
Outer VLAN ID:            101
Inner VLAN ID:            99
Subscriber Label:         0x00000041
Created:                  Mon Jul 21 15:07:41 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            unauthorized
Ifhandle:                 0x000013e0
Session History ID:       2
Access-interface:         Bundle-Ether101.99
Policy Executed:

  event Session-Start match-first [at Mon Jul 21 15:07:41 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_LCP [cerr: No error][aaa: Success]
  event Session-Activate match-first [at Mon Jul 21 15:07:44 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 activate dynamic-template DOWNLOADING_SERVICE_1 aaa list S99_AAA_list
[cerr: No error][aaa: Success]
```

```
      30 activate dynamic-template S99_DT_PTA_MIN [cerr: No error][aaa: Success]
  event Account-Logoff match-first [at Mon Jul 21 15:08:07 2014]
    class type control subscriber S99_PTA do-until-failure [Succeeded]
      10 activate dynamic-template HTTPRDRT_TPL_1 [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Mon Jul 21 15:08:07 2014
COA Request  Attribute List: 0x500fa324
1:  command         len= 15  value= account-logoff
Last COA response: Result ACK
COA Response  Attribute List: 0x500fa534
User Profile received from AAA:
 Attribute List: 0x500fa744
1:  ipv6-enable     len=  4  value= 1(1)
Services:
  Name        : S99_DT_LCP
  Service-ID  : 0x400003e
  Type        : Template
  Status      : Applied
-------------------------
  Name        : DOWNLOADING_SERVICE_1
  Service-ID  : 0x4000087
  Type        : Profile
  Status      : Applied
-------------------------
  Name        : S99_DT_PTA_MIN
  Service-ID  : 0x400005b
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1
  Service-ID  : 0x400002c
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul 21 15:07:44.640 IPv4 Up
   Jul 21 15:07:44.640 IPv6 Up [many]
   Jul 21 15:08:07.296 CoA request
   Jul 21 15:08:07.424 SUBDB produce done [many]
```

6.6.Account-logon

The subscriber credential information input by subscriber on a Web Portal can be pushed to a BNG using CoA request with account-logon command. Normally, a HTTP-redirect policy could be use to redirect the subscriber's http request to the web-portal to prompt him/her to input the username/password.

Please be noted that the username is carried in the IETF attribute User-Name, and password is not carried in IETF attribute Password, instead, Cisco VSA 249 (not a cisco AVPair, the code is 26,9,249) "cisco-subscriber-password" is used with encryption.

6.6.1.Example of TAL + CoA account-logon

Scenario

This is a example deployed in real network to provide TAL+Portal based web-logon using CoA Account-logon request to SP-WIFI subscriber.

When the FSOL (dhcp discover) arrive at ASR9K BNG, a IPoE session is triggered to establish and TAL using source MAC is conducted. If the TAL fails, a timer is set to 3 minutes and the session could live with unauthenticated state before the timer fires. HTTP redirect policy is enabled to redirect the subscriber's http request to a web portal for username/password input. The username and password will be pushed to BNG using CoA message with command account-logon. On receipt of the CoA message , BNG will do authentication using the provided username/password to RADIUS server, and deactivate the HTTP-R policy.

The Portal used in following example is a demo version portal application with CoA client functionality.

```
aaa attribute format MAC_USERNAME
 mac-address

dhcp ipv4
 profile S99_SERVER_PROFILE server
  lease 0 0 10
  pool S99_POOL_DHCPV4
  subnet-mask 255.255.255.255
  default-router 2.1.99.254
 !
 interface Bundle-Ether201.99 server profile S99_SERVER_PROFILE

interface Loopback2099
 ipv4 address 2.1.99.254 255.255.255.0

interface Bundle-Ether201.99
 description student-99 DHCPv4 session
 ipv4 point-to-point
 ipv4 unnumbered Loopback2099
 service-policy type control subscriber S99_IPoE_TAL_WEBLOGON
 ipsubscriber ipv4 l2-connected
  initiator dhcp
 !
 encapsulation ambiguous dot1q 201 second-dot1q 99-100

policy-map type control subscriber S99_IPoE_TAL_WEBLOGON
 event session-start match-first
```

```
  class type control subscriber DHCPv4 do-until-failure
   10 activate dynamic-template S99_DT_DHCPV4_MIN
   20 authorize aaa list S99_AAA_list format MAC_USERNAME password
cisco
  !
 !
 event authorization-failure match-first
  class type control subscriber DHCPv4 do-until-failure
   10 activate dynamic-template  HTTPRDRT_TPL_1
   20 set-timer UNAUTH_TMR 3
  !
 !
 event account-logon match-first
  class type control subscriber DHCPv4 do-until-failure
   10 authenticate aaa list S99_AAA_list
   20 deactivate dynamic-template HTTPRDRT_TPL_1
  !
 !
 event timer-expiry match-first
  class type control subscriber UNAUTH_TMR_CM do-until-failure
   10 disconnect
  !
 !
 end-policy-map

class-map type control subscriber match-all UNAUTH_TMR_CM
 match timer UNAUTH_TMR
 match authen-status unauthenticated
 end-class-map

class-map type control subscriber match-any DHCPv4
 match protocol dhcpv4
 end-class-map
!

dynamic-template
 type ipsubscriber S99_DT_DHCPV4_MIN
  ipv4 unnumbered Loopback2099

 type service HTTPRDRT_TPL_1
  service-policy type pbr HTTPRDRT_PBR_1

policy-map type pbr HTTPRDRT_PBR_1
 class type traffic Portal
  transmit
 !
 class type traffic HTTPRDRT
  http-redirect http://172.18.88.224
 !
 class type traffic class-default
  drop
 !
 end-policy-map

class-map type traffic match-any Portal
 match access-group ipv4 Portal
 end-class-map
```

```
!

class-map type traffic match-any HTTPRDRT
 match access-group ipv4 HTTPRDRT_ACL
 end-class-map

ipv4 access-list Portal
 10 permit icmp any any
 20 permit ipv4 any host 172.18.88.224
 30 permit ipv4 any host 172.18.88.228
!
ipv4 access-list HTTPRDRT_ACL
 10 permit tcp any any eq www
```

step 1 , session established but TAL fail.

RADIUS server log for TAL(failure)

```
Mon Jul 21 16:58:55 2014 : Info: Ready to process requests.
rad_recv: Access-Request packet from host 192.168.88.99 port 29765, id=33, lengt
h=233
        Cisco-AVPair = "client-mac-address=3c07.545f.c041"
        Acct-Session-Id = "00000020"
        NAS-Port = 3372271872
        NAS-Port-Id = "0/0/201/99.201"
        Cisco-NAS-Port = "0/0/201/99.201"
        User-Name = "3c07.545f.c041"
        Service-Type = Outbound-User
        User-Password = "cisco"
        NAS-Port-Type = 44
        Called-Station-Id = "99"
        Calling-Station-Id = "3c07.545f.c041"
        Event-Timestamp =
        Cisco-AVPair = "dhcp-client-id=<\007T_\300A"
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99
Mon Jul 21 22:52:30 2014 : Info: # Executing section authorize from file ../etc/
raddb/sites-enabled/default

Mon Jul 21 22:52:30 2014 : Info: Failed to authenticate the user.
Mon Jul 21 22:52:30 2014 : Auth: Login incorrect: [3c07.545f.c041] (from client
192.168.88.99 port 3372271872 cli 3c07.545f.c041)
Mon Jul 21 22:52:30 2014 : Info: Using Post-Auth-Type REJECT
```

BNG session information- unauthenticated and unauthorised with HTTP-redirect policy enabled

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al  de internal
Mon Jul 21 22:51:34.510 UTC
```

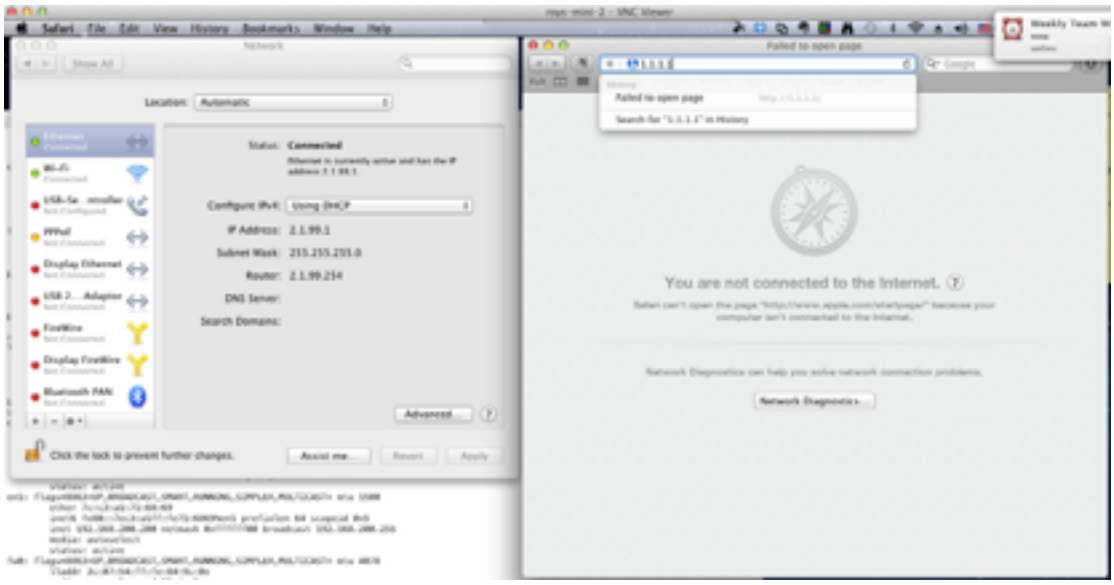
```
Interface:                Bundle-Ether201.99.ip4
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Mon Jul 21 22:51:31 2014
IPv4 Address:             2.1.99.1, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000020
Nas-Port:                 3372271872
User name:                3c07.545f.c041
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x0000005f
Created:                  Mon Jul 21 22:51:28 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            unauthorized
Ifhandle:                 0x000014e0
Session History ID:       6
Access-interface:         Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Mon Jul 21 22:51:28 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Reject]
  event Author Failure match-first [at Mon Jul 21 22:51:29 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template HTTPRDRT_TPL_1 [cerr: No error][aaa: Success]
      20 set-timer UNAUTH_TMR 3 [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA: None
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000086
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1
  Service-ID  : 0x400002c
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul 21 22:51:28.768 IPv4 Start
   Jul 21 22:51:30.944 SUBDB produce done
   Jul 21 22:51:31.072 IPv4 Up
```

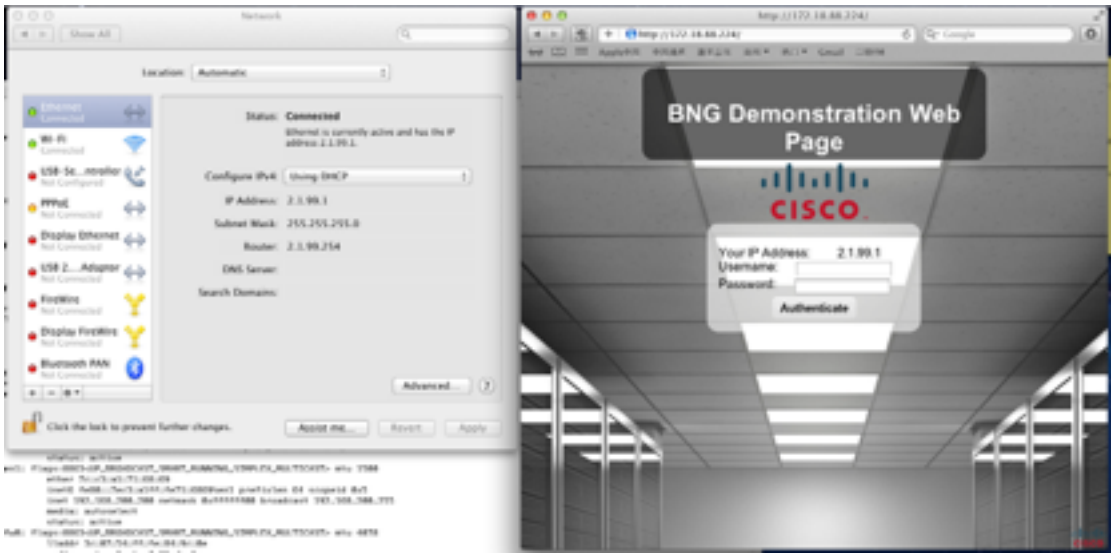
step 1.1 ,Session get disconnected and dhcp proxy binding entry also get cleared if no authentication is completed within 3 minutes

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh  subscriber  manager  disconnect-history   unique

Disconnect Reason:        Subscriber disconnect on Timer-Expiry policy event
Disconnect Cause:         AAA_DISC_CAUSE_TIMER_EXPIRY (9)
```

```
Abort Cause:              AAA_AV_ABORT_CAUSE_LOCAL_ADMIN_DISC (52)
Terminate Cause:          AAA_AV_TERMINATE_CAUSE_ADMIN_RESET (6)
Disconnect Count:         1
Last Time Disconnected:   2014:07:21 22:54:29
Client:                   [iEdge internal]
Last Subscriber Label:    0x0000005f
Last Interface:           BE201.99.ip4

[ Last Session Info ]

Interface:                Unknown
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: DHCP-trigger
IPv4 State:               Up, Mon Jul 21 22:51:31 2014
IPv4 Address:             2.1.99.1, VRF: default
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              3c07.545f.c041
Account-Session Id:       00000020
Nas-Port:                 3372271872
User name:                3c07.545f.c041
Outer VLAN ID:            201
Inner VLAN ID:            99
Subscriber Label:         0x0000005f
Created:                  Mon Jul 21 22:51:28 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            unauthorized
Ifhandle:                 0x000014e0
Session History ID:       6
Access-interface:         Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Mon Jul 21 22:51:28 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Reject]
  event Author Failure match-first [at Mon Jul 21 22:51:29 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template HTTPRDRT_TPL_1 [cerr: No error][aaa: Success]
      20 set-timer UNAUTH_TMR 3 [cerr: No error][aaa: Success]
  event Timer-Expiry match-first [at Mon Jul 21 22:54:29 2014]
    class type control subscriber UNAUTH_TMR_CM do-until-failure [Succeeded]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA: None
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000086
  Type        : Template
  Status      : Applied
-------------------------
  Name        : HTTPRDRT_TPL_1
  Service-ID  : 0x400002c
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul 21 22:51:28.768 IPv4 Start
   Jul 21 22:51:30.944 SUBDB produce done
   Jul 21 22:51:31.072 IPv4 Up
```

step 2, http request get redirect to a portal





Step 3, CoA request with accont-logon is sent to BNG and triggered an successful authentication to radius server(username=WIFI, Password=cisco)

debug display on ASR9K BNG

```
RP/0/RSP0/CPU0:Roy_BNG_1#debug radius
Tue Jul 22 00:04:30.619 UTC
RP/0/RSP0/CPU0:Roy_BNG_1#ter moni

Tue Jul 22 00:04:32.902 UTC
RP/0/RSP0/CPU0:Roy_BNG_1#RP/0/RSP0/CPU0:Jul 22 00:04:49.781 : radiusd[1117]:
RADIUS: Received from id 0 172.18.88.224, CoA Request, len 112
RP/0/RSP0/CPU0:Jul 22 00:04:49.781 : radiusd[1117]:  RADIUS:  authenticator CF DD
0E E6 FA D2 D3 27 - 8F D7 DA 5E AA 32 5D 34
```

```
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:  Framed-IP-Address
[8]     6       2.1.99.1
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:   Cisco AVpair
[1]    34      subscriber:command=account-logon
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:  Vendor,Cisco
[26]    40
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:  Vendor,Cisco
[26]    40
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:  User-Name
[1]     6       WIFI
RP/0/RSP0/CPU0:Jul 22 00:04:49.782 : radiusd[1117]:  RADIUS:   Subscriber-password
[249]  34      *
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: Received request [handle
0x5013d2e8] with server-group   : S99_GRP1
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: Building header for the
Authentication request
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: radius_get_prfrd_srvr_info:
Retrive Preferred Server info from attr list
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: radius_get_prfrd_srvr_info:
Preferred server handle is set to NULL
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: (handle_nas_req) Couldn't
retrive the preferred server info
RP/0/RSP0/CPU0:Jul 22 00:04:49.785 : radiusd[1117]: Trying to find the first radius
server to use.
RP/0/RSP0/CPU0:Jul 22 00:04:49.786 : radiusd[1117]: Created transaction_id
(3D000001) for server group F000001
RP/0/RSP0/CPU0:Jul 22 00:04:49.786 : radiusd[1117]: Picking the rad id 1:0 sockfd
0x5004ACA4
RP/0/RSP0/CPU0:Jul 22 00:04:49.786 : radiusd[1117]: rctx 0x5013aa9c added
successfully
RP/0/RSP0/CPU0:Jul 22 00:04:49.786 : radiusd[1117]:  RADIUS: Send Access-Request to
172.18.88.221:1812 id 1, len 289
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  authenticator 68 E4
F9 AC 5C 19 4D AB - 84 92 43 61 53 A8 36 57
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    41
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Acct-Session-Id
[44]    10      00000001
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  NAS-Port
[5]     6       3372271872
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  NAS-Port-Id
[87]    16      0/0/201/99.201
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    22
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Framed-IP-Address
[8]     6       2.1.99.1
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    22
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Service-Type
[6]     6       Outbound[0]
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  User-Password
[2]     18      *
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]: Unsuppoted attribute.
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    32
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  NAS-Port-Type
[61]    6       VIRTUAL_IPOEOQINQ[0]
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Called-Station-Id
[30]    4       99
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Calling-Station-Id
[31]    16      3c07.545f.c041
```

```
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Event-Timestamp
[55]    6       1405987489
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    29
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  Nas-Identifier
[32]    11      Roy_BNG_1
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  NAS-IP-Address
[4]     6       192.168.88.99
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]: Updating last used server
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]:  RADIUS:  User-Name
[1]     6       WIFI
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]: Got global deadtime 0
RP/0/RSP0/CPU0:Jul 22 00:04:49.788 : radiusd[1117]: Start timer thread rad_ident 1
remote_port 1812 remote_addr 0xac1258dd, socket 1342483620 rctx 0x5013aa9c
RP/0/RSP0/CPU0:Jul 22 00:04:49.787 : radiusd[1117]: Using global deadtime = 0 sec
RP/0/RSP0/CPU0:Jul 22 00:04:49.788 : radiusd[1117]: Successfully sent packet and
started timeout handler for rctx 0x5013aa9c
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: rctx found is 0x5013aa9c
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: Radius packet decryption
complete with rc = 0
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]:  RADIUS: Received from id 1
172.18.88.221:1812, Access-Accept, len 114
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    46
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]:  RADIUS:  authenticator F7 60
83 17 70 9D 99 31 - EC 48 D2 E6 37 CB 9A 0F
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: Freeing server group
transaction_id (3D000001)
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]:  RADIUS:   Vendor-Specific
[26]    48
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: pack_length = 114 radius_len =
114
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: (rad_nas_reply_to_client)
Successfully decoded the response No error: PASS
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: (rad_nas_reply_to_client)
Successfully stored the preferred server info
RP/0/RSP0/CPU0:Jul 22 00:04:49.823 : radiusd[1117]: rad_nas_reply_to_client:
Received response from id : 1,packet type 2
RP/0/RSP0/CPU0:Jul 22 00:04:50.033 : radiusd[1117]:  RADIUS: Send CoA Ack Response
to 172.18.88.224 id 0, len 20
RP/0/RSP0/CPU0:Jul 22 00:04:50.033 : radiusd[1117]:  RADIUS:  authenticator 4F 7D
C0 D4 FE E4 23 80 - 64 7A BE 95 2A BB 43 0A
RP/0/RSP0/CPU0:Jul 22 00:04:50.033 : radiusd[1117]: Updating last used server
```

Packet capture from wireshark

1), CoA request account-logon packet

```
No.     Time           Source                Destination           Protocol Length Info
    243 207.577075000  172.18.88.224         192.168.100.1         RADIUS   158    CoA-
Request(43) (id=0, l=112) [ETHERNET FRAME CHECK SEQUENCE INCORRECT]

Frame 243: 158 bytes on wire (1264 bits), 158 bytes captured (1264 bits) on interface 0
Ethernet II, Src: Vmware_43:a6:e8 (00:0c:29:43:a6:e8), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Destination: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Source: Vmware_43:a6:e8 (00:0c:29:43:a6:e8)
    Type: IP (0x0800)
    Frame check sequence: 0x00000000 [incorrect, should be 0x3b886bd8]
Internet Protocol Version 4, Src: 172.18.88.224 (172.18.88.224), Dst: 192.168.100.1
(192.168.100.1)
User Datagram Protocol, Src Port: 36030 (36030), Dst Port: mps-raft (1700)
```

```
Radius Protocol
    Code: CoA-Request (43)
    Packet identifier: 0x0 (0)
    Length: 112
    Authenticator: cfdd0ee6fad2d3278fd7da5eaa325d34
    [The response to this request is in frame 248]
    Attribute Value Pairs
        AVP: l=6  t=Framed-IP-Address(8): 2.1.99.1
        AVP: l=40  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=34 t=Cisco-AVPair(1): subscriber:command=account-logon
        AVP: l=40  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=34 t=Cisco-Subscriber-Password(249):
4949494949494949\017\001,\313\364.}\212\240\336\342\177[\306\374\302
        AVP: l=6  t=User-Name(1): WIFI
            User-Name: WIFI
```

2),radius access-request packet

```
No.     Time           Source                Destination           Protocol Length Info
    244 207.584928000  192.168.88.99         172.18.88.221         RADIUS   335    Access-
Request(1) (id=1, l=289) [ETHERNET FRAME CHECK SEQUENCE INCORRECT]

Frame 244: 335 bytes on wire (2680 bits), 335 bytes captured (2680 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_8b:c1:22 (00:0c:29:8b:c1:22)
    Destination: Vmware_8b:c1:22 (00:0c:29:8b:c1:22)
    Source: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Type: IP (0x0800)
    Frame check sequence: 0x00000000 [incorrect, should be 0xbf09b8be]
Internet Protocol Version 4, Src: 192.168.88.99 (192.168.88.99), Dst: 172.18.88.221
(172.18.88.221)
User Datagram Protocol, Src Port: 59111 (59111), Dst Port: radius (1812)
Radius Protocol
    Code: Access-Request (1)
    Packet identifier: 0x1 (1)
    Length: 289
    Authenticator: 68e4f9ac5c194dab8492436153a83657
    [The response to this request is in frame 247]
    Attribute Value Pairs
        AVP: l=41  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=35 t=Cisco-AVPair(1): client-mac-address=3c07.545f.c041
        AVP: l=10  t=Acct-Session-Id(44): 00000001
        AVP: l=6  t=NAS-Port(5): 3372271872
        AVP: l=16  t=NAS-Port-Id(87): 0/0/201/99.201
        AVP: l=22  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=16 t=Cisco-NAS-Port(2): 0/0/201/99.201
        AVP: l=6  t=Framed-IP-Address(8): 2.1.99.1
        AVP: l=22  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=16 t=Cisco-AVPair(1): vrf-id=default
        AVP: l=6  t=Service-Type(6): Dialout-Framed-User(5)
        AVP: l=18  t=User-Password(2): Encrypted
        AVP: l=6  t=User-Name(1): WIFI
            User-Name: WIFI
        AVP: l=6  t=Unknown-Attribute(196): 0000000a
        AVP: l=32  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=26 t=Cisco-AVPair(1): connect-progress=Call Up
        AVP: l=6  t=NAS-Port-Type(61): Unknown(44)
        AVP: l=4  t=Called-Station-Id(30): 99
        AVP: l=16  t=Calling-Station-Id(31): 3c07.545f.c041
        AVP: l=6  t=Event-Timestamp(55): Jul 22, 2014 08:04:49.000000000 中国标准时间
        AVP: l=29  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=23 t=Cisco-AVPair(1): dhcp-client-id=<\aT_\300A
        AVP: l=11  t=NAS-Identifier(32): Roy_BNG_1
        AVP: l=6  t=NAS-IP-Address(4): 192.168.88.99
```

3),radius access-accept packet

```
No.     Time           Source                Destination           Protocol Length Info
```

```
    247 207.619366000  172.18.88.221         192.168.88.99         RADIUS   156    Access-
Accept(2) (id=1, l=114)

Frame 247: 156 bytes on wire (1248 bits), 156 bytes captured (1248 bits) on interface 0
Ethernet II, Src: Vmware_8b:c1:22 (00:0c:29:8b:c1:22), Dst: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Destination: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Source: Vmware_8b:c1:22 (00:0c:29:8b:c1:22)
    Type: IP (0x0800)
Internet Protocol Version 4, Src: 172.18.88.221 (172.18.88.221), Dst: 192.168.88.99
(192.168.88.99)
User Datagram Protocol, Src Port: radius (1812), Dst Port: 59111 (59111)
Radius Protocol
    Code: Access-Accept (2)
    Packet identifier: 0x1 (1)
    Length: 114
    Authenticator: f7608317709d9931ec48d2e637cb9a0f
    [This is a response to a request in frame 244]
    [Time from request: 0.034438000 seconds]
    Attribute Value Pairs
        AVP: l=46  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=40 t=Cisco-AVPair(1): sub-qos-policy-in=S99_IN_POLICING_256K
        AVP: l=48  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=42 t=Cisco-AVPair(1): sub-qos-policy-out=S99_OUT_POLICING_512K
```

4),CoA ACK packet

```
No.     Time           Source                Destination           Protocol Length Info
    248 207.830557000  192.168.100.1         172.18.88.224         RADIUS   66     CoA-ACK(44)
(id=0, l=20) [ETHERNET FRAME CHECK SEQUENCE INCORRECT]

Frame 248: 66 bytes on wire (528 bits), 66 bytes captured (528 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_43:a6:e8 (00:0c:29:43:a6:e8)
    Destination: Vmware_43:a6:e8 (00:0c:29:43:a6:e8)
    Source: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Type: IP (0x0800)
    Frame check sequence: 0x00000000 [incorrect, should be 0x778cd475]
Internet Protocol Version 4, Src: 192.168.100.1 (192.168.100.1), Dst: 172.18.88.224
(172.18.88.224)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 36030 (36030)
Radius Protocol
    Code: CoA-ACK (44)
    Packet identifier: 0x0 (0)
    Length: 20
    Authenticator: 4f7dc0d4fee42380647abe952abb430a
    [This is a response to a request in frame 243]
    [Time from request: 0.253482000 seconds]
```

Session information after web-logon

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Tue Jul 22 00:12:49.748 UTC
Interface:               Bundle-Ether201.99.ip1
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    IP: DHCP-trigger
IPv4 State:              Up, Tue Jul 22 00:03:44 2014
IPv4 Address:            2.1.99.1, VRF: default
IPv4 Up helpers:         0x00000040 {IPSUB}
IPv4 Up requestors:      0x00000040 {IPSUB}
Mac Address:             3c07.545f.c041
Account-Session Id:      00000001
Nas-Port:                3372271872
User name:               WIFI
Outer VLAN ID:           201
```

```
Inner VLAN ID:            99
Subscriber Label:         0x00000040
Created:                  Tue Jul 22 00:03:42 2014
State:                    Activated
Authentication:           authenticated
Authorization:            unauthorized
Ifhandle:                 0x000013a0
Session History ID:       1
Access-interface:         Bundle-Ether201.99
Policy Executed:

  event Session-Start match-first [at Tue Jul 22 00:03:42 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template S99_DT_DHCPV4_MIN [cerr: No error][aaa: Success]
      20 authorize aaa list S99_AAA_list [cerr: No error][aaa: Reject]
  event Author Failure match-first [at Tue Jul 22 00:03:43 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 activate dynamic-template HTTPRDRT_TPL_1 [cerr: No error][aaa: Success]
      20 set-timer UNAUTH_TMR 3 [cerr: No error][aaa: Success]
  event Account-Logon match-first [at Tue Jul 22 00:04:49 2014]
    class type control subscriber DHCPv4 do-until-failure [Succeeded]
      10 authenticate aaa list S99_AAA_list [cerr: No error][aaa: Success]
      20 deactivate dynamic-template HTTPRDRT_TPL_1 [cerr: No error][aaa: Success]
  event Timer-Expiry match-first [at Tue Jul 22 00:06:43 2014]
    class type control subscriber UNAUTH_TMR_CM do-until-failure [Failed]
Session Accounting: disabled
Last COA request: Tue Jul 22 00:04:49 2014
COA Request  Attribute List: 0x500fa45c
1:  addr            len=  4  value= 2.1.99.1
2:  password        len=  5  value= <opaque value>
3:  username        len=  4  value= WIFI
4:  command         len= 14  value= account-logon
Last COA response: Result ACK
COA Response  Attribute List: 0x500fa66c
User Profile received from AAA:
 Attribute List: 0x500fa87c
1:  sub-qos-policy-in len= 20  value= S99_IN_POLICING_256K
2:  sub-qos-policy-out len= 21  value= S99_OUT_POLICING_512K
Services:
  Name        : S99_DT_DHCPV4_MIN
  Service-ID  : 0x4000086
  Type        : Template
  Status      : Applied
-------------------------
[Event History]
   Jul 22 00:03:42.208 IPv4 Start
   Jul 22 00:03:44.640 IPv4 Up
   Jul 22 00:04:49.792 CoA request
   Jul 22 00:04:50.048 SUBDB produce done [many]
```

Step 3.1, COA NAK sent to Portal on failure of radius authentication

3)access-reject from radius server

```
No.     Time           Source                Destination           Protocol Length
Info
   1587 1524.875532000 172.18.88.221         192.168.88.99         RADIUS   62
Access-Reject(3) (id=3, l=20)
```

```
Frame 1587: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface
0
Ethernet II, Src: Vmware_8b:c1:22 (00:0c:29:8b:c1:22), Dst: Cisco_3a:d1:f5
(e4:c7:22:3a:d1:f5)
    Destination: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Source: Vmware_8b:c1:22 (00:0c:29:8b:c1:22)
    Type: IP (0x0800)
Internet Protocol Version 4, Src: 172.18.88.221 (172.18.88.221), Dst: 192.168.88.99
(192.168.88.99)
User Datagram Protocol, Src Port: radius (1812), Dst Port: 59111 (59111)
Radius Protocol
    Code: Access-Reject (3)
    Packet identifier: 0x3 (3)
    Length: 20
    Authenticator: 424d25ab6483ec7fc27e1d207cd1ca3d
    [This is a response to a request in frame 1576]
    [Time from request: 1.017996000 seconds]
```

4) CoA NAK from BNG to Portal

```
No.     Time           Source                Destination           Protocol Length
Info
   1588 1524.878803000 192.168.100.1         172.18.88.224         RADIUS   83
CoA-NAK(45) (id=146, l=37) [ETHERNET FRAME CHECK SEQUENCE INCORRECT]

Frame 1588: 83 bytes on wire (664 bits), 83 bytes captured (664 bits) on interface
0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_43:a6:e8 (00:0c:
29:43:a6:e8)
    Destination: Vmware_43:a6:e8 (00:0c:29:43:a6:e8)
    Source: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5)
    Type: IP (0x0800)
    Frame check sequence: 0x00000000 [incorrect, should be 0x24b44945]
Internet Protocol Version 4, Src: 192.168.100.1 (192.168.100.1), Dst: 172.18.88.224
(172.18.88.224)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 35832 (35832)
Radius Protocol
    Code: CoA-NAK (45)
    Packet identifier: 0x92 (146)
    Length: 37
    Authenticator: 114c6b8d5a0c94054d14a0949ab71fa5
    [This is a response to a request in frame 1575]
    [Time from request: 1.026754000 seconds]
    Attribute Value Pairs
        AVP: l=6  t=Error-Cause(101): Resources-Unavailable(506)
            Error-Cause: Resources-Unavailable (506)
        AVP: l=11  t=Reply-Message(18): CoA error
            Reply-Message: CoA error
```

Note: the error-cause and reply-message in the CoA NAK do not reflect the reason of COA failure correctly in 5.1.1 release. There was a ddts CSCun27442 raised to enhance it by copying the reply-message(IETF attribute e18) downloaded from radius server in the access-reject to the CoA NAK message. This enhancement will be integrated into 5.1.2 release.

Note

- framed-ip-address here is used as a session key.
- The Cisco AVPair “command=account-logon” is also included in the CoA request, it’s mandatory for the action of accont-logon.
- Action of authentication is configured in a “policy-map type control subscriber XXX event account-logon”, it’s mandatory , since the RADIUS authentication will not take place automatically without explicitly configured action on reception of CoA account-logon request.

6.7.Account-update

BNG supporst CoA requests for account-update or called “per-user feature push”. These request message could have no subscriber command but attributes that change or apply certain configuration parameters on the session on BNG. If BNG could not find any command in CoA request then it will consider as per-user push or account-update, in this case CoA module on the BNG will insert the attribute with “account-update” as the value before handing the request over to command –handler for further processing.

Almost all subscriber level features can be changed on-demand via per-user push or account-update, except those related to the forwarding behaviour, eg, vrf-id, ipv4-unnumbered, addressing related attribute, etc. Normally, Lawful Intercept, Parameterized QoS , Interim-Interval (attribute#85), Idle-Timeout (attribute#27), Session-Timeout (attribute#28), ACL, Policy-map are some known features that will use account-update CoA requests.

BTW, it works as well if there is a Cisco-avpair=”subscriber:command=account-update” included in the CoA request.

Something what to highlight here

- CoA account-update apply attributes to a session, it replaces existing configure if present, but there is no way to withdraw an individual attribute via CoA command(service-deactivate works in that way).
- The session configuration enabled by receiving attributes in CoA account-update are stored in the SUBDB(subscriber database) as user-profile, identical to those downloaded from radius server upon authentication and have highest reference comparing to those configuration come from local defined dynamic-template or service-profile.
- multiple RADIUS attribute could be carried in a single account-update CoA message.
- CoA account-update to pushing framed-route for PPPoE session is not supported and will cause the session disconnected(CSCue45808)

6.7.1.Example of CoA account-update for interface session

Scenario

This time we use a interface session(also called static session) as example.
an interface session means BNG treat all of the traffic on a sub-interface as a session , their is no FSOL for interface session , the session-start event take place when the sub-interface with ipsub enabled get up. AAA and CoA for interface session is also supported for interface session.

BNG config for session interface

```
interface Bundle-Ether901.100
 ipv4 point-to-point
 ipv4 unnumbered Loopback500
 service-policy type control subscriber CP_INTF_2
 shutdown
 encapsulation dot1q 901 second-dot1q 100
 ipsubscriber interface
!

policy-map type control subscriber CP_INTF_2
 event session-start match-first
  class type control subscriber class-default do-until-failure
   10 authorize aaa list S99_AAA_list format INTF_ID password cisco
  !
```

```
 !
 end-policy-map
!

aaa attribute format INTF_ID
 format-string length 253 "%s/%s/%s/%s_%s:%s" physical-chassis
physical-slot physical-subslot physical-port outer-vlan-id inner-
vlan-id

policy-map S99_IN_POLICING_256K
 class class-default
  police rate 256 kbps
  !
 !
 end-policy-map
!


policy-map S99_OUT_POLICING_512K
 class class-default
  police rate 512 kbps
  !
 !
 end-policy-map
!

interface Loopback500
 ipv4 address 20.0.0.1 255.255.255.0
!

ipv4 access-list S99_ACL_in
 10 deny ipv4 1.1.99.0/24 host 172.18.88.224
 20 permit ipv4 any any
!

ipv4 access-list S99_ACL_out
 10 permit ipv4 any any
!
```

Step 1 , get session up by no shut the interface and do TAL with QoS and ACL attributes downloaded.

radius server log for TAL

```
rad_recv: Access-Request packet from host 192.168.88.99 port 11969, id=83, lengt
h=153
        Acct-Session-Id = "0000000f"
        NAS-Port = 2231600384
        NAS-Port-Id = "0/0/901/100.901"
        Cisco-NAS-Port = "0/0/901/100.901"
        User-Name = "0/0/0/901_901:100"
        Service-Type = Outbound-User
        User-Password = "cisco"
        NAS-Port-Type = 44
        Called-Station-Id = "100"
        Event-Timestamp =
```

```
        NAS-Identifier = "Roy_BNG_1"
        NAS-IP-Address = 192.168.88.99

Sending Access-Accept of id 83 to 192.168.88.99 port 11969
        Cisco-AVPair = "ipv4-unnumbered=Loopback500"
        Cisco-AVPair += "sub-qos-policy-in=S99_IN_POLICING_256K"
        Cisco-AVPair += "sub-qos-policy-out=S99_OUT_POLICING_512K"
        Cisco-AVPair += "outacl=S99_ACL_out"
        Cisco-AVPair += "inacl=S99_ACL_in"
Tue Jul 22 15:52:20 2014 : Info: Finished request 1.

Tue Jul 22 15:52:25 2014 : Info: Ready to process requests.
```

original session information on BNG

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all  de internal
Fri Jul 25 18:11:01.369 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Fri Jul 25 18:10:51 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       0000000f
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x0000004e
Created:                  Fri Jul 25 18:10:51 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       6
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Fri Jul 25 18:10:51 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f95f4
1:  ipv4-unnumbered len= 11  value= Loopback500
2:  sub-qos-policy-in len= 20  value= S99_IN_POLICING_256K
3:  sub-qos-policy-out len= 21  value= S99_OUT_POLICING_512K
4:  outacl          len= 11  value= S99_ACL_out
5:  inacl           len= 10  value= S99_ACL_in
No Services
[Event History]
   Jul 25 18:10:51.264 IPv4 Start
   Jul 25 18:10:51.520 SUBDB produce done
   Jul 25 18:10:51.520 IPv4 Up
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  manager  sadb
Fri Jul 25 18:11:29.210 UTC


Sublabel: 0x0000004e Node_ID: 00000001 Signature: 0xabcdef12 Version: 1 Rev: 12
Length: 231

Attribute list: 1343138132
1:  protocol-type    len=  4  ip
2:  outer-vlan-id    len=  4  901(385)
3:  inner-vlan-id    len=  4  100(64)
4:  port-type        len=  4  Virtual IP over QinQ
5:  static-session   len=  1  true
6:  parent-if-handle len=  4  4960(1360)
7:  string-session-id len=  8  0000000f <-radius acct-session-id
8:  nas-port         len=  4  2231600384(85038500)
9:  interface        len= 15  0/0/901/100.901
10:  dnis             len=  3  100
11:  username         len= 17  0/0/0/901_901:100
12:  author_status    len=  1  true
13:  if-handle        len=  4  4960(1360)
14:  ipv4-session-state len=  1  true



RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database association
Fri Jul 25 18:11:51.458 UTC

Location 0/RSP0/CPU0

Bundle-Ether901.100, subscriber label 0x4e
  Name                             Template Type
  --------                         -------------
  U0000004e                        User profile

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database configuration  name U0000004e
Fri Jul 25 18:12:06.194 UTC

Subscriber configuration database object 'U0000004e' on node 0/RSP0/CPU0

 Template:                 U0000004e
   Type:                   User profile
   Feature:                IPV4
     Attribute:            ipv4/unnumbered
       SysDB pathname:     /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4/
unnumbered
       Datatype:           string/wstring
       Length:             12
       Value:              Loopback500
   Feature:                IPV4PacketFilter
     Attribute:            ipv4-accessgroup/0x0
       SysDB pathname:     /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4-
accessgroup/0x0
       Datatype:           packed
       Value:
                           00000000 : AB CD 43 21 02 00 04 FF FF FF FF 05 00 01 00 05
: ..C!............
                           00000010 : 00 0B 53 39 39 5F 41 43 4C 5F 69 6E 00 03 00 04
: ..S99_ACL_in....
                           00000020 : 00 00 00 00 03 00 04 00 00 00 00 03 00 04 00 00
: ................
```

```
                          00000030 : 00 00 06 00 00
: .....
     Attribute:           ipv4-accessgroup/0x1
       SysDB pathname:    /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4-
accessgroup/0x1
       Datatype:          packed
       Value:
                          00000000 : AB CD 43 21 02 00 04 FF FF FF FF 05 00 01 00 05
: ..C!............
                          00000010 : 00 0C 53 39 39 5F 41 43 4C 5F 6F 75 74 00 03 00
: ..S99_ACL_out...
                          00000020 : 04 00 00 00 00 03 00 04 00 00 00 00 03 00 04 00
: ................
                          00000030 : 00 00 00 06 00 00
: ......
   Feature:               QoS
     Attribute:           qos/service/sub_sp_in
       SysDB pathname:    /cfg/gl/dynamic-templates/user-profile/U0000004e/qos/
service/sub_sp_in
       Datatype:          packed
       Value:
                          00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 15 53 39
: ..C!..........S9
                          00000010 : 39 5F 49 4E 5F 50 4F 4C 49 43 49 4E 47 5F 32 35
: 9_IN_POLICING_25
                          00000020 : 36 4B 00 03 00 04 00 00 00 00 05 00 01 00 06 00
: 6K..............
                          00000030 : 00
: .
     Attribute:           qos/service/sub_sp_out
       SysDB pathname:    /cfg/gl/dynamic-templates/user-profile/U0000004e/qos/
service/sub_sp_out
       Datatype:          packed
       Value:
                          00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 16 53 39
: ..C!..........S9
                          00000010 : 39 5F 4F 55 54 5F 50 4F 4C 49 43 49 4E 47 5F 35
: 9_OUT_POLICING_5
                          00000020 : 31 32 4B 00 03 00 04 00 00 00 00 05 00 01 00 06
: 12K.............
                          00000030 : 00 00
: ..
 Config DB entry size: 783 bytes

No matching object in Subscriber configuration  database with name 'U0000004e' on
node 0/0/CPU0



RP/0/RSP0/CPU0:Roy_BNG_1#sh policy-map applied int Bundle-Ether901.100
Fri Jul 25 18:12:38.559 UTC

Input policy-map applied to Bundle-Ether901.100:

  policy-map S99_IN_POLICING_256K
   class class-default
    police rate 256 kbps
    !
   !

Output policy-map applied to Bundle-Ether901.100:
```

```
  policy-map S99_OUT_POLICING_512K
   class class-default
    police rate 512 kbps
    !
   !
RP/0/RSP0/CPU0:Roy_BNG_1#sh access-lists inter Bundle-Ether901.100
Fri Jul 25 18:12:46.446 UTC
Input ACL (common): N/A (interface): S99_ACL_in
Output ACL: S99_ACL_out
```

Step 2, COA account-update with other attribute

COA client command

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,0000000f -2 26,9,1
,"accounting-list=S99_AAA_list" -3 26,9,1,"strict-rpf=1" -4 26,9,1,"ipv4-icmp-un
reachable=1" -5 26,9,1,"ipv4-mtu=1300"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 179)
```

CoA packet captured by wireshark

CoA request for account-update

```
No.     Time           Source                Destination           Protocol Length
Info
     17 13.527285000   172.18.88.223         172.18.88.230         RADIUS   180
CoA-Request(43) (id=1, l=138)

Frame 17: 180 bytes on wire (1440 bits), 180 bytes captured (1440 bits) on
interface 0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5
(e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30632 (30632), Dst Port: mps-raft (1700)
    Source port: 30632 (30632)
    Destination port: mps-raft (1700)
    Length: 146
    Checksum: 0x01ed [validation disabled]
Radius Protocol
    Code: CoA-Request (43)
    Packet identifier: 0x1 (1)
    Length: 138
    Authenticator: f39e18de3fc526588e44a1e378b6121f
    [The response to this request is in frame 18]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 0000000f
```

```
            Acct-Session-Id: 0000000f
        AVP: l=36  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=30 t=Cisco-AVPair(1): accounting-list=S99_AAA_list
                Cisco-AVPair: accounting-list=S99_AAA_list
        AVP: l=20  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=14 t=Cisco-AVPair(1): strict-rpf=1
                Cisco-AVPair: strict-rpf=1
        AVP: l=31  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=25 t=Cisco-AVPair(1): ipv4-icmp-unreachable=1
                Cisco-AVPair: ipv4-icmp-unreachable=1
        AVP: l=21  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=15 t=Cisco-AVPair(1): ipv4-mtu=1300
                Cisco-AVPair: ipv4-mtu=1300
```

CoA ACK

```
No.     Time           Source                Destination           Protocol Length
Info
     18 13.535854000   172.18.88.230         172.18.88.223         RADIUS   62
CoA-ACK(44) (id=1, l=20)

Frame 18: 62 bytes on wire (496 bits), 62 bytes captured (496 bits) on interface 0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:
29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 30632 (30632)
    Source port: mps-raft (1700)
    Destination port: 30632 (30632)
    Length: 28
    Checksum: 0x48c7 [validation disabled]
Radius Protocol
    Code: CoA-ACK (44)
    Packet identifier: 0x1 (1)
    Length: 20
    Authenticator: d7d43463a90e35dc3b3b52846cf81cc8
    [This is a response to a request in frame 17]
    [Time from request: 0.008569000 seconds]
```

session display n BNG after account-update

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  ses all detail internal
Fri Jul 25 18:20:25.564 UTC
Interface:               Bundle-Ether901.100
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    IP: Static
IPv4 State:              Up, Fri Jul 25 18:10:51 2014
IPv4 Up helpers:         0x00000040 {IPSUB}
IPv4 Up requestors:      0x00000040 {IPSUB}
Mac Address:             Unknown
Account-Session Id:      0000000f
Nas-Port:                2231600384
User name:               0/0/0/901_901:100
Outer VLAN ID:           901
Inner VLAN ID:           100
Subscriber Label:        0x0000004e
Created:                 Fri Jul 25 18:10:51 2014
```

```
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       6
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Fri Jul 25 18:10:51 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting:
  Acct-Session-Id:          0000000f
  Method-list:              S99_AAA_list
  Accounting started:       Fri Jul 25 18:19:14 2014
  Interim accounting:       Off
    Last update sent:       Never
    Updates sent:           0
    Updates accepted:       0
    Updates rejected:       0
    Update send failures:   0
  Accouting stop state:     Final stats available
Last COA request: Fri Jul 25 18:19:14 2014
COA Request  Attribute List: 0x500f9948
1:  accounting-list len= 12  value= S99_AAA_list
2:  strict-rpf      len=  4  value= 1(1)
3:  ipv4-icmp-unreachable len=  4  value= 1(1)
4:  ipv4-mtu        len=  4  value= 1300(514)
5:  command         len= 15  value= account-update <—this command is not included
in the CoA request in this case, it’s added by BNG AAA code on reception a CoA
without any command.
Last COA response: Result ACK
COA Response  Attribute List: 0x500f9b58
User Profile received from AAA:
 Attribute List: 0x500f9d68
1:  ipv4-unnumbered len= 11  value= Loopback500
2:  sub-qos-policy-in len= 20  value= S99_IN_POLICING_256K
3:  sub-qos-policy-out len= 21  value= S99_OUT_POLICING_512K
4:  outacl          len= 11  value= S99_ACL_out
5:  inacl           len= 10  value= S99_ACL_in
6:  accounting-list len= 12  value= S99_AAA_list
7:  strict-rpf      len=  4  value= 1(1)
8:  ipv4-icmp-unreachable len=  4  value= 1(1)
9:  ipv4-mtu        len=  4  value= 1300(514)
No Services
[Event History]
   Jul 25 18:10:51.264 IPv4 Start
   Jul 25 18:10:51.520 IPv4 Up
   Jul 25 18:19:14.048 CoA request
   Jul 25 18:19:14.176 SUBDB produce done [many]


RP/0/RSP0/CPU0:Roy_BNG_1#sh ipv4 int bundle-e 901.100
Fri Jul 25 18:21:00.162 UTC
Bundle-Ether901.100 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Interface is unnumbered.  Using address of Loopback500 (20.0.0.1/24)
  MTU is 1522 (1300 is available to IP)
  Helper address is not set

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database configuration  name U0000004e
Fri Jul 25 18:24:12.431 UTC
```

```
Subscriber configuration database object 'U0000004e' on node 0/RSP0/CPU0

 Template:               U0000004e
   Type:                 User profile
   Feature:              SubAcct
     Attribute:          acct/sess-acct
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/acct/
sess-acct
       Datatype:         packed
       Value:
                         00000000 : AB CD 43 21 02 00 04 00 00 00 01 05 00 0D 53 39
: ..C!..........S9
                         00000010 : 39 5F 41 41 41 5F 6C 69 73 74 00 03 00 00 03 00
: 9_AAA_list......
                         00000020 : 00 06 00 00
: ....
   Feature:              IPV4
     Attribute:          ipv4/mtu
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4/mtu
       Datatype:         uint32
       Length:           4
       Value:            1300
     Attribute:          ipv4/unnumbered
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4/
unnumbered
       Datatype:         string/wstring
       Length:           12
       Value:            Loopback500
     Attribute:          ipv4/fib__rpf
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4/
fib__rpf
       Datatype:         uint32
       Length:           4
       Value:            1


       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4/
unreachables
       Datatype:         uint32
       Length:           4
       Value:            1
   Feature:              IPV4PacketFilter
     Attribute:          ipv4-accessgroup/0x0
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4-
accessgroup/0x0
       Datatype:         packed
       Value:
                         00000000 : AB CD 43 21 02 00 04 FF FF FF FF 05 00 01 00 05
: ..C!............
                         00000010 : 00 0B 53 39 39 5F 41 43 4C 5F 69 6E 00 03 00 04
: ..S99_ACL_in....
                         00000020 : 00 00 00 00 03 00 04 00 00 00 00 03 00 04 00 00
: ................
                         00000030 : 00 00 06 00 00
: .....
     Attribute:          ipv4-accessgroup/0x1
       SysDB pathname:   /cfg/gl/dynamic-templates/user-profile/U0000004e/ipv4-
accessgroup/0x1
       Datatype:         packed
       Value:
```

```
                        00000000 : AB CD 43 21 02 00 04 FF FF FF FF 05 00 01 00 05
: ..C!............
                        00000010 : 00 0C 53 39 39 5F 41 43 4C 5F 6F 75 74 00 03 00
: ..S99_ACL_out...
                        00000020 : 04 00 00 00 00 03 00 04 00 00 00 00 03 00 04 00
: ................
                        00000030 : 00 00 00 06 00 00
: ......
   Feature:             QoS
     Attribute:         qos/service/sub_sp_in
       SysDB pathname:  /cfg/gl/dynamic-templates/user-profile/U0000004e/qos/
service/sub_sp_in
       Datatype:        packed
       Value:
                        00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 15 53 39
: ..C!..........S9
                        00000010 : 39 5F 49 4E 5F 50 4F 4C 49 43 49 4E 47 5F 32 35
: 9_IN_POLICING_25
                        00000020 : 36 4B 00 03 00 04 00 00 00 00 05 00 01 00 06 00
: 6K..............
                        00000030 : 00
: .
     Attribute:         qos/service/sub_sp_out
       SysDB pathname:  /cfg/gl/dynamic-templates/user-profile/U0000004e/qos/
service/sub_sp_out
       Datatype:        packed
       Value:
                        00000000 : AB CD 43 21 02 00 04 00 00 00 07 05 00 16 53 39
: ..C!..........S9
                        00000010 : 39 5F 4F 55 54 5F 50 4F 4C 49 43 49 4E 47 5F 35
: 9_OUT_POLICING_5
                        00000020 : 31 32 4B 00 03 00 04 00 00 00 00 05 00 01 00 06
: 12K.............
                        00000030 : 00 00
: ..
 Config DB entry size: 1246 bytes

No matching object in Subscriber configuration  database with name 'U0000004e' on
node 0/0/CPU0
```

Step 3 , COA account-update with new ACL and QoS to replace existing one(which are downloaded from radius upon authentication as individual attributes, this step is based on the result of step 2)

COA client command

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,0000000f -2 26,9,1
,"sub-qos-policy-in=S99_IN_POLICING_1M" -3 26,9,1,"sub-qos-policy-out=S99_OUT_SH
APING_9M_H" -4 26,9,1,"inacl=S99_ACL_in_2" -5 26,9,1,"outacl=S99_ACL_out_2"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 233)
```

```
C:\COA>
```

Session display n BNG after account-update

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Fri Jul 25 23:13:21.508 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Fri Jul 25 18:10:51 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       0000000f
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x0000004e
Created:                  Fri Jul 25 18:10:51 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       6
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Fri Jul 25 18:10:51 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting:
  Acct-Session-Id:          0000000f
  Method-list:              S99_AAA_list
  Accounting started:       Fri Jul 25 18:19:14 2014
  Interim accounting:       Off
    Last update sent:       Never
    Updates sent:           0
    Updates accepted:       0
    Updates rejected:       0
    Update send failures:   0
  Accouting stop state:     Final stats available
Last COA request: Fri Jul 25 23:13:09 2014
COA Request  Attribute List: 0x500f9cf0
1:  sub-qos-policy-in len= 18  value= S99_IN_POLICING_1M
2:  sub-qos-policy-out len= 20  value= S99_OUT_SHAPING_9M_H
3:  inacl           len= 12  value= S99_ACL_in_2
4:  outacl          len= 13  value= S99_ACL_out_2
5:  command         len= 15  value= account-update
Last COA response: Result ACK
COA Response  Attribute List: 0x500f9f00
User Profile received from AAA:
 Attribute List: 0x500fa110
1:  ipv4-unnumbered len= 11  value= Loopback500
2:  accounting-list len= 12  value= S99_AAA_list
3:  strict-rpf      len=  4  value= 1(1)
4:  ipv4-icmp-unreachable len=  4  value= 1(1)
5:  ipv4-mtu        len=  4  value= 1300(514)
6:  sub-qos-policy-in len= 18  value= S99_IN_POLICING_1M
7:  sub-qos-policy-out len= 20  value= S99_OUT_SHAPING_9M_H
```

```
8:  inacl           len= 12  value= S99_ACL_in_2
9:  outacl          len= 13  value= S99_ACL_out_2
No Services
[Event History]
   Jul 25 18:10:51.264 IPv4 Start
   Jul 25 18:10:51.520 IPv4 Up
   Jul 25 23:10:16.064 SUBDB produce done(fail)
   Jul 25 23:13:09.760 CoA request [many]
   Jul 25 23:13:09.888 SUBDB produce done [many]


RP/0/RSP0/CPU0:Roy_BNG_1#sh policy-map applied  interface  bundle-e 901.100
Fri Jul 25 23:43:35.023 UTC

Input policy-map applied to Bundle-Ether901.100:

  policy-map S99_IN_POLICING_1M
   class class-default
    police rate 1 mbps
    !
   !

Output policy-map applied to Bundle-Ether901.100:

  policy-map S99_OUT_SHAPING_9M_H
   class class-default
    service-policy S99_OUT_SHAPING_9M_CHILD
    shape average 9 mbps
   !

Child policy-map(s) of policy-map S99_OUT_SHAPING_9M_H:

  policy-map S99_OUT_SHAPING_9M_CHILD
   class CM_VIDEO_IPP
    priority level 1
    police rate 8 mbps
    !
   !
   class class-default
   !
   end-policy-map
  !
RP/0/RSP0/CPU0:Roy_BNG_1#sh access-lists  ipv4 interface bundle-e 901.100
Fri Jul 25 23:43:53.099 UTC
Input ACL (common): N/A (interface): S99_ACL_in_2
Output ACL: S99_ACL_out_2
```

Step 4 , COA account-update with new Parameter QoS to replace existing one.

based on Step 4, a PQoS attributes is pushed via CoA and the result show that a n existing QoS policy-map called by previous COA pushing could be updated by PQoS via CoA.

CoA client command

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,0000000f -2 26,9,1
,"ip:qos-policy-out=add-class(sub,(class-default),shape(106496))"
```

```
CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 206)
```

session information display on BNG after account-update

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  session  all de internal
Fri Jul 25 23:48:08.727 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Fri Jul 25 18:10:51 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       0000000f
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x0000004e
Created:                  Fri Jul 25 18:10:51 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       6
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Fri Jul 25 18:10:51 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting:
  Acct-Session-Id:          0000000f
  Method-list:              S99_AAA_list
  Accounting started:       Fri Jul 25 18:19:14 2014
  Interim accounting:       Off
    Last update sent:       Never
    Updates sent:           0
    Updates accepted:       0
    Updates rejected:       0
    Update send failures:   0
  Accouting stop state:     Final stats available
Last COA request: Fri Jul 25 23:47:39 2014
COA Request  Attribute List: 0x500f9c98
1:  qos-policy-out  len= 44  value= add-class(sub,(class-default),shape(106496))
2:  command         len= 15  value= account-update
Last COA response: Result ACK
COA Response  Attribute List: 0x500f9ea8
User Profile received from AAA:
 Attribute List: 0x500fa0b8
1:  ipv4-unnumbered len= 11  value= Loopback500
2:  accounting-list len= 12  value= S99_AAA_list
```

```
3:  strict-rpf      len=  4  value= 1(1)
4:  ipv4-icmp-unreachable len=  4  value= 1(1)
5:  ipv4-mtu        len=  4  value= 1300(514)
6:  sub-qos-policy-in len= 18  value= S99_IN_POLICING_1M
7:  inacl           len= 12  value= S99_ACL_in_2
8:  outacl          len= 13  value= S99_ACL_out_2
9:  sub-qos-policy-out len= 14  value= __sub_3d62123d
No Services
[Event History]
   Jul 25 18:10:51.264 IPv4 Start
   Jul 25 18:10:51.520 IPv4 Up
   Jul 25 23:10:16.064 SUBDB produce done(fail)
   Jul 25 23:47:39.264 CoA request [many]
   Jul 25 23:47:39.264 SUBDB produce done [many]


RP/0/RSP0/CPU0:Roy_BNG_1#sh policy-map applied  interface  bundle-e 901.100
Fri Jul 25 23:47:46.244 UTC

Input policy-map applied to Bundle-Ether901.100:

  policy-map S99_IN_POLICING_1M
   class class-default
    police rate 1 mbps
    !
   !

Output policy-map applied to Bundle-Ether901.100:

  policy-map __sub_3d62123d
   class class-default
    shape average 106496 kbps
```

6.8.Service-Activate

The cisco AVPair “sa=servicename” could be used in CoA request as well, to activate a dynamic-template (type ppp or type ipsub or type service) defined in the BNG box to a session.

Please be noted, the preference calculation among user-profile, service-profile and dynamic-template to build the final config for a session still work in the CoA case, which means a CoA activated dynamic-template can not override user-profile.

6.8.1.Example of Service-Activate failed to override the existing user-profile

based on the 6.7 step 4 result, let's push a new service called S99_SERVICE_1 with following definition.

```
dynamic-template
 type service S99_SERVICE_1
  service-policy input S99_IN_POLICING_256K
  service-policy output S99_OUT_POLICING_512K
  ipv4 access-group S99_ACL_in ingress
  ipv4 access-group S99_ACL_out egress
```

You will find that the new service (dynamic-template) is activated on reception of CoA request, but the QoS and ACL config defined in dynamic-template S99_SERVICE_1 are not able to override the QoS and ACL in existing user-profile as a result of preference comparison.

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,0000000f -2 26,9,1
,"sa=S99_SERVICE_1"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 223)
```

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess all de internal
Sat Jul 26 00:25:43.447 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Fri Jul 25 18:10:51 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       0000000f
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x0000004e
Created:                  Fri Jul 25 18:10:51 2014
State:                    Activated
```

```
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       6
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Fri Jul 25 18:10:51 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting:
  Acct-Session-Id:          0000000f
  Method-list:              S99_AAA_list
  Accounting started:       Fri Jul 25 18:19:14 2014
  Interim accounting:       Off
    Last update sent:       Never
    Updates sent:           0
    Updates accepted:       0
    Updates rejected:       0
    Update send failures:   0
  Accouting stop state:     Final stats available
Last COA request: Sat Jul 26 00:25:16 2014
COA Request  Attribute List: 0x500f9f30
1:  sa              len= 13  value= S99_SERVICE_1 <-the attribute included in CoA
2:  command         len= 16  value= activate-service <—added by the AAA code
3:  service-info    len= 13  value= S99_SERVICE_1<-interpreted/added by AAA code
4:  service-name    len= 13  value= S99_SERVICE_1<-interpreted/added by AAA code
Last COA response: Result ACK
COA Response  Attribute List: 0x500fa140
1:  sa              len= 13  value= S99_SERVICE_1
User Profile received from AAA:
 Attribute List: 0x500fa350
1:  ipv4-unnumbered len= 11  value= Loopback500
2:  accounting-list len= 12  value= S99_AAA_list
3:  strict-rpf      len=  4  value= 1(1)
4:  ipv4-icmp-unreachable len=  4  value= 1(1)
5:  ipv4-mtu        len=  4  value= 1300(514)
6:  inacl           len= 12  value= S99_ACL_in_2
7:  outacl          len= 13  value= S99_ACL_out_2
8:  sub-qos-policy-out len= 14  value= __sub_3d62123d
9:  sub-qos-policy-in len= 20  value= S99_IN_POLICING_1M
Services:
  Name        : S99_SERVICE_1
  Service-ID  : 0x4000029
  Type        : Multi Template
  Status      : Applied
-------------------------
[Event History]
   Jul 25 18:10:51.264 IPv4 Start
   Jul 25 18:10:51.520 IPv4 Up
   Jul 25 23:10:16.064 SUBDB produce done(fail)
   Jul 26 00:25:16.544 CoA request [many]
   Jul 26 00:25:16.544 SUBDB produce done [many]

RP/0/RSP0/CPU0:Roy_BNG_1#

RP/0/RSP0/CPU0:Roy_BNG_1#sh policy-map applied  int bundle-e 901.100
Sat Jul 26 00:29:32.451 UTC

Input policy-map applied to Bundle-Ether901.100:

  policy-map S99_IN_POLICING_1M
```

```
   class class-default
    police rate 1 mbps
    !
   !

Output policy-map applied to Bundle-Ether901.100:

  policy-map __sub_3d62123d
   class class-default
    shape average 106496 kbps
   !
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#
RP/0/RSP0/CPU0:Roy_BNG_1#sh access-lists  ipv4 int bundle-e901.100
Sat Jul 26 00:30:31.248 UTC
Input ACL (common): N/A (interface): S99_ACL_in_2
Output ACL: S99_ACL_out_2


RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  database   association
Sat Jul 26 00:44:22.888 UTC

Location 0/RSP0/CPU0

Bundle-Ether901.100, subscriber label 0x4e
  Name                            Template Type
  --------                        -------------
  U0000004e                       User profile
  S99_SERVICE_1                   Service

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  running-config  <--this show command would
display the Subscriber running config (or real working config) derived from
dynamic-templates and user-profile and service-profile after reference
calculation , but unfortunately, the display has something wrong at this release of
5.1.1, but from 5.2.0 release you will find a cool display  to reflect the running
config for a session. see ddts CSCto31115.

Sat Jul 26 00:44:50.579 UTC
Subscriber Label: 0x4e
% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)

% No such configuration item(s)
```

6.8.2.Example of a successful Service-Activate

To avoid to fall into the 6.8.1 situation, let's remove all of the QoS and ACL from the user-profile and try again .

```
dynamic-template
 type service S99_SERVICE_1
  service-policy input S99_IN_POLICING_256K
  service-policy output S99_OUT_POLICING_512K
  ipv4 access-group S99_ACL_in ingress
  ipv4 access-group S99_ACL_out egress
```

Session information before service-actoivate. Note there is no existing user-profile specifying QoS/ACL feature, so no conflict here and the dynamic-template could be activated and turn to real config for the session.

```
RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh subscriber  sess all de internal
Sat Jul 26 01:11:47.009 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Sat Jul 26 01:11:41 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       00000011
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x00000050
Created:                  Sat Jul 26 01:11:41 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       7
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Sat Jul 26 01:11:41 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request received: unavailable
User Profile received from AAA:
 Attribute List: 0x500f9474
1:  ipv4-unnumbered len= 11  value= Loopback500
No Services
[Event History]
   Jul 26 01:11:41.312 IPv4 Start
   Jul 26 01:11:41.440 SUBDB produce done
```

```
   Jul 26 01:11:41.440 IPv4 Up
```

CoA client command

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,00000011 -2 26,9,1
,"sa=S99_SERVICE_1"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 35)
```

Packet capture for CoA request

```
No.     Time           Source                Destination           Protocol Length
Info
  14554 24148.522586000 172.18.88.223         172.18.88.230         RADIUS   96
CoA-Request(43) (id=35, l=54)

Frame 14554: 96 bytes on wire (768 bits), 96 bytes captured (768 bits) on interface
0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5
(e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30121 (30121), Dst Port: mps-raft (1700)
    Source port: 30121 (30121)
    Destination port: mps-raft (1700)
    Length: 62
    Checksum: 0x3b74 [validation disabled]
Radius Protocol
    Code: CoA-Request (43)
    Packet identifier: 0x23 (35)
    Length: 54
    Authenticator: 48bf2003edbc1a42f39c2cac65758b9a
    [The response to this request is in frame 14555]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 00000011
            Acct-Session-Id: 00000011
        AVP: l=24  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=18 t=Cisco-AVPair(1): sa=S99_SERVICE_1
                Cisco-AVPair: sa=S99_SERVICE_1
```

Packet capture for CoA ACK

```
No.     Time           Source                Destination           Protocol Length
Info
  14555 24148.577271000 172.18.88.230         172.18.88.223         RADIUS   86
CoA-ACK(44) (id=35, l=44)
```

```
Frame 14555: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface
0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:
29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 30121 (30121)
    Source port: mps-raft (1700)
    Destination port: 30121 (30121)
    Length: 52
    Checksum: 0x1a34 [validation disabled]
Radius Protocol
    Code: CoA-ACK (44)
    Packet identifier: 0x23 (35)
    Length: 44
    Authenticator: 679efc313e59b59938a531bc14e0b93f
    [This is a response to a request in frame 14554]
    [Time from request: 0.054685000 seconds]
    Attribute Value Pairs
        AVP: l=24  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=18 t=Cisco-AVPair(1): sa=S99_SERVICE_1
                Cisco-AVPair: sa=S99_SERVICE_1
```

Session information after CoA service-activate.

```
RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh subscriber  sess all de internal
Sat Jul 26 01:13:24.866 UTC
Interface:               Bundle-Ether901.100
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    IP: Static
IPv4 State:              Up, Sat Jul 26 01:11:41 2014
IPv4 Up helpers:         0x00000040 {IPSUB}
IPv4 Up requestors:      0x00000040 {IPSUB}
Mac Address:             Unknown
Account-Session Id:      00000011
Nas-Port:                2231600384
User name:               0/0/0/901_901:100
Outer VLAN ID:           901
Inner VLAN ID:           100
Subscriber Label:        0x00000050
Created:                 Sat Jul 26 01:11:41 2014
State:                   Activated
Authentication:          unauthenticated
Authorization:           authorized
Ifhandle:                0x00001360
Session History ID:      7
Access-interface:        Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Sat Jul 26 01:11:41 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Sat Jul 26 01:13:14 2014
COA Request  Attribute List: 0x500f969c
1:  sa              len= 13  value= S99_SERVICE_1
2:  command         len= 16  value= activate-service
3:  service-info    len= 13  value= S99_SERVICE_1
4:  service-name    len= 13  value= S99_SERVICE_1
```

```
Last COA response: Result ACK
COA Response  Attribute List: 0x500f98ac
1:  sa              len= 13  value= S99_SERVICE_1
User Profile received from AAA:
 Attribute List: 0x500f9abc
1:  ipv4-unnumbered len= 11  value= Loopback500
Services:
  Name        : S99_SERVICE_1
  Service-ID  : 0x4000029
  Type        : Multi Template
  Status      : Applied
-------------------------
[Event History]
   Jul 26 01:11:41.312 IPv4 Start
   Jul 26 01:11:41.440 IPv4 Up
   Jul 26 01:13:14.240 CoA request
   Jul 26 01:13:14.240 SUBDB produce done [many]

RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh policy-map applied  int bundle-e
901.100
Sat Jul 26 01:13:55.707 UTC

Input policy-map applied to Bundle-Ether901.100:

  policy-map S99_IN_POLICING_256K
   class class-default
    police rate 256 kbps
    !
   !

Output policy-map applied to Bundle-Ether901.100:

  policy-map S99_OUT_POLICING_512K
   class class-default
    police rate 512 kbps

RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh access-lists  ipv4 int bundle-e901.100
Sat Jul 26 01:14:19.126 UTC
Input ACL (common): N/A (interface): S99_ACL_in
Output ACL: S99_ACL_out


RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh subscriber  database   association
Sat Jul 26 01:15:16.933 UTC

Location 0/RSP0/CPU0

Bundle-Ether901.100, subscriber label 0x50
  Name                            Template Type
  --------                        -------------
  U00000050                       User profile
  S99_SERVICE_1                   Service

RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  running-config  <—this show command would
display the Subscriber running config (or real working config) derived from
dynamic-templates and user-profile and service-profile after reference
calculation , but unfortunately, the display has something wrong at this release of
5.1.1, but from 5.2.0 release you will find a cool display  to reflect the running
config for a session. see ddts CSCto31115.

RP/0/RSP0/CPU0:Roy_BNG_1(config-subif)#do sh subscriber  running-config
Sat Jul 26 01:14:49.040 UTC
```

```
Subscriber Label: 0x50
% No such configuration item(s) <— this should be the missing ipv4-unnumbered from
user-profile

dynamic-template
 type service S99_SERVICE_1
  ipv4 access-group S99_ACL_in ingress
 !
!

dynamic-template
 type service S99_SERVICE_1
  ipv4 access-group S99_ACL_out egress
 !
!

dynamic-template
 type service S99_SERVICE_1
  service-policy input S99_IN_POLICING_256K
 !
!

dynamic-template
 type service S99_SERVICE_1
  service-policy output S99_OUT_POLICING_512K
 !
```

6.9.Service-Deactivate

The cisco AVPair “sd=servicename” could be used in CoA request as well, to deactivate a dynamic-template (type ppp or type ipsub or type service) defined in the BNG box to a session. The dynamic-template to be deactivate could be activated via CLI or a previous radius downloading or CoA pushing of service-activate.

6.9.1.Example of a successful Service-Deactivate

session information before service-deactivate

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al de internal
Sat Jul 26 01:23:31.182 UTC
Interface:               Bundle-Ether901.100
Circuit ID:              Unknown
Remote ID:               Unknown
Type:                    IP: Static
```

```
IPv4 State:                Up, Sat Jul 26 01:11:41 2014
IPv4 Up helpers:           0x00000040 {IPSUB}
IPv4 Up requestors:        0x00000040 {IPSUB}
Mac Address:               Unknown
Account-Session Id:        00000011
Nas-Port:                  2231600384
User name:                 0/0/0/901_901:100
Outer VLAN ID:             901
Inner VLAN ID:             100
Subscriber Label:          0x00000050
Created:                   Sat Jul 26 01:11:41 2014
State:                     Activated
Authentication:            unauthenticated
Authorization:             authorized
Ifhandle:                  0x00001360
Session History ID:        7
Access-interface:          Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Sat Jul 26 01:11:41 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Sat Jul 26 01:13:14 2014
COA Request  Attribute List: 0x500f969c
1:  sa              len= 13  value= S99_SERVICE_1
2:  command         len= 16  value= activate-service
3:  service-info    len= 13  value= S99_SERVICE_1
4:  service-name    len= 13  value= S99_SERVICE_1
Last COA response: Result ACK
COA Response  Attribute List: 0x500f98ac
1:  sa              len= 13  value= S99_SERVICE_1
User Profile received from AAA:
 Attribute List: 0x500f9abc
1:  ipv4-unnumbered len= 11  value= Loopback500
Services:
  Name         : S99_SERVICE_1
  Service-ID   : 0x4000029
  Type         : Multi Template
  Status       : Applied
-------------------------
[Event History]
   Jul 26 01:11:41.312 IPv4 Start
   Jul 26 01:11:41.440 IPv4 Up
   Jul 26 01:13:14.240 CoA request
   Jul 26 01:13:14.240 SUBDB produce done [many]
```

CoA client command

```
C:\COA>coa_w32.exe -n 172.18.88.230 -p 1700 -k cisco123 -1 44,00000011 -2 26,9,1
,"sd=S99_SERVICE_1"

CoA Client (version 2.6),(c) April-2012,
xander thuijs CCIE#6775 Cisco Systems Int.

Using COA with :
```

```
NAS: ac1258e6
Port: 1700
Secret: cisco123
Timeout: 2 (0 means indefinite wait)

CoA: Request was accepted! (ID 1)

C:\COA>
```

Packet capture for CoA request

```
No.     Time           Source                Destination           Protocol Length
Info
  14973 24863.538907000 172.18.88.223         172.18.88.230         RADIUS   96
CoA-Request(43) (id=1, l=54)

Frame 14973: 96 bytes on wire (768 bits), 96 bytes captured (768 bits) on interface
0
Ethernet II, Src: Vmware_c3:a0:3a (00:0c:29:c3:a0:3a), Dst: Cisco_3a:d1:f5
(e4:c7:22:3a:d1:f5)
Internet Protocol Version 4, Src: 172.18.88.223 (172.18.88.223), Dst: 172.18.88.230
(172.18.88.230)
User Datagram Protocol, Src Port: 30442 (30442), Dst Port: mps-raft (1700)
    Source port: 30442 (30442)
    Destination port: mps-raft (1700)
    Length: 62
    Checksum: 0x5ea5 [validation disabled]
Radius Protocol
    Code: CoA-Request (43)
    Packet identifier: 0x1 (1)
    Length: 54
    Authenticator: edeb582c5e18658932e434a3b7753510
    [The response to this request is in frame 14974]
    Attribute Value Pairs
        AVP: l=10  t=Acct-Session-Id(44): 00000011
            Acct-Session-Id: 00000011
        AVP: l=24  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=18 t=Cisco-AVPair(1): sd=S99_SERVICE_1
                Cisco-AVPair: sd=S99_SERVICE_1
```

Packet capture for CoA ACK

```
No.     Time           Source                Destination           Protocol Length
Info
  14974 24863.637399000 172.18.88.230         172.18.88.223         RADIUS   86
CoA-ACK(44) (id=1, l=44)

Frame 14974: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface
0
Ethernet II, Src: Cisco_3a:d1:f5 (e4:c7:22:3a:d1:f5), Dst: Vmware_c3:a0:3a (00:0c:
29:c3:a0:3a)
Internet Protocol Version 4, Src: 172.18.88.230 (172.18.88.230), Dst: 172.18.88.223
(172.18.88.223)
User Datagram Protocol, Src Port: mps-raft (1700), Dst Port: 30442 (30442)
    Source port: mps-raft (1700)
    Destination port: 30442 (30442)
    Length: 52
    Checksum: 0xe888 [validation disabled]
Radius Protocol
    Code: CoA-ACK (44)
    Packet identifier: 0x1 (1)
```

```
    Length: 44
    Authenticator: 4ce8c15d6da1fbc48d749f9e27dff42e
    [This is a response to a request in frame 14973]
    [Time from request: 0.098492000 seconds]
    Attribute Value Pairs
        AVP: l=24  t=Vendor-Specific(26) v=ciscoSystems(9)
            VSA: l=18 t=Cisco-AVPair(1): sd=S99_SERVICE_1
                Cisco-AVPair: sd=S99_SERVICE_1
```

Session information on BNG after Service-deactivate

```
RP/0/RSP0/CPU0:Roy_BNG_1#sh subscriber  sess al  de internal
Sat Jul 26 01:25:20.360 UTC
Interface:                Bundle-Ether901.100
Circuit ID:               Unknown
Remote ID:                Unknown
Type:                     IP: Static
IPv4 State:               Up, Sat Jul 26 01:11:41 2014
IPv4 Up helpers:          0x00000040 {IPSUB}
IPv4 Up requestors:       0x00000040 {IPSUB}
Mac Address:              Unknown
Account-Session Id:       00000011
Nas-Port:                 2231600384
User name:                0/0/0/901_901:100
Outer VLAN ID:            901
Inner VLAN ID:            100
Subscriber Label:         0x00000050
Created:                  Sat Jul 26 01:11:41 2014
State:                    Activated
Authentication:           unauthenticated
Authorization:            authorized
Ifhandle:                 0x00001360
Session History ID:       7
Access-interface:         Bundle-Ether901.100
Policy Executed:

  event Session-Start match-first [at Sat Jul 26 01:11:41 2014]
    class type control subscriber class-default do-until-failure [Succeeded]
      10 authorize aaa list S99_AAA_list [cerr: No error][aaa: Success]
Session Accounting: disabled
Last COA request: Sat Jul 26 01:25:09 2014
COA Request  Attribute List: 0x500f967c
1:  sd              len= 13  value= S99_SERVICE_1
2:  command         len= 18  value= deactivate-service
3:  service-info    len= 13  value= S99_SERVICE_1
4:  service-name    len= 13  value= S99_SERVICE_1
Last COA response: Result ACK
COA Response  Attribute List: 0x500f988c
1:  sd              len= 13  value= S99_SERVICE_1
User Profile received from AAA:
 Attribute List: 0x500f9a9c
1:  ipv4-unnumbered len= 11  value= Loopback500
No Services
[Event History]
   Jul 26 01:11:41.312 IPv4 Start
   Jul 26 01:11:41.440 IPv4 Up
   Jul 26 01:25:09.248 CoA request [many]
   Jul 26 01:25:09.248 SUBDB produce done [many]

RP/0/RSP0/CPU0:Roy_BNG_1# sh subscriber database  association
```

```
Sat Jul 26 01:25:44.679 UTC

Location 0/RSP0/CPU0

Bundle-Ether901.100, subscriber label 0x50
  Name                             Template Type
  --------                         -------------
  U00000050                        User profile
```

Appendix 1 packet capture for access-request for DHCP initiated IPoE session(4.2.1 release)

```
2012/06/06 18:05:23.190715 DCHP-test1::AddPacket() Request Packet is:
                          NASPacket: 200.1.1.10.25586---->200.1.1.2.1645,
Code=1(Access-Request), ID=20
                                Vector=98 26 53 02 FA 3E 7D 96 CD 5C D2 C9 B0 49 9E
33
                                Attrib List is:
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="client-
mac-address=0015.c54b.350e", Len=33
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="dhcp-
vendor-class=MSFT 5.0", Len=26
                                Attrib=NAS-Port-Id(87,-1,-1)-String,
Value="eth0/0/1:2. 0/0/0/0/0/0", Len=23
                                Attrib=Cisco-NAS-Port(26,9,2)-String,
Value="eth0/0/1:2. 0/0/0/0/0/0", Len=23
                                Attrib=User-Name(1,-1,-1)-String, Value="MSFT 5.0",
Len=8
                                Attrib=Service-Type(6,-1,-1)-List,
Value=Outbound(00000005)
                                Attrib=User-Password(2,-1,-1)-Secret, Value="123",
Len=3
                                Attrib=Acct-Session-Id(44,-1,-1)-String,
Value="00000043", Len=8
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="parent-
if-handle=134218144", Len=26
                                Attrib=NAS-Port-Type(61,-1,-1)-List,
Value=VIRTUAL_IPOEOVLAN(0000002B)
                                Attrib=Event-Timestamp(55,-1,-1)-Integer,
Value=1339034271(4FD00A9F)
                                Attrib=NAS-Identifier(32,-1,-1)-String,
Value="AS9000BNG", Len=9
                                Attrib=NAS-IP-Address(4,-1,-1)-Address,
Value=200.1.1.10(C801010A)
                                Attrib=ai-Domain(26,999,8)-String, Value="MSFT
5.0", Len=8
```

Appendix 2 packet capture for access-request for PPPoE PTA session(4.2.1 release)

```
2012/05/28 19:24:42.633741 radius2::AddPacket() Request Packet is:
                          NASPacket: 200.1.1.10.64060---->200.1.1.2.1645,
Code=1(Access-Request), ID=25
                                Vector=AA 5A 11 5B 4C 13 8F 9B AB 47 06 79 9E 93 CE
C5
                                Attrib List is:
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="if-
handle=134218848", Len=19
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="client-
mac-address=0015.c54b.350e", Len=33
                                Attrib=NAS-Port(5,-1,-1)-Integer,
Value=16777729(01000201)
                                Attrib=NAS-Port-Id(87,-1,-1)-String, Value=".",
Len=1
                                Attrib=Cisco-NAS-Port(26,9,2)-String, Value=".",
Len=1
                                Attrib=User-Name(1,-1,-1)-String,
Value="ciscotest", Len=9
                                Attrib=Service-Type(6,-1,-1)-List,
Value=Framed(00000002)
                                Attrib=CHAP-Password(3,-1,-1)-String, Value="锆7S<鐵
暑", Len=17
                                Attrib=CHAP-Challenge(60,-1,-1)-String, Value="压w素
z涋唷傈晫", Len=16
                                Attrib=Acct-Session-Id(44,-1,-1)-String,
Value="0000004b", Len=8
                                Attrib=Ascend-Connect-Progress(196,-1,-1)-Integer,
Value=65(00000041)
                                Attrib=Cisco-AVPair(26,9,1)-String, Value="connect-
progress=LCP Open", Len=25
                                Attrib=Framed-Protocol(7,-1,-1)-List,
Value=PPP(00000001)
                                Attrib=NAS-Port-Type(61,-1,-1)-List,
Value=VIRTUAL_PPPOEOVLAN(00000024)
                                Attrib=Event-Timestamp(55,-1,-1)-Integer,
Value=1338261499(4FC43FFB)
                                Attrib=NAS-Identifier(32,-1,-1)-String,
Value="AS9000BNG", Len=9
                                Attrib=NAS-IP-Address(4,-1,-1)-Address,
Value=200.1.1.10(C801010A)
```