



## Routing Behind the Mobile Station on an APN

The following rules apply:

- AAA interface of GGSN/P-GW supports receiving "Framed Route AVP" in Radius Access-Accept Message from the Radius Server.
- AAA interface of GGSN/P-GW supports maximum 16 "Framed Route AVP" in Radius Access-Accept Message
- GGSN/P-GW does not accept framed route with destination address as 0.0.0.0 and/or netmask as 0.0.0.0.
- GGSN/P-GW does not accept framed route where gateway address in the route is not matching with the address that would be assigned to Mobile station.
- GGSN/P-GW ignores duplicate framed routes.
- GGSN/P-GW supports controlling enabling/disabling of this feature through CLI in APN Configuration.
- GGSN/P-GW supports controlling number of framed-routes to be installed through this feature.
- GGSN/P-GW supports controlling number of hosts (addresses) supported behind the mobile station per route.
- The routing behind an MS is supported only for IPv4 PDP contexts.
- Packets routed behind the MS share the same 3GPP QoS settings of the MS.
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### Feature Description

The Framed-Route attribute provides routing information to be configured for the user on the network access server (NAS). The Framed-Route information is returned to the RADIUS server in the Access-Accept message. Framed-Route can work at a context level or VRF level. VRFs can be on per enterprise and each can have its own set of framed-routes. In such configuration, framed routes will be installed in VRF's dedicated for respective enterprise. Association of Framed-Route with VRF will be done based on subscriber IP pool.

Mobile Router enables a router to create a PDN Session which the GGSN authorizes using RADIUS server. The RADIUS server authenticates this router and includes a Framed-Route attribute in the access-accept response packet. Framed-Route attribute also specifies the subnet routing information to be installed in the GGSN for the "mobile router." If the GGSN receives a packet with a destination address matching the Framed-Route, the packet is forwarded to the mobile router through the associated PDN session.

## How It Works

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- Packets routed behind the MS share the same 3GPP QoS settings of the MS.

## Configuring Routing Behind the Mobile Station

The routing behind the MS feature enables the routing of packets to IPv4 addresses that do not belong to the PDN Session (the MS), but exist behind it. The network address of the destination can be different than the MS address.

Before enabling routing behind the MS, the following requirements must be met:

- The MS must use RADIUS for authentication and authorization.
- The Framed-Route (attribute 22) as defined in Internet Engineering Task Force (IETF) standard RFC 2865, must be configured in the profile of a user and contain at least one route, and up to 16 routes for each MS that is to use the routing behind the MS feature.

When configured, the Framed-Route attribute is automatically downloaded to the GGSN during the RADIUS authentication and authorization phase of the PDN Session creation. If routing behind the MS has not been enabled using the network-behind-mobile command in access-point configuration mode, the GGSN ignores the Framed-Route attribute.

When the MS session is no longer active, the routes are deleted.

- Static routes are not configured. The configuration of the routing behind the mobile station feature (Framed Route, attribute 22) and static routes at the same time is not supported.

## Configuration Overview

To enable routing behind a Mobile Station perform the following steps:

- 
- Step 1** Create an APN Profile. Refer to [Creating an APN Profile, on page 3](#).
- Step 2** Enable or disable a Network behind Mobile Station for APN. Refer to [Enabling Routing Behind the Mobile Station, on page 3](#).
- 

## Creating an APN Profile

Use the following example to create an APN profile on the P-GW/SAEGW/S-GW:

```
config
  context context_name
    apn apn_name
  end
```

Notes:

- The apn name must be an alphanumeric string from 1 to 64 characters in length.
- Once you have created an APN profile, you will enter the Access Point Profile Configuration Mode.

## Enabling Routing Behind the Mobile Station

To enable routing behind an MS, use the following steps command in access-point configuration mode:

```
config
  network-behind-mobile { max-addresses-behind-mobile max_addr |
max-subnets max_subnets }
  { default | no } network-behind-mobile
end
```

Notes:

- **default**  
Enables the default settings for this function. It enables NBMS with max-subnets as 10 and max-addresses-behind-mobile as 16,777,214 default values.
- **no**  
Disables the network behind mobile station functionality on the APN.
- **max-addresses-behind-mobile** *max\_addr*  
Configures the maximum number of addresses that are allowed in a single Network/subnet Behind MS.
- **max-subnets** *max\_subnets*  
Specifies the maximum number of subnets that can be enabled for a call in the APN.  
*max\_subnets* must be an integer from 1 through 16.  
Default: 10

## Verifying the Routing Behind the Mobile Station

To verify the routing behind the mobile station configuration, use the following show commands.

- ```

Router show ip route vrf vpn_am2
"*" indicates the Best or Used route.  S indicates Stale.
Destination      Nexthop          Protocol  Prec Cost Interface
*17.18.19.20/32  10.7.104.2      bgp       20  0   bgp_neighbour
(nhlfe-ix:3)
*17.18.19.21/32  0.0.0.0         connected  0   0   vpn_am2lb1
*40.40.41.0/24  0.0.0.0         connected  0   0
*41.40.41.0/24  0.0.0.0         connected  0   0
*42.40.41.0/24  0.0.0.0         connected  0   0
*43.40.41.0/24  0.0.0.0         connected  0   0
*44.40.41.0/24  0.0.0.0         connected  0   0
*45.40.41.0/24  0.0.0.0         connected  0   0
*46.40.41.0/24  0.0.0.0         connected  0   0
*47.40.41.0/24  0.0.0.0         connected  0   0
*48.40.41.0/24  0.0.0.0         connected  0   0
*49.40.41.0/24  0.0.0.0         connected  0   0
*106.106.0.0/16 0.0.0.0         connected  0   0   pool pool_test_3
Total route count : 13
Unique route count: 13
Connected: 12 BGP: 1

```
- ```

show subscribers pgw-only full all
Username: starent
Subscriber Type : Visitor
Status          : Online/Active
State           : Connected
Connect Time    : Mon Oct 12 12:23:52 2015
Auto Delete     : No
Idle time       : 00h00m50s
MS TimeZone     : n/a
Daylight Saving Time: n/a
Access Type: gtp-pdn-type-ipv4
Network Type: IP
Access Tech: eUTRAN
pgw-service-name: PGW21
Callid: 0db5d3a3
IMSI: 123456789012345
Protocol Username: starent
MSISDN: 9326737733
Interface Type: S5S8GTP
Low Access Priority: N/A
Emergency Bearer Type: N/A
IMS-media Bearer: No
S6b Auth Status: N/A
Access Peer Profile: default
Acct-session-id (C1): 141414650F55554B
ThreeGPP2-correlation-id (C2): 17767C4D / 6SKDhW-2
Card/Cpu: 12/0
Sessmgr Instance: 47
Bearer Type: Default
Bearer-Id: 5
Bearer State: Active
IP allocation type: local pool
IPv6 allocation type: N/A
IP address: 106.106.0.5
Framed Routes:
40.40.41.0      255.255.255.0  106.106.0.5
41.40.41.0      255.255.255.0  106.106.0.5
43.40.41.0      255.255.255.0  106.106.0.5
44.40.41.0      255.255.255.0  106.106.0.5
45.40.41.0      255.255.255.0  106.106.0.5
46.40.41.0      255.255.255.0  106.106.0.5
47.40.41.0      255.255.255.0  106.106.0.5
48.40.41.0      255.255.255.0  106.106.0.5
49.40.41.0      255.255.255.0  106.106.0.5
42.40.41.0      255.255.255.0  106.106.0.5
ULI:
TAI-ID:
Framed Routes Source: RADIUS

```

```

MCC: 214 MNC: 365
TAC: 0x6789
ECGI-ID:
MCC: 214 MNC: 365
ECI: 0x1234567
Accounting mode: None
MEI: 1122334455667788
charging id: 257250635
Source context: EPC2
S5/S8/S2b/S2a-APN: cisco.com
SGi-APN: cisco.com
APN-OI: n/a
Restoration priority level: n/a
traffic flow template: none
IMS Auth Service : IMSGx
active input ipv4 acl: IPV4ACL
active input ipv6 acl:
ECS Rulebase: cisco
Bearer QoS:
QCI: 5
ARP: 0x04
PCI: 0 (Enabled)
PL : 1
PVI: 0 (Enabled)
MBR Uplink(bps): 0
GBR Uplink(bps): 0
PCRF Authorized Bearer QoS:
QCI: n/a
ARP: n/a
PCI: n/a
PL: n/a
PVI: n/a
MBR uplink (bps): n/a
GBR uplink (bps): n/a
Downlink APN AMBR: n/a
P-CSCF Address Information:
Primary IPv6 : n/a
Secondary IPv6: n/a
Tertiary IPv6 : n/a
Primary IPv4 : n/a
Secondary IPv4: n/a
Tertiary IPv4 : n/a
Access Point MAC Address: N/A
pgw c-teid: [0x8000002f] 2147483695
sgw c-teid: [0x50010001] 1342242817
ePDG c-teid: N/A
cgw c-teid: N/A
pgw c-addr: 2002::2:101
sgw c-addr: 2002::2:61
ePDG c-addr: N/A
cgw c-addr: N/A
Downlink APN AMBR: 16534000 bps
Mediation context: None
Mediation No Interims: Disabled
input pkts: 0
input bytes: 0
input bytes dropped: 0
input pkts dropped: 0
input pkts dropped due to lorc : 0
0
input bytes dropped due to lorc : 0
in packet dropped suspended state: 0
in bytes dropped suspended state: 0

APN Selection Mode: Sent by MS
Serving Nw: MCC=123, MNC=765
charging chars: normal
Destination context: ISPL
active output ipv4 acl: IPV4ACL
active output ipv6 acl:
MBR Downlink(bps): 0
GBR Downlink(bps): 0
MBR downlink (bps): n/a
GBR downlink (bps): n/a
Uplink APN AMBR: n/a
pgw u-teid: [0x8000002f] 2147483695
sgw u-teid: [0x60010001] 1610678273
ePDG u-teid: N/A
cgw u-teid: N/A
pgw u-addr: 20.20.20.101 2002::2:101
sgw u-addr: 2002::2:61
ePDG u-addr: N/A
cgw u-addr: N/A
Uplink APN AMBR: 16534000 bps
Mediation no early PDUs: Disabled
Mediation Delay PBA: Disabled
output pkts: 0
output bytes: 0
output bytes dropped: 0
output pkts dropped: 0
output pkts dropped due to lorc :
out packet dropped suspended state: 0
out bytes dropped suspended state: 0

```

```

    in packet dropped overcharge protection: 0      out packet dropped overcharge
protection: 0
    in bytes dropped overcharge protection: 0      out bytes dropped overcharge protection:
0
    in packet dropped sgw restoration state: 0      out packet dropped sgw restoration
state: 0
    in bytes dropped sgw restoration state: 0      out bytes dropped sgw restoration
state: 0
    pk rate from user(bps): 0                      pk rate to user(bps): 0
    ave rate from user(bps): 0                    ave rate to user(bps): 0
    sust rate from user(bps): 0                  sust rate to user(bps): 0
    pk rate from user(pps): 0                    pk rate to user(pps): 0
    ave rate from user(pps): 0                  ave rate to user(pps): 0
    sust rate from user(pps): 0                  sust rate to user(pps): 0
    link online/active percent: 65
    ipv4 bad hdr: 0
    ipv4 fragments sent: 0
    ipv4 input acl drop: 0
    ipv4 bad length trim: 0
    ipv4 input mcast drop: 0
    ipv6 input acl drop: 0
    ipv4 input css down drop: 0
    ipv4 input css down drop: 0
    ipv4 output xoff pkts drop: 0
    ipv6 output xoff pkts drop: 0
    ipv6 input ehrpd-access drop: 0
input pkts dropped (0 mbr): 0
    ip source violations: 0
    ipv6 egress filtered: 0
    ipv4 proxy-dns redirect: 0
    ipv4 proxy-dns drop: 0
    ipv4 proxy-dns redirect tcp connection: 0
    ipv6 bad hdr: 0
    ip source violations no acct: 0
    ip source violations ignored: 0
    dormancy total: 0
    ipv4 icmp packets dropped: 0
    APN AMBR Input Pkts Drop: 0
    APN AMBR Input Bytes Drop: 0

    ipv4 ttl exceeded: 0
    ipv4 could not fragment: 0
    ipv4 output acl drop: 0

    ipv4 input bcast drop: 0
    ipv6 output acl drop: 0
    ipv4 output css down drop: 0
    ipv4 output css down drop: 0
    ipv4 output xoff bytes drop: 0
    ipv6 output xoff bytes drop: 0
    ipv6 output ehrpd-access drop: 0
output pkts dropped (0 mbr): 0
    ipv4 output no-flow drop: 0

    ipv4 proxy-dns pass-thru: 0

    ipv6 bad length trim: 0

    handoff total: 0

    APN AMBR Output Pkts Drop: 0
    APN AMBR Output Bytes Drop: 0

```

# Monitoring and Troubleshooting the Routing Behind the Mobile Station

## Routing Behind the Mobile Station Show Command(s) and/or Outputs

**show apn name <apn\_name>**

```

...
proxy-mip: Disabled
proxy-mipv6: Disabled
proxy-mip null-username static home address: Disabled
Network Behind Mobile Station: Enabled
Maximum subnets behind Mobile station: 10
Maximum Addresses Behind Mobile Station: 16777214
Tunnel peer load-balancing : random
L3-to-L2 tunnel address-policy no-alloc-validate

```

```
tunnel address-policy alloc-validate  
NPU QoS Traffic Priority: Derive from packet DSCP
```

show apn name <apn\_name>