AT&T IP Flexible Reach Service and AT&T IP Toll-Free on AT&T VPN Service

Quick Start Guide for the Customer Edge Router with AT&T IP Flexible Reach Service and/or AT&T IP Toll-Free on AT&T VPN Service

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Contents

1. Introduction

This document outlines the steps required for a customer's technical team to setup and confirm network connectivity to AT&T IP Flexible Reach Service and/or AT&T IP Toll-Free on AT&T VPN Underlying Transport Service using a Customer-managed Customer Edge Router (CER). CERs can be utilized for either one of those services or for both services simultaneously. For more details and for configurations specific to each approved router platform, please reference the following AT&T document specific to your router platform:

Customer Edge Router (CER) Customer Configuration Guide (CCG) for AT&T IP Flexible Reach Service and AT&T IP Toll-Free on AVPN ("CER CCG")

These documents can be downloaded from the AT&T website under the Cisco heading:

http://www.corp.att.com/bvoip/avpn/implementation/ (login: att, password: attvoip)

Note: This Quick Start Guide is to be used as an outline for basic router setup. It is not to be used as a replacement for the CCG. Please read the CCG for more detailed instructions.

This guide covers configuring the CER for routing signaling and media traffic.

2. CER Configuration for Signaling and Media

This section covers the steps to configure the CER to route signaling and media traffic.

- First, confirm the Cisco Systems CER platform and IOS comply with those certified by AT&T (see section 1.1 of the CER CCG).
- Next, gather the IP address information (see section below).
- Configure IP networks, addressing and routing on the CER (section 2.2 below). This includes:
  - BGP to advertise the signaling network.
  - Internal route to find the Session Border Controller (SBC), if not directly connected.
- Configure CER Class of Service (CoS) and apply to the WAN interface (section 2.3 below).
- Verify the configuration using show commands (section 2.4 below).

Note: Your VoIP signaling and media traffic must be on the same physical path for the service to work properly. The configuration information assumes a single primary CER. Any use of alternate routing configurations or remote branch connectivity to other sites within the same or other AT&T VPN requires proper configuration of the signaling and media paths of the primary CER. Contact your Sales person for technical support.

2.1 Network Diagram Sample IP Addressing

The specific IP addresses for a customer order will be emailed by AT&T to the customer. The letter is titled: *"Customer Router Configuration Shipping/Confirmation".*

The emailed letter includes the IP addressing information like the following:

AT&T Provided IP Addresses:

Signaling IP Address, public, AT&T assigned (e.g. for SBC):	32.252.57.90	A host address, usually out of a /29 subnet, for customer to assign to the SBC.
Media IP Address:	32.252.57.89	A host address out of the same subnet as the signaling address. If not needed for a separate media device, use on the CER LAN interface toward the SBC or PBX.
IP Border Element (IPBE) IP Addresses:	12.194.**133**.41	Primary. Not configured on CER but must be in the routing tables at the site.
	12.194.**131**.41	Secondary. Not configured on CER but must be in the routing tables at the site.

Below is an example configuration to show where the customer should configure the IP addresses.

Figure 1 Network Diagram

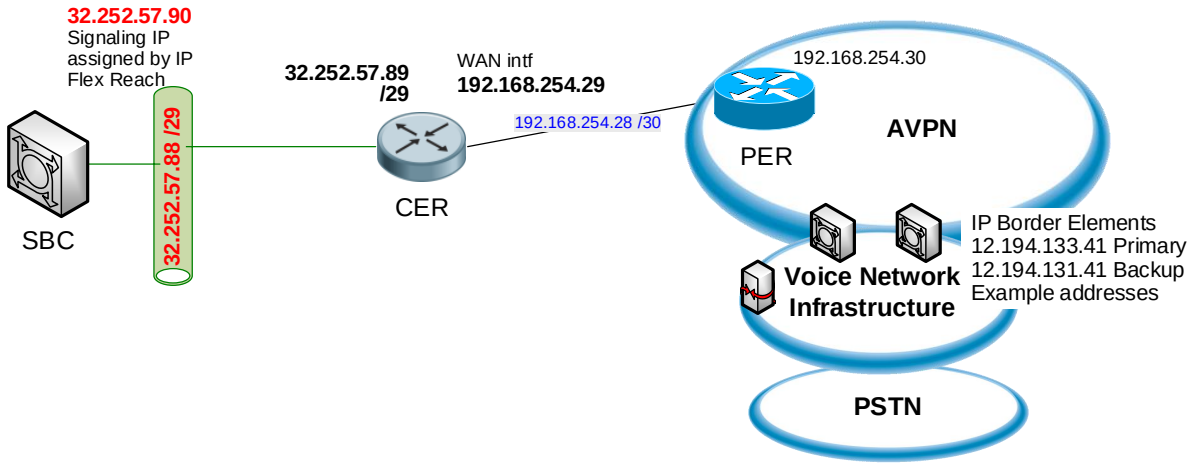
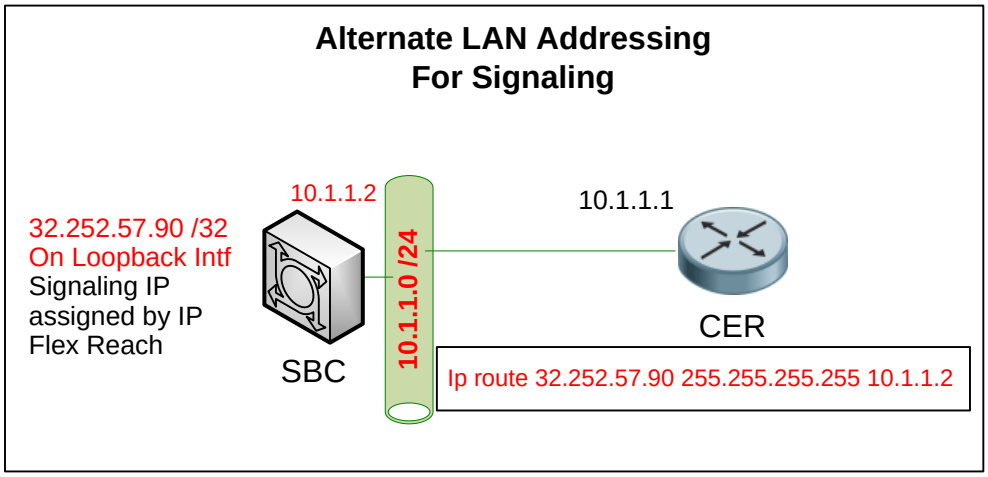
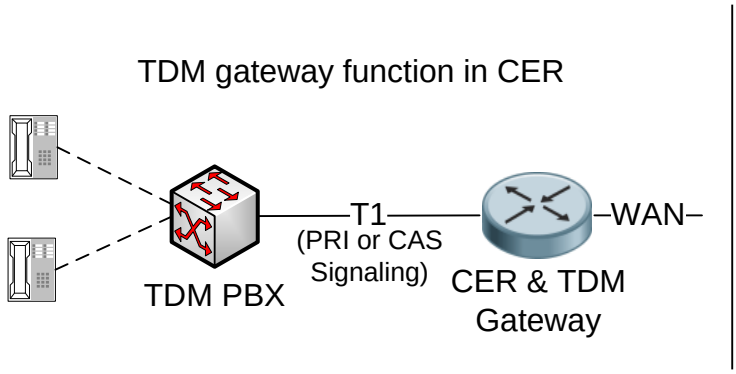


Figure 2 Alternate LAN Signaling Addressing



TDM Gateway configuration: Customers may use a TDM gateway with AT&T IP Flexible Reach Service and/or AT&T IP Toll-Free. The most common configuration is combining the TDM gateway function with the CER. Figure 3, below, shows an example network diagram.

Figure 3 TDM Gateway Diagram, with CER and Gateway Combined



Section 0 discusses configuring a TDM gateway.

2.2 Configuration Command Example

Key addresses are highlighted in yellow:

```
Int gi0/0
 ip address 32.252.57.89 255.255.255.248    ! LAN to SBC
 …

int Serial 0/1/0
 ip address 192.168.254.29 255.255.255.252  ! WAN intf to AVPN PER

router bgp <your ASN>                       ! WAN routing
 no synchronization
 bgp log-neighbor-changes
 network 32.252.57.88 mask 255.255.255.248  ! adv the LAN with the public
          signaling address(s)
 neighbor 192.168.254.30 remote-as 13979
 no auto-summary
!
ip route 32.252.57.90 255.255.255.255 <next hop internal router>
          ! alternate config (see Figure 2) for the signaling address;
          necessary only if the signaling address is not on a LAN directly
          connected to this router
```

For details on configuring CERs for the basic AVPN transport service, independent of IP Flexible Reach Service or AT&T IP Toll-Free, reference:

AT&T VPN Service Customer Router Configuration Guide

Available on AT&T *BusinessDirect* under *Insight and News, Tech Specs* or from your Sale team.

2.3 Class of Service (CoS)

Configure Class of Service (CoS) on the CER and apply to the WAN interface.

- Classify traffic by configuring access lists and then class maps (section 4.1 of the CER CCG).
- Configure the policy map appropriate for the WAN interface type (section 4.2 of the CER CCG).
- For sub-rate ports and sub-interfaces (PVCs or VLANs) configure traffic shaping (section 4.2 of the CER CCG) when applicable to the router platform. This assures that queuing occurs where you apply the CoS service policy.
- Apply the service policy to the WAN interface (section 4.3 of the CER CCG).

2.4 Verify the configuration of the CER

To determine if the CER is configured properly please check the following:

❒ ***Are the relevant interfaces up?***

Check that the appropriate WAN and LAN interfaces on the CER show "up" and "up" for both status and protocol with the "show ip interface brief" command, for example:

```
2821#sh ip interface brief

Interface              IP-Address      OK? Method Status          Protocol
GigabitEthernet0/0     32.252.57.89    YES NVRAM  up              up
Serial0/1/0            192.168.254.29  YES NVRAM  up              up
```

One of the LAN interfaces on the CER will face either a cascaded TDM Gateway (unless the TDM Gateway is combined in the CER) or an IP PBX solution. Verify that the interfaces are up with the "show ip interface brief" command.

If using compressed RTP (cRTP) with Link Fragmentation and Interleaving (LFI) on a frame relay interface with MLPPP encapsulation, one or more 'virtual-access' interfaces are created. The virtual-access interface shows the actual status of the MLPPP interface. In the show command, it may appear that more than one virtual-access interface is active for the template. For example:

```
2821#sh ip interface brief

Interface                  IP-Address      OK? Method Status          Protocol
…
Serial0/2/0                unassigned      YES NVRAM  up              up
Serial0/2/0.1              unassigned      YES unset  up              up
Serial0/2/1                unassigned      YES NVRAM  down            down
Virtual-Access1            192.168.254.29  YES TFTP   up              up
Virtual-Template1          192.168.254.29  YES NVRAM  down            down
Virtual-Access2            unassigned      YES unset  down            down
Virtual-Access3            192.168.254.29   YES TFTP   up              up
…
```

To determine the proper virtual-access interface, show the route to the next hop (PER address) with the "show ip route" command. This assumes routing is working properly. For example:

```
2821#show ip route 192.168.254.30

Routing entry for 192.168.254.30/32
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via Virtual-Access3
      Route metric is 0, traffic share count is 1
```

❒ ***Has the BGP session been established?***

Verify that a BGP session has been established between the CER and the PER (Provider Edge Router). If the BGP session is established, then the BGP neighbor IP address will be listed. Also, the BGP state will be listed as "established, up" for the

duration of time that it has been connected. If the BGP state is listed as “idle” or “active” then the BGP session is down.

For example (example shows a BGP neighbor established to a PER IP address of 195.18.31.22):

```
2821#sh ip bgp neighbor

BGP neighbor is 195.18.31.22,  remote AS 13979, external link
  BGP version 4, remote router ID 10.144.10.5
  BGP state = Established, up for 3w0d
  Last read 00:00:42, last write 00:00:02, hold time is 180, keepalive
interval is 60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    …
 …
```

Another convenient show command is:

Show ip BGP summary

(Note that “idle” and “active” in the last column means the router is still trying to establish a connection but one is not established. A number means the session is established and has received this number of prefixes from the neighbor.)

❒ ***Verify the CER is advertising the routes with BGP***

Certain IP addresses must be advertised by the CER to the WAN using “network” statements under the BGP configuration.

The IP addresses which the CER must advertise with BGP to the PER include:

1) **Signaling** IP Address: 32.252.57.90 in our example.
2) Media IP Address (if separate from signaling), 32.252.57.89 in our example.

In the following example, the PER IP address is 192.168.254.30.

```
Store70#show ip bgp neighbors 192.168.254.30 advertised-routes

BGP table version is 670, local router ID is 192.169.135.1
Status codes: s suppressed, d damped, h history, * valid, > best, i -
internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
…
*> 32.252.57.88 /29 0.0.0.0                  0         32768 ?
! [note that the 32.252.57.88/29 includes the .90 host address]
![or 32.252.57.90 /32 (and .89 /32 if used]
```

```
! Next hop of "0.0.0.0" means this router is the source of the route (i.e.
advertising this route out, not receiving it in.
```

❒ ***Verify the route from the CER to the AT&T IP Border Elements***

Customers will be assigned multiple BVoIP IP Border Element (IPBE) IP Addresses during the provisioning process. The IP Border Element IP Addresses can be located in the

"Customer Router Configuration Shipping/Confirmation" letter:

IP Border Element (IPBE) IP Addresses:

*12.194.**133**.41 (Primary) (example)*
*12.194.**131**.41 (Secondary) (example)*

Determine if the IP addresses for those Border Elements are in the routing table with the "show ip route <IP Border Element IP address>" command.

Note: The route to the IP Border Element should route through the PER. For security purposes you will not be able to ping the Border Elements IP Addresses.

```
2821#show ip route 12.194.133.41

Routing entry for 12.194.133.0/24
  Known via "bgp 65001", distance 20, metric 0
  Tag 13979, type external
  Last update from 192.168.254.30 3d20h ago
  Routing Descriptor Blocks:
  * 192.168.254.30, from 192.168.254.30, 3d20h ago
      Route metric is 0, traffic share count is 1
      AS Hops 3
```

Repeat for the additional IPBE addresses.

❒ ***Verify the signaling IP address is configured.***

Show that the CER has a route to the signaling address and ping to assure it is reachable and configured on the SBC.

If you have configured the signaling network directly attached to the CER:

```
2821#show ip route 32.252.57.88
Routing entry for 32.252.57.88 /29
  Known via "connected", distance 0, metric 0 (connected, via interface)
  Routing Descriptor Blocks:
  * directly connected, via GigabitEthernet0/0
      Route metric is 0, traffic share count is 1
…

2821#Ping 32.252.57.90
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 32.252.57.90, timeout is 2 seconds:
```

```
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
```

If you have configured the signaling address on a loopback on the SBC:

```
2821#show ip route 32.252.57.90
Routing entry for 32.252.57.90 /32
  Known via "static"   [or "EIGRP" for example]
…

2821#Ping 32.252.57.90
```

❒ ***Verify CoS is working***

Verify CoS has been configured and is working on the correct WAN interface with the "show policy-map interface" command. This command will display output if a CoS configuration is applied to an interface. If the output is blank, CoS has not been configured properly. Also verify that the class-maps have **match on some packets**.

For example:

```
2801#sh policy-map interface
 Serial 0/1
  Service-policy output: COS

    Class-map: COS1 (match-any)
      305848 packets, 22209677 bytes
      30 second offered rate 0 bps, drop rate 0 bps
      Match: access-group name RTP
        305081 packets, 21671114 bytes
        30 second rate 0 bps
      Match: access-group name SIP
        767 packets, 538563 bytes
        30 second rate 0 bps
      Queueing
        Strict Priority
        Output Queue: Conversation 40
        Bandwidth 32 (kbps) Burst 4000 (Bytes)
        (pkts matched/bytes matched) 305848/10725127
        (total drops/bytes drops) 0/0
      QoS Set
        dscp ef
          Packets marked 305848

    Class-map: COS2 (match-any)
      80683 packets, 4389538 bytes
      30 second offered rate 0 bps, drop rate 0 bps
      Match: access-group name COS2-Traffic
        0 packets, 0 bytes
        30 second rate 0 bps
      Match: access-group name BGP
        80683 packets, 4389538 bytes
        30 second rate 0 bps
      Queueing
```

```
        Output Queue: Conversation 41
        Bandwidth remaining 40 (%)Max Threshold 64 (packets)
        (pkts matched/bytes matched) 80683/4389538
        (depth/total drops/no-buffer drops) 0/0/0
      QoS Set
        dscp af31
          Packets marked 80683

      Service-policy : MARK-BGP
        Class-map: BGP (match-any)
          80683 packets, 4389538 bytes
          30 second offered rate 0 bps, drop rate 0 bps
          Match: access-group name BGP
            80683 packets, 4389538 bytes
            30 second rate 0 bps
          QoS Set
            dscp cs6
              Packets marked 80683

        Class-map: class-default (match-any)
          0 packets, 0 bytes
          30 second offered rate 0 bps, drop rate 0 bps
          Match: any

    Class-map: COS3 (match-any)
      0 packets, 0 bytes
      30 second offered rate 0 bps, drop rate 0 bps
      Match: access-group name COS3-Traffic
        0 packets, 0 bytes
        30 second rate 0 bps
      Queueing
        Output Queue: Conversation 42
        Bandwidth remaining 30 (%)Max Threshold 64 (packets)
        (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0
      QoS Set
        dscp af21
          Packets marked 0

    Class-map: class-default (match-any)
      1711 packets, 197345 bytes
      30 second offered rate 0 bps, drop rate 0 bps
      Match: any
      Queueing
        Flow Based Fair Queueing
        Maximum Number of Hashed Queues 32
        (total queued/total drops/no-buffer drops) 0/0/0
      QoS Set
        dscp default
          Packets marked 1708
```

❒ ***Verify that compression is enabled if cRTP was ordered.***

Verify compression is enabled with the “show ip rtp header-compression” command. The compression should be shown as “on”. Also verify the compressed packet counters are incrementing in both the received and sent directions when voice traffic is present.

```
2821#show ip rtp header-compression

RTP/UDP/IP header compression statistics:
We're compressing using MQC profiles, use the
MQC commands to see the stats for each class.
  Interface Virtual-Access1 (compression on, IPHC, RTP)
    Rcvd:    4045902 total, 4041070 compressed, 7 errors, 5 status msgs
             0 dropped, 0 buffer copies, 0 buffer failures
    Sent:    3400310 total, 3274292 compressed, 7 status msgs, 1206318 not
predicted
             116433530 bytes saved, 222363379 bytes sent
             1.52 efficiency improvement factor
    Connect: 1000 rx slots, 1000 tx slots,
             112536 misses, 517 collisions, 74 negative cache hits, 1000 free
contexts
             96% hit ratio, five minute miss rate 0 misses/sec, 0 max
```

3. Configure the SBC and IP PBX or TDM Gateway

After configuring the CER, you can follow the next steps:

1) For IP PBX solutions, install and configure the IP PBX and Session Border Controller. An SBC is mandatory with most solutions. Use the vendor CCG appropriate to your solution which can be found at the following link:

   http://www.corp.att.com/bvoip/avpn/implementation/ (*login: att, password: attvoip)*.

   - Additional commands are also required on the CER for interoperability with the IP PBX Solutions. For instructions, please refer to the "*Customer Edge Router CCG for Certified IP-PBX Solutions on AT&T IP Flexible Reach Service and AT&T IP Toll-Free on AT&T VPN"* at (*http://www.corp.att.com/bvoip/avpn/implementation/* (login: att, password: attvoip).

   or

2) Configure the TDM Gateway according to the TDM Gateway CCG for AT&T IP Flexible Reach Service and/or AT&T IP Toll-Free Service on AT&T VPN, specific to your router platform:

   http://www.corp.att.com/bvoip/avpn/implementation/
   login: att, password: attvoip.

   Use the appropriate guide for your router platform. The TDM Gateway can be a cascaded device or can be combined with the CER. Note: Combined solutions require Cisco ISR (Integrated Service Router) platforms. Add the additional routing commands on the CER (section 5 of the CER CCG)

This Quick Start Guide is offered to AT&T's customers as a start to, not a replacement for the Customer Configuration Guide. The specifications and information regarding the product in this Quick Start Guide are subject to change without notice. All statements, information, and recommendations in this Guide are believed to be accurate but are presented without warranty of any kind, express or implied, and are provided "As is". Users must take full responsibility for the application of the specifications and information in this Guide.

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