Planning Guide: Verizon LTE Split Data Routing, for Cisco ISR 4000, 8x9, 1900/2900/3900 Series

Overview

Verizon has offered four 3G/4G data services for enterprises to connect remote sites through Verizon Wireless Long Term Evolution (LTE):

- **Machine-to-Machine (M2M) with Internet access and dynamic IP:** This service enables a router to connect devices to the Internet or an enterprise network (via a customer premises equipment (CPE)-based VPN).
- **M2M plan with Internet access with static IP:** This service offers the same services as the previous one, except the 3G or 4G interface of each router receives a consistent predetermined IP address.
- **Mobile Private Network (MPN):** This service enables a router to connect users to an organization’s private network. Traffic does not traverse the Internet. It generally requires a customer premises-based VPN for the LTE router such as Cisco IWAN.
- **MPN with Dynamic Mobile Network Routing (DMNR):** This service enables a router to connect users to an organization’s private network without the need for customer premises-based VPN. Traffic does not traverse the Internet. Dynamic routing allows changing of local and remote IP addresses without coordination with Verizon. It can be used with any Cisco VPN option, including Group Encrypted Transport VPN.

Verizon now offers a 5th LTE data service for enterprises that combines Internet access and private network access. The new offering, Verizon LTE Split Data Routing, allows a remote LTE-connected site to directly access the Internet while also directly accessing the organization’s private network. Features include:

- A single SIM and rate plan. The service does not require multiple SIMs nor multiple LTE modems/modules.
- Direct Internet access without having to traverse the private network, providing a higher performing more efficient route (does not use private network links nor datacenter Internet gateway/security resources).

Combined with a Cisco ISR, the Verizon Split Data Routing Service:

- Allows for strong security via firewall, IPS, DNS and VRF options
- Can provide upstream quality of service (QoS) on both connections, and service level objectives on the private network connection via Verizon Private Network Traffic Management offering (PNTM)
- Combines the power of direct Internet access and Verizon’s DMNR service for the highest flexibility and design, with dynamic routing whenever an organization makes changes
This planning guide outlines the process to plan for Verizon Split Data Routing LTE service. Relevant documents are also referenced.

1. No special service is needed outside of an approved plan and a provisioned SIM (Subscriber Identity Module). However, the LTE enhanced high-speed WAN interface card (eHWIC) must be used with a Cisco Integrated Services Routers Generation 2 (ISR G2) router (Cisco 1900, 2900, or 3900 Series Integrated Services Router) whether provided by a Verizon/Cisco demonstration loan program or by your organization. For the CGR-2010 the LTE GRWIC is required. For the ISR 4K the LTE NIM is required. For the 819, 829, 899, the LTE interface is integrated.

2. Ensure you have a subscriber identity module (SIM/USIM/Mini-SIM or Micro SIM that is appropriate for the ISR and module being used:
   a. Verizon SKU "DIRECTSIM4G-D" for LTE NIM/eHWIC/GRWIC/CGM, 819, 899, 809, 829
   b. Verizon SKU “DFILLSIM3FF-A” for NIM-LTE-A

3. Ensure the SIM is properly provisioned:
   a. The SIM (its phone number, e.g. MDN/MSISDN) must be provisioned and associated with the international mobility equipment identity (IMEI) of the ISR LTE modem before activation on an approved plan.
      i. The IMEI information is available via Cisco Commerce Workspace shipment details or via "sh cell x hardware" command on the ISR.
      ii. If this ISR is a demonstration unit provided by Verizon Wireless, an appropriately provisioned SIM should be included as part of the package sent to you.
   b. The APNs will need to be set manually. OTA-DM will not automatically set the APNs. Your Verizon Wireless representative can provide the APN information. No username or password is set for the APNs

4. Insert the SIM using the instructions found at
   The GRWIC on CGR is similar. The 819 has a small SIM panel underneath. The 809/829 have external slots.

5. Install the eHWIC/NIM/GRWIC/CMG module into the ISR/CGR (modular platforms only).
   a. The instructions to physically install the LTE eHWIC or NIM into the ISR are at
      The CGR-2010 is similar. The 8x9 ISRs have the LTE already integrated.
   b. Install the LTE eHWIC/NIM into the right-most eHWIC slot (looking at the rear of the ISR, slot 0/0).

Figure 1. LTE eHWIC
6. Power up the ISR and ensure that the antennas are positioned appropriately.
   a. With terminal or console access to the ISR (logging the terminal console is recommended):
      di. Hit Enter, and log in if the ISR has already been configured. If the unit is new, no ID or password may
         be set. If a new unit prompts for user/id/password, try cisco/cisco. If there is, follow the instructions to
      ii. At the console prompt type “enable”. Position antennas for the best RSSI signal > -80 dBm and RSRP
          signal > - 105 dBm, with the show cell 0/0/0 radio command (show cell 0 radio for 819).
      iii. Type “sh cell 0/x/0 hardware (cell 0 for 819) and “show version”, and ensure that the recommended
           Cisco IOS® Software version is running. The generally recommended Cisco IOS software release
           depends on the LTE modem firmware level (seen via “show cell 0/x/0|0 hardware” command).
           The SKUs below are approved or will be tested for operation with Verizon Split Data Routing.

<table>
<thead>
<tr>
<th>ISR LTE SKU</th>
<th>LTE Modem</th>
<th>Recommended firmware</th>
<th>Recommended IOS Release</th>
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<tbody>
<tr>
<td>EHWIC-4G-LTE-VZ</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
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<tr>
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<td>EMM7455</td>
<td>02.20.03.22</td>
<td>16.6.1A</td>
</tr>
</tbody>
</table>

iv. Type “show run” to see if the configuration matches the configuration guide on the following pages.

v. If the configuration does not match the provided configuration, add or change the appropriate lines
   through the command-line interface (CLI) config t, etc. Note: The cell interface's IP address is always
   defined as "ip address negotiated" as the network always assigns it (even with persistent addressing).
7. Set the APNs appropriately for both public and private networks
   a. Verizon Split Data Routing allows for 2 active data connections, 1 public Internet, 1 private
      network, via connection to 2 separate Packet Data Networks (PDNs). These connections are
      defined by the appropriate LTE modem profiles. There is a separate ISR interface associated
      with each connection (cell 0 and 1 for 8xx, cell 0/x/0 and 0/x/1 for modular ISRs).
   b. If a new deployment, the Internet APN (profile 3) will already be set. The private APN is defined
      via IOS enable-mode command. The profile number is different for ISR 4K vs ISR 8xx.
      For 8xx: cell 0 lte profile create 6 <theapnvalue> <enter> <enter> <enter>
      For 4K: cell 0/x/0 lte profile create 4 <theapnvalue> <enter> <enter> <enter>
   c. If this ISR is an existing deployment, profile 3 is in use for the private network. Both the Internet
      profile and private network profile are defined via IOS enable-mode command.
      For both: cell 0 lte profile create 3 VZWINTERNET none ipv4v6 <enter> <enter> <enter>
      For 8xx: cell 0 lte profile create 6 <theapnvalue> <enter> <enter> <enter>
      For 4K: cell 0/x/0 lte profile create 4 <theapnvalue> <enter> <enter> <enter>
   d. The Cisco IOS Software command show cellular 0/x/0 profile displays the APN (show cellular
      0 profile for the 8x9).

8. Connect both antennas (at least one with an antenna extension cable) to the LTE eHWIC/NIM/GRWIC/8x9.
   The antennas should be at least 2 feet apart. Instructions can be found in the section “Additional Information”.

9. If the LTE connection becomes active but then begins to flap (repeats going down and up periodically,
    usually every 5 to 60 seconds), a configuration problem must be resolved.
   a. This behavior can be caused by a network disconnect due to IP source address violations. It is
      resolved by reconfiguring the traffic to be tunneled, NAT, or access control lists (ACLs) so that no
      traffic is routed without being tunneled or subjected to NAT. If you cannot determine which IP
      address is causing the IP source violation, contact the Verizon Wireless Enterprise Help Desk
      (800 922-0204) and ask them to trace the call and report the IP address that is causing the
      problem. Then correct or add NAT, ACL, or VPN to stop any packets with a source address other
      than the LTE eHWIC IP address from leaking out.

10. See the configurations and display output in the sections below. Note that these configurations are for LTE only,
    and do not include security. As the ISR is connected to both the Internet and private network,
    strong security should be enabled on the ISR. The following page reviews available ISR security features
Additional Information

- Cisco LTE Portal: [www.cisco.com/go/4g](http://www.cisco.com/go/4g)
- Verizon planning/configuration documents:
- LTE eHWIC hardware overview, SIM install, antenna connection, and module install:
- LTE NIM hardware overview, SIM install, antenna connection, and module install:
- LTE eHWIC Cisco IOS Software configuration (use the Verizon planning/configuration documents):
- LTE NIM Cisco IOS Software configuration (use the Verizon planning/configuration documents):
- LTE eHWIC antenna, cabling, and lightning arrester instructions:
High-Level Network Diagram

The traffic to/from the public network is logically separate from the traffic to/from the private network, between the ISR cellular interface and destination. Behind the ISR cellular interfaces, traffic can be logically separated using VRFs, policy-based routing, access control lists, and zone-based firewall SR functions.

Both LTE interfaces will send and receive traffic based on the ISR routing configuration. This is no different than wireline ISR interfaces. All ISR techniques are available to be used with cellular interfaces; however their use depends on configuration:

- Private Network APN:
  - NeMo (Verizon DMNR service). Provides a default route, marked as an M (mobile) route. The organization's private LTE network peers with LTE ISRs and advertises the appropriate networks behind each LTE ISR to the organization's private wireline network. The configuration examples shown are for Verizon DMNR service with the private network APN.
  - IGP (interior gateway routing protocols such as EIGRP and OSPF) can be used only if tunneled (i.e. DMVPN, FlexVPN, GRE) between each LTE ISR and the organization’s VPN head end.
  - Policy-Based Routing (PBR) in conjunction with one of the two methods above

- Public Internet APN:
  - Static routes with NAT (Network Address Translation)
  - Policy-Based Routing (PBR) with NAT

Recommendations for Split Data Routing with MPN and CPE-based VPN Tunnels (DMVPN, FlexVPN, etc.)

- Use an IGP (OSPF, EIGRP, etc.) within the Tunnel over the cellular interface to the LTE private network to receive specific route advertisements from the wireline VPN head end. This provides for routing to the private network without receiving a default route from the private network.
- Use a static default route pointing to the LTE interface to the public Internet. Thus any traffic not destined to the private network will be forwarded to the Internet via a single configuration line
  - Example: “ip route 0.0.0.0 0.0.0.0 cell 0” for 8x9, “ip route 0.0.0.0 0.0.0.0 0.0.0.0 cell 0/x/0” for ISR 4K.
Recommendations for Split Data Routing with MPN and DMNR (NeMo)

- Verizon Dynamic Network Mobile Routing (DMNR) offers organizations LTE network routing/advertising that is simple, cost effective (no VPN tunnel head end equipment to acquire, maintain, manage), highly scalable (from ten to tens of thousands of LTE routers) and dynamic (add a subnet to the remote router, it is automatically advertised and reachable across the private wireline network).

- However, the LTE router receives a default route from the private network. There are 2 ways to direct traffic to public cloud services on the Internet

1. Override the dynamically assigned default route to the private network with a static default route to the public network (cell 0 or cell 0/x/0); define static routes pointing to the private network (cell 0 or cell 0/x/1).
   a. Example: “ip route 0.0.0.0 0.0.0.0 cell 0” for 8x9, “ip route 0.0.0.0 0.0.0.0 cell 0/0/0” for ISR 4K
   b. Example: “ip route 10.0.0.0 255.0.0.0 cell 1” 8x9, “ip route 10.0.0.0 255.0.0.0 cell 0/0/1” ISR 4K

2. Leave in place the static default route for interface cell 1 (8x9) or 0/x/1 (modular ISR) to the private network. Define static routes to cover the publicly routable IP space via cell 0 (8x9) or 0/x/0 (modular ISR).
   a. A set of static routes accomplishing this is included in each configuration example and the display output in this guide.

NAT is always required for the Public Internet APN. Verizon provides one IP address (actually one IPv4 and one IPv6) to the ISR cell interface representing the public Internet connection. The NAT technique NPAT or PAT is used so that multiple users/devices can access the Internet via the single LTE IP address. This is also a common configuration for many broadband Internet connections.

The “show running-config” is provided for an ISR 4000 and 819. Other platforms will be similar (1900/2900/3900, 899). Only the configuration commands pertinent to LTE and IP routing are shown. Full configurations for various LTE scenarios can be found in the guides here:  

Display output (show command results) is subsequently provided for both platforms.
ISR 4000 Series NIM-LTEA-EA Split Data Routing/Dual APN Configuration

### command allowing for “LTE test cellular” enable mode commands ###

service internal
!
hostname c4321-4G
!
### load appropriate IOS image ###

boot system bootflash:isr4300-universalk9.16.03.03.SPA.bin
!
interface Loopback1234
   description ### NEMO Router Home Address
   ip address 1.2.3.4 255.255.255.255
!
### The maximum TCP MSS is set to 1390 bytes to allow for GRE, IPsec and other network overhead. The route-map clears DF bits in the IP headers. ###

interface GigabitEthernet0/0/0
   ip address 10.250.1.1 255.255.255.0
   ip nat inside
   ip tcp adjust-mss 1390
   ip policy route-map clear-df
   load-interval 30
   media-type rj45
   negotiation auto
!
interface GigabitEthernet0/0/1
   ip address 10.0.3.1 255.255.255.0
   ip nat inside
   ip tcp adjust-mss 1390
   ip policy route-map clear-df
   load-interval 30
   negotiation auto
!
### Interface Cellular – 0/x/0 x depends on ISR slot. This interface is for the Internet PDN. Connection is activated using dialer watch list 1. ###

interface Cellular0/1/0
   ip address negotiated
   no ip unreachable
   ip nat outside
   ip tcp adjust-mss 1390
   load-interval 30
dialer in-band
dialer idle-timeout 0
dialer enable-timeout 2
dialer watch-group 1
   pulse-time 1
!
### Interface Cellular – 0/x/1 x depends on ISR slot. This interface is for the private network PDN. Connection activated via dialer watch list 2. NAT not needed as all traffic sent in the NeMo (IP Mobile Router) tunnel. ###


interface Cellular0/1/1
ip address negotiated
no ip unreachables
ip mobile router-service roam
ip mobile router-service collocated ccoa-only
ip tcp adjust-mss 1390
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer enable-timeout 2
dialer watch-group 2
pulse-time 1

!### This stanza enables NEMO Routing. Admin distance can be adjusted ###
!router mobile
distance 33

!### This NAT statement ensures all traffic leaving the ISR is sourced with the IP address of the LTE cellular interface, to avoid auto-disconnection by the network. All traffic appears to come from the LTE IP address. ###

ip nat inside source list 100 interface Cellular0/1/0 overload

!### This ACL enables NATing of traffic leaving the cell interface. “Permit ip any any” is no longer supported. This example will NAT any packet with the source address’s 1st octet having an even number (including 10.x.x.x 172.x.x.x and 192.x.x.x, a superset of RFC1918 addresses). ###
access-list 100 permit ip 0.0.0.0 254.255.255.255 any

!### These static routes send all traffic destined to Internet routable destinations via the LTE Internet connection/interface. This is the 2nd option mentioned earlier, leaving the M/Mobile IP default route in place ###
ip route 0.0.0.0 248.0.0.0 Cellular0/1/0
ip route 8.0.0.0 254.0.0.0 Cellular0/1/0
ip route 11.0.0.0 255.0.0.0 Cellular0/1/0
ip route 12.0.0.0 254.0.0.0 Cellular0/1/0
ip route 14.0.0.0 254.0.0.0 Cellular0/1/0
ip route 16.0.0.0 240.0.0.0 Cellular0/1/0
ip route 32.0.0.0 224.0.0.0 Cellular0/1/0
ip route 64.0.0.0 192.0.0.0 Cellular0/1/0
ip route 128.0.0.0 224.0.0.0 Cellular0/1/0
ip route 160.0.0.0 240.0.0.0 Cellular0/1/0
ip route 168.0.0.0 248.0.0.0 Cellular0/1/0
ip route 172.0.0.0 255.240.0.0 Cellular0/1/0
ip route 172.33.0.0 255.255.0.0 Cellular0/1/0
ip route 172.34.0.0 255.254.0.0 Cellular0/1/0
ip route 172.36.0.0 255.254.0.0 Cellular0/1/0
ip route 172.38.0.0 255.254.0.0 Cellular0/1/0
ip route 172.40.0.0 255.248.0.0 Cellular0/1/0
ip route 172.56.0.0 255.248.0.0 Cellular0/1/0
ip route 172.64.0.0 255.192.0.0 Cellular0/1/0
ip route 172.128.0.0 255.128.0.0 Cellular0/1/0
ip route 173.0.0.0 255.0.0.0 Cellular0/1/0
ip route 174.0.0.0 254.0.0.0 Cellular0/1/0
ip route 176.0.0.0 254.255.0.0 Cellular0/1/0
ip route 192.0.0.0 255.128.0.0 Cellular0/1/0
ip route 192.128.0.0 255.224.0.0 Cellular0/1/0
ip route 192.160.0.0 255.248.0.0 Cellular0/1/0
ip route 192.169.0.0 255.255.0.0 Cellular0/1/0
ip route 192.170.0.0 255.254.0.0 Cellular0/1/0
ip route 192.172.0.0 255.252.0.0 Cellular0/1/0
ip route 192.176.0.0 255.248.0.0 Cellular0/1/0
ip route 192.192.0.0 255.192.0.0 Cellular0/1/0
ip route 192.224.0.0 255.224.0.0 Cellular0/1/0
ip route 193.0.0.0 255.0.0.0 Cellular0/1/0
ip route 194.0.0.0 255.0.0.0 Cellular0/1/0
ip route 196.0.0.0 252.0.0.0 Cellular0/1/0
ip route 200.0.0.0 248.0.0.0 Cellular0/1/0
ip route 208.0.0.0 248.0.0.0 Cellular0/1/0
ip route 216.0.0.0 248.0.0.0 Cellular0/1/0

!### This command configures NEMO Authentication with EXGW. Use the appropriate EXGW IP address based on the geographic location (page 3). Note that SPI and KEY must match to what is set on the EXGW under the NEMO service. Note that the algorithm must be set to "hmac-md5". ###
ip mobile secure home-agent 66.174.XXX.XXX spi decimal 256 key ascii VzWNeMo
algorithm hmac-md5

!### This section configures the NEMO Mobile Router parameters and defines what router interfaces and their subnets to be included into the NEMO registration with EXGW. Use the appropriate EXGW IP address as above. ###

ip mobile router
address 1.2.3.4 255.255.255.0
collocated single-tunnel
home-agent 66.174.XXX.XXX
mobile-network GigabitEthernet0/0/1
mobile-network GigabitEthernet0/0/0
non-connected-network 192.168.222.0 255.255.255.0
register extend expire 10 retry 3 interval 5
reverse-tunnel
tunnel mode gre

!### This route-map clears the DF-bit in IP packets that come into the ISR from the Gigabit Ethernet interfaces. ###
route-map clear-df permit 10
set ip df 0

!### This section defines the LTE call activation triggers and timers. ###
### The LTE connection for cell 0/x/0 will be triggered by this statement. The address “5.6.7.8” is a “dummy” route. Any “dummy” value can be used. ###
dialer watch-list 1 ip 5.6.7.8 0.0.0.0
### The ISR will wait 60 sec. before activating LTE after initial boot. ###
dialer watch-list 1 delay route-check initial 60
### The ISR will wait 1 sec. before activating the call. ###
dialer watch-list 1 delay connect 1
### These watch-list commands are for interface cell 0/x/1
dialer watch-list 2 ip 5.6.7.8 0.0.0.0
dialer watch-list 2 delay route-check initial 60
dialer watch-list 2 delay connect 1
end
ISR 819/899 Split Data Routing/Dual APN Configuration

!### command allowing for “LTE test cellular” enable mode commands ###
service internal
!
hostname 819-XL
!
!### load appropriate IOS image ###
boot system flash:c800-universalk9-mz.SPA.156-3.M2.bin
!
ip cef
!
!### CHAT Script to make a data call ###
chat-script lte "" "AT!CALL1" TIMEOUT 20 "OK"
!
!### This Loopback address used to source pings for testing purposes. ###
!
interface Loopback1
description ### always-on interface ###
ip address 1.2.3.22 255.255.255.255
ip nat inside
!
!### The maximum TCP MSS is set to 1390 bytes to allow for GRE, IPsec and other network overhead. The route-map clears DF bits in the IP headers. ###
!
interface VLAN1
ip address 172.21.22.1 255.255.255.0
ip nat inside
ip tcp adjust-mss 1390
ip policy route-map clear-df
!
!### Interface Cell 0 is the interface is for the Internet PDN. Connection is activated using dialer watch list 1. ###
!
interface Cellular0
ip address negotiated
no ip unreachables
ip nat outside
encapsulation slip
ip tcp adjust-mss 1390
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer string lte
dialer watch-group 1
no peer default ip address
async mode interactive
pulse-time 0
routing dynamic
!
!### Interface Cellular – 0/x/1 x depends on ISR slot. This interface is for the private network PDN. Connection activated via dialer watch list 2. NAT not needed as all traffic sent in the NeMo (IP Mobile Router) tunnel. ###
!
interface Cellular1
  ip address negotiated
  no ip unreachable
  ip mobile router-service roam
  ip mobile router-service collocated ccoa-only
  ip virtual-reassembly in
  encapsulation slip
  ip tcp adjust-mss 1390
  load-interval 30
  dialer in-band
  dialer idle-timeout 0
  dialer string lte
  dialer watch-group 2
  no peer default ip address
  async mode interactive
  pulse-time 0
  routing dynamic

!### This stanza enables NEMO Routing. Admin distance can be adjusted ###
!
!### This command configures NEMO Authentication with EXGW. Use the appropriate EXGW IP address based on the geographic location (page 3). Note that SPI and KEY must match to what is set on the EXGW under the NEMO service. Note that the algorithm must be set to “hmac-md5”. ###
!
router mobile
  distance 111

!### This NAT statement ensures all traffic leaving the ISR is sourced with the IP address of the LTE cellular interface, to avoid auto-disconnection by the network. All traffic appears to come from the LTE IP address. ###
!
ip nat inside source list 100 interface Cellular0 overload

!### This ACL enables NATing of traffic leaving the cell interface. “Permit ip any any” is no longer supported. This example will NAT any packet with the source address’s 1st octet having an even number (including 10.x.x.x 172.x.x.x and 192.x.x.x, a superset of RFC1918 addresses). ###
!
access-list 100 permit ip 0.0.0.0 254.255.255.255 any

!### These static routes send all traffic destined to Internet routable destinations via the LTE Internet connection/interface. This is the 2nd option mentioned earlier, leaving the M/Mobile IP default route in place ###
!
ip route 0.0.0.0 248.0.0.0 Cellular0
ip route 8.0.0.0 254.0.0.0 Cellular0
ip route 11.0.0.0 255.0.0.0 Cellular0
ip route 12.0.0.0 254.0.0.0 Cellular0
ip route 14.0.0.0 254.0.0.0 Cellular0
ip route 16.0.0.0 240.0.0.0 Cellular0
ip route 32.0.0.0 224.0.0.0 Cellular0
ip route 64.0.0.0 192.0.0.0 Cellular0
ip route 128.0.0.0 224.0.0.0 Cellular0
ip route 160.0.0.0 240.0.0.0 Cellular0
ip route 168.0.0.0 248.0.0.0 Cellular0
ip route 172.0.0.0 255.240.0.0 Cellular0
ip route 172.33.0.0 255.255.0.0 Cellular0
ip route 172.34.0.0 255.254.0.0 Cellular0
ip route 172.36.0.0 255.254.0.0 Cellular0
ip route 172.40.0.0 255.248.0.0 Cellular0
ip route 172.56.0.0 255.248.0.0 Cellular0
ip route 172.64.0.0 255.192.0.0 Cellular0
ip route 172.128.0.0 255.128.0.0 Cellular0
ip route 173.0.0.0 255.0.0.0 Cellular0
ip route 174.0.0.0 254.0.0.0 Cellular0
ip route 176.0.0.0 255.240.0.0 Cellular0
ip route 192.0.0.0 255.128.0.0 Cellular0
ip route 192.128.0.0 255.224.0.0 Cellular0
ip route 192.160.0.0 255.248.0.0 Cellular0
ip route 192.169.0.0 255.255.0.0 Cellular0
ip route 192.170.0.0 255.254.0.0 Cellular0
ip route 192.172.0.0 255.252.0.0 Cellular0
ip route 192.176.0.0 255.248.0.0 Cellular0
ip route 192.192.0.0 255.192.0.0 Cellular0
ip route 192.224.0.0 255.224.0.0 Cellular0
ip route 193.0.0.0 255.0.0.0 Cellular0
ip route 194.0.0.0 254.0.0.0 Cellular0
ip route 196.0.0.0 252.0.0.0 Cellular0
ip route 200.0.0.0 248.0.0.0 Cellular0
ip route 208.0.0.0 248.0.0.0 Cellular0
ip route 216.0.0.0 248.0.0.0 Cellular0

!### This section configures the NEMO Mobile Router parameters and defines what router interfaces and their subnets to be included into the NEMO registration with EXGW. Use the appropriate EXGW IP address as above. ###!

ip mobile secure home-agent 66.174.XXX.XXX spi decimal 256 key ascii VzWNcop algorithm hmac-md5

ip mobile router
address 1.2.3.22 255.255.255.255
collocated single-tunnel
home-agent 66.174.XXX.XXX
mobile-network Loopback100
mobile-network Vlan1
non-connected-network 172.30.30.0 255.255.255.0
register extend expire 10 retry 3 interval 5
reverse-tunnel
tunnel mode gre

!### Route-map clears DF-bit in packets to exit via the LTE interface. ###!

route-map clear-df permit 10
set ip df 0

!### This section defines the LTE call activation triggers and timers. ###!

!
The LTE connection for cell 0 will be triggered by this statement. The address “5.6.7.8” is a “dummy” route. Any “dummy” value can be used. ###
dialer watch-list 1 ip 5.6.7.8 0.0.0.0
!
!!! Wait for 60 sec. before activating the call after the initial boot. !!!
dialer watch-list 1 delay route-check initial 60
!
!!! The ISR will wait 1 sec. before activating the call. !!!
dialer watch-list 1 delay connect 1
!
!!! These watch-list commands are for interface cell 1
!  
dialer watch-list 2 ip 5.6.7.8 0.0.0.0
  
dialer watch-list 2 delay route-check initial 60
  
dialer watch-list 2 delay connect 1
!
!!! chat script “lte” is also called by the line interface
!
  line 3
  script dialer lte
    modem InOut
    no exec
    transport input ssh
  
end
Operation and Show Commands for ISR 4000 Series and LTE-A NIM

C4321-4G#### Some public addresses have been hidden via “XXXX”
C4321-4G#### Existing Deployment Example
C4321-4G# sh cell 0/1/0 profile

Profile 1 = INACTIVE **
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
--------
PDP Type = IPv4
PDP address = 10.1.1.18
Access Point Name (APN) = CISCO.GW4.VZWENTP
Authentication = None
  Primary DNS address = 171.70.168.XXX
  Secondary DNS address = 173.36.131.XXX
  Primary DNS IPV6 address = 0
  Secondary DNS IPV6 address = 0

Profile 4 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
Authentication = None

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

* - Default profile
** - LTE attach profile
C4321-4G#cell 0/1/0 lte profile create 3 VZWINTERNET ?
  chap       CHAP authentication only
  none       No authentication
  pap        PAP authentication only
  pap_chap   PAP or CHAP authentication
  <cr>

C4321-4G#cell 0/1/0 lte profile create 3 VZWINTERNET none ?
  ipv4       IPv4 type Bearer
  ipv4v6     IPV4V6 type Bearer
  ipv6       IPV6 type Bearer
  <cr>

C4321-4G#cell 0/1/0 lte profile create 3 VZWINTERNET none ipv4v6 ?
  <cr>

C4321-4G#cell 0/1/0 lte profile create 3 VZWINTERNET none ipv4v6
Warning: You are attempting to modify a currently ACTIVE data profile.
This is not recommended and may affect the connection state

PDP Type = IPv4
Access Point Name (APN) = CISCO.GW4.VZWENTP
Authentication = NONE

Profile 3 already exists with above parameters. Do you want to overwrite? [confirm]

Profile 3 will be overwritten with the following values:

PDP type = IPv4v6
APN = VZWINTERNET
Authentication = NONE

Are you sure? [confirm]
Profile 3 written to modem
C4321-4G#
C4321-4G#
C4321-4G#cellu 0/1/0 lte profile create 4 cisco.gw4.vzwentp none ipv4

PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
Authentication = NONE

Profile 4 already exists with above parameters. Do you want to overwrite? [confirm]
Profile 4 will be overwritten with the following values:

PDP type = IPv4
APN = cisco.gw4.vzwentp
Authentication = NONE

Are you sure? [confirm]n
Profile 4 written to modem
C4321-4G#
C4321-4G#sh cell 0/1/0 all
Hardware Information
====================================
Modem Firmware Version = SWI9X30C_02.20.03.22
Modem Firmware built = 2016/10/11 16:03:14
Hardware Version = 1.0
Device Model ID: EM7455
International Mobile Subscriber Identity (IMSI) = 311480148781216
International Mobile Equipment Identity (IMEI) = 356129070053217
Integrated Circuit Card ID (ICCID) = 89148000001470156554
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) = 408649XXXX
Modem Status = Modem Online
Current Modem Temperature = 36 deg C
PRI SKU ID = 1102526, PRI version = 002.026_000, Carrier = Verizon
OEM PRI version = 006

Profile Information
====================
Profile 1 = INACTIVE **
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
PDP type = IPv4v6
PDP address = 72.105.30.XXX
PDP IPV6 address = 2600:1002:B02D:XXXX:CC49:42FF:FE46:908/64  Scope: Global
PDP IPV6 address = FE80:0:0:0:CC49:42FF:FE46:908/64  Scope: Link
Access Point Name (APN) = VZWINTERNET
Authentication = None
  Primary DNS address = 198.224.188.XXX
  Secondary DNS address = 198.224.189.XXX
  Primary DNS IPV6 address = 2001:4888:15:XXXX:194:D:0:0
  Secondary DNS IPV6 address = 2001:4888:14:XXXX:196:D:0:0

Profile 4 = ACTIVE
--------
PDP Type = IPv4
PDP address = 10.1.1.18
Access Point Name (APN) = cisco.gw4.vzwentp
Authentication = None
  Primary DNS address = 171.70.168.XXX
  Secondary DNS address = 173.36.131.XXX
  Primary DNS IPV6 address = 0
  Secondary DNS IPV6 address = 0

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

Configured default profile for active SIM 0 is profile 3.

Data Connection Information
----------------------------
Profile 1, Packet Session Status = INACTIVE
Profile 2, Packet Session Status = INACTIVE
Profile 3, Packet Session Status = ACTIVE
  Cellular0/1/0:
    Data Transmitted = 1440 bytes, Received = 1539 bytes
    IP address = 72.105.30.XXX
    IPV6 address = 2600:1002:B02D:XXXX:CC49:42FF:FE46:908/64  Scope: Global
    IPV6 address = FE80:0:0:0:CC49:42FF:FE46:908/64  Scope: Link
    Primary DNS address = 198.224.188.XXX
    Secondary DNS address = 198.224.189.XXX
    Primary DNS IPV6 address = 2001:4888:15:XXXX:194:D:0:0
    Secondary DNS IPV6 address = 2001:4888:14:XXXX:196:D:0:0

Profile 4, Packet Session Status = ACTIVE
  Cellular0/1/1:
Data Transmitted = 1496 bytes, Received = 264 bytes
IP address = 10.1.1.18
Primary DNS address = 171.70.168.XXX
Secondary DNS address = 173.36.131.XXX
Profile 5, Packet Session Status = INACTIVE
Profile 6, Packet Session Status = INACTIVE
Profile 7, Packet Session Status = INACTIVE
Profile 8, Packet Session Status = INACTIVE
Profile 9, Packet Session Status = INACTIVE
Profile 10, Packet Session Status = INACTIVE
Profile 11, Packet Session Status = INACTIVE
Profile 12, Packet Session Status = INACTIVE
Profile 13, Packet Session Status = INACTIVE
Profile 14, Packet Session Status = INACTIVE
Profile 15, Packet Session Status = INACTIVE
Profile 16, Packet Session Status = INACTIVE

Network Information

Current System Time = Tue May 30 17:0:22 2017
Current Service Status = Normal
Current Service = Packet switched
Current Roaming Status = Home
Network Selection Mode = Automatic
Network = VzW
Mobile Country Code (MCC) = 311
Mobile Network Code (MNC) = 480
Packet switch domain(PS) state = Attached
LTE Carrier Aggregation state = Deconfigured
Registration state(EMM) = Registered
EMM Sub State = Normal Service
Tracking Area Code (TAC) = 25856
Cell ID = 25932322

Radio Information

Radio power mode = online
LTE Rx Channel Number = 1000
LTE Tx Channel Number = 19000
LTE Band = 2
LTE Bandwidth = 10 MHz
Current RSSI = -76 dBm
Current RSRP = -98 dBm
Current RSRQ = -11 dB
Current SNR = 14.4 dB
Physical Cell Id = 227
Number of nearby cells = 1
Idx      PCI (Physical Cell Id)
--------------------------------
  1              227

Radio Access Technology(RAT) Preference = AUTO
Radio Access Technology(RAT) Selected = LTE

Modem Security Information
==================================
Active SIM = 0
SIM switchover attempts = 0
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3

Cellular Firmware List
==================================
Idx Carrier      FwVersion    PriVersion   Status
1   ATT          02.20.03.00  002.019_000  Inactive
2   GENERIC      02.20.03.00  002.017_000  Inactive
3   SPRINT       02.20.03.22  002.020_000  Inactive
4   VERIZON      02.20.03.22  002.026_000  Active

Firmware Activation mode : AUTO

GPS Information
==================================
GPS Feature: enabled
GPS Mode Configured: not configured
GPS Status: NMEA Disabled

SMS Information
==================================
Incoming Message Information
==================================
SMS stored in modem = 0
SMS archived since booting up = 0
Total SMS deleted since booting up = 0
Storage records allocated = 25
Storage records used = 0
Number of callbacks triggered by SMS = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0

Outgoing Message Information
-------------------------------
Total SMS sent successfully = 0
Total SMS send failure = 0
Number of outgoing SMS pending = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0
Last Outgoing SMS Status = SUCCESS
Copy-to-SIM Status = 0x0
Send-to-Network Status = 0x0
Report-Outgoing-Message-Number:
  Reference Number = 0
  Result Code = 0x0
  Diag Code = 0x0 0x0 0x0 0x0 0x0

SMS Archive URL =

Error Information
=================
This command is not supported on 4G modems.

Modem Crashdump Information
============================
Modem crashdump logging: off

Dying Gasp Information
======================
Dying Gasp Detach: Enabled
SMS: Enabled

  SMS Message = 4321LTEA in Horsham lab lost power
  Destination Number = 215300XXXX
  C4321-4G#ping 8.8.8.8
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 8.8.8.8, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 38/68/160 ms
  C4321-4G#ping 10.1.1.18
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.18, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

sh ver | i IOS
Cisco IOS XE Software, Version 16.03.03
Cisco IOS Software [Denali], ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 16.3.3, RELEASE SOFTWARE (fc3)
Cisco IOS-XE software, Copyright (c) 2005-2017 by cisco Systems, Inc.
All rights reserved. Certain components of Cisco IOS-XE software are
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
ROM: IOS-XE ROMMON
C4321-4G#
C4321-4G#sh ip int brie | i Ce
Cellular0/1/0          72.105.31.XXX YES IPCP   up                    up
Cellular0/1/1   10.1.1.18       YES IPCP   up                    up
C4321-4G#
C4321-4G#sh ip rou
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
  D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
  N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
  E1 - OSPF external type 1, E2 - OSPF external type 2
  i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
  ia - IS-IS inter area, * - candidate default, U - per-user static route
  o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
  a - application route
  + - replicated route, % - next hop override, p - overrides from PfR

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

M= 0.0.0.0/0/0 is directly connected, Tunnel10
S 0.0.0.0/5 is directly connected, Cellular0/1/0
  1.0.0.0/32 is subnetted, 1 subnets
C 1.2.3.4 is directly connected, Loopback1234
S 8.0.0.0/7 is directly connected, Cellular0/1/0
  10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S  10.0.0.0/8 is directly connected, Cellular0/1/1
C 10.1.1.18/32 is directly connected, Cellular0/1/1
S 11.0.0.0/8 is directly connected, Cellular0/1/0
S 12.0.0.0/7 is directly connected, Cellular0/1/0
S 14.0.0.0/7 is directly connected, Cellular0/1/0
S 16.0.0.0/4 is directly connected, Cellular0/1/0
S 32.0.0.0/3 is directly connected, Cellular0/1/0
S 64.0.0.0/2 is directly connected, Cellular0/1/0
66.0.0.0/32 is subnetted, 1 subnets
M 66.174.XXX.XXX [33/1], 01:05:09, Cellular0/1/1
72.0.0.0/32 is subnetted, 1 subnets
C 72.105.31.45 is directly connected, Cellular0/1/0
S 128.0.0.0/3 is directly connected, Cellular0/1/0
S 160.0.0.0/4 is directly connected, Cellular0/1/0
S 168.0.0.0/5 is directly connected, Cellular0/1/0
S 172.0.0.0/12 is directly connected, Cellular0/1/0
S 172.33.0.0/16 is directly connected, Cellular0/1/0
S 172.34.0.0/15 is directly connected, Cellular0/1/0
S 172.36.0.0/15 is directly connected, Cellular0/1/0
S 172.38.0.0/15 is directly connected, Cellular0/1/0
S 172.40.0.0/13 is directly connected, Cellular0/1/0
S 172.56.0.0/13 is directly connected, Cellular0/1/0
S 172.64.0.0/10 is directly connected, Cellular0/1/0
S 172.128.0.0/9 is directly connected, Cellular0/1/0
S 173.0.0.0/8 is directly connected, Cellular0/1/0
S 174.0.0.0/7 is directly connected, Cellular0/1/0
S 176.0.0.0/12 is directly connected, Cellular0/1/0
S 192.0.0.0/9 is directly connected, Cellular0/1/0
S 192.128.0.0/11 is directly connected, Cellular0/1/0
S 192.160.0.0/13 is directly connected, Cellular0/1/0
S 192.169.0.0/16 is directly connected, Cellular0/1/0
S 192.170.0.0/15 is directly connected, Cellular0/1/0
S 192.172.0.0/14 is directly connected, Cellular0/1/0
S 192.176.0.0/13 is directly connected, Cellular0/1/0
S 192.192.0.0/10 is directly connected, Cellular0/1/0
S 192.224.0.0/11 is directly connected, Cellular0/1/0
S 193.0.0.0/8 is directly connected, Cellular0/1/0
S 194.0.0.0/7 is directly connected, Cellular0/1/0
S 196.0.0.0/6 is directly connected, Cellular0/1/0
S 200.0.0.0/5 is directly connected, Cellular0/1/0
S 208.0.0.0/5 is directly connected, Cellular0/1/0
S 216.0.0.0/5 is directly connected, Cellular0/1/0

C4321-4G#
C4321-4G#sh ip mob rou

Mobile Router
Enabled 06/01/17 13:21:41
Last redundancy state transition NEVER

Configuration:
Home Address 1.2.3.4 Mask 255.255.255.0
Home Agent 66.174.XXX.XXX Priority 100 (best) (current)
Registration lifetime 65534 sec
Retransmit Init 1000, Max 5000 msec, Limit 3
Extend Expire 10, Retry 3, Interval 5
Reverse tunnel required
Request GRE tunnel
Multi-path denied by HA, Requested metric: bandwidth
Mobile Networks: GigabitEthernet0/0/1 (Down)
  GigabitEthernet0/0/0 (Down)
  non connected subnet (192.168.222.0/255.255.255.0)

Monitor:
  Status -Registered-
  Using collocated care-of address 10.1.1.18
  On interface Cellular0/1/1
  Tunnel0 mode GRE/IP
C4321-4G#
Example of display output. This LTE SIM/subscription also has LTE QoS (PNTM)
Some public addresses have been hidden via “XXXX”

*May 31 23:45:06.451: %CELLWAN-2-BEARER_UP: Instance id=1, Default bearer (bearer_id=7) in Cellular1 is now UP
*May 31 23:45:06.551: %CELLWAN-2-BEARER_UP: Instance id=1, Dedicated bearer (bearer_id=8) QCI=7 in Cellular1 is now UP
*May 31 23:45:08.555: %LINK-3-UPDOWN: Interface Cellular1, changed state to up
*May 31 23:45:09.555: %LINEPROTO-5-UPDOWN: Line protocol on Interface Cellular1, changed state to up

```
sh ip int brie
Interface      IP-Address      OK? Method Status    Protocol
Cellular0      72.105.X.X     YES IPCP   up                    up
Cellular1      10.1.1.18       YES IPCP   up                    up
CellNM5        unassigned      YES unset  down       down
FastEthernet0  unassigned      YES unset  down       down
FastEthernet1  unassigned      YES unset  down       down
FastEthernet2  unassigned      YES unset  down       down
FastEthernet3  unassigned      YES unset  down       down
GigabitEthernet0 172.20.12.12 YES NVRAM  down                  down
Loopback99     unassigned      YES unset  up           up
Loopback100    1.2.3.22        YES NVRAM  up                    up
Loopback1234   1.2.3.4         YES NVRAM  up                    up
Mobile0        unassigned      YES unset  up                    up
NV10           21.21.21.1      YES unset  up                    up
Serial0        unassigned      YES unset  down                  down
Tunnel10       10.1.1.18       YES unset  up                    up
Tunnel101      172.21.22.1     YES TFTP   up                    down
Vlan1          172.21.22.1     YES NVRAM  down                  down
```

```
sh ip rou
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2
        i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
        IA - IS-IS inter area, * - candidate default, U - per-user static route
        o - ODR, P - periodic downloaded static route, H - NHRP, L - LISP
        a - application route
        + - replicated route, % - next hop override, P - overrides from PfR

Gateway of last resort is 0.0.0.0 to network 0.0.0.0
M* 0.0.0.0/0 is directly connected, Tunnel0
S 0.0.0.0/5 is directly connected, Cellular0
1.0.0.0/32 is subnetted, 2 subnets
C 1.2.3.4 is directly connected, Loopback1234
C 1.2.3.22 is directly connected, Loopback100
S 8.0.0.0/7 is directly connected, Cellular0
10.0.0.0/32 is subnetted, 1 subnets
C 10.1.1.18 is directly connected, Cellular1
S 11.0.0.0/8 is directly connected, Cellular0
S 12.0.0.0/7 is directly connected, Cellular0
S 14.0.0.0/7 is directly connected, Cellular0
S 16.0.0.0/4 is directly connected, Cellular0
S 32.0.0.0/3 is directly connected, Cellular0
S 64.0.0.0/2 is directly connected, Cellular0
66.0.0.0/32 is subnetted, 1 subnets
M 66.174.XXX.XXX [111/1], 00:10:24, Cellular1
72.0.0.0/32 is subnetted, 1 subnets
C 72.105.31.99 is directly connected, Cellular0
108.0.0.0/32 is subnetted, 1 subnets
M 108.16.125.4 [111/1], 00:29:29, Cellular0
S 128.0.0.0/3 is directly connected, Cellular0
S 160.0.0.0/4 is directly connected, Cellular0
S 168.0.0.0/5 is directly connected, Cellular0
S 172.0.0.0/12 is directly connected, Cellular0
S 172.33.0.0/16 is directly connected, Cellular0
S 172.34.0.0/15 is directly connected, Cellular0
S 172.36.0.0/15 is directly connected, Cellular0
S 172.38.0.0/15 is directly connected, Cellular0
S 172.40.0.0/13 is directly connected, Cellular0
S 172.56.0.0/13 is directly connected, Cellular0
S 172.64.0.0/10 is directly connected, Cellular0
S 172.128.0.0/9 is directly connected, Cellular0
S 173.0.0.0/8 is directly connected, Cellular0
S 174.0.0.0/7 is directly connected, Cellular0
S 176.0.0.0/12 is directly connected, Cellular0
S 192.0.0.0/9 is directly connected, Cellular0
S 192.128.0.0/11 is directly connected, Cellular0
S 192.160.0.0/13 is directly connected, Cellular0
S 192.169.0.0/16 is directly connected, Cellular0
S 192.170.0.0/15 is directly connected, Cellular0
S 192.172.0.0/14 is directly connected, Cellular0
S  192.176.0.0/13 is directly connected, Cellular0
S  192.192.0.0/10 is directly connected, Cellular0
S  192.224.0.0/11 is directly connected, Cellular0
S  193.0.0.0/8 is directly connected, Cellular0
S  194.0.0.0/7 is directly connected, Cellular0
S  196.0.0.0/6 is directly connected, Cellular0
S  200.0.0.0/5 is directly connected, Cellular0
S  208.0.0.0/5 is directly connected, Cellular0
S  216.0.0.0/5 is directly connected, Cellular0

819-XL#sh ip mob rou

Mobile Router
    Enabled 05/31/17 21:36:10
    Last redundancy state transition NEVER

Configuration:
    Home Address 1.2.3.22 Mask 255.255.255.255
    Home Agent 66.174.XXX.XXX Priority 100 (best) (current)
    Registration lifetime 65534 sec
    Retransmit Init 1000, Max 5000 msec, Limit 3
    Extend Expire 10, Retry 3, Interval 5
    Reverse tunnel required
    Request GRE tunnel
    Multi-path denied by HA, Requested metric: bandwidth
    Mobile Networks: Loopback100 (1.2.3.22/255.255.255.255)
        Vlan1 (Down)
        non connected subnet (172.30.30.0/255.255.255.0)

Monitor:
    Status -Registered-
    Using collocated care-of address 10.1.1.18
    On interface Cellular1
    Tunnel0 mode GRE/IP

819-XL#
819-XL#sh cell 0 all

Hardware Information
====================
Modem Firmware Version = SWI9X15C_05.05.58.01
Modem Firmware built = 2015/03/05 00:02:40
Hardware Version = 1.0
Device Model ID: MC7350
Package Identifier ID: 1102036_9903208_MC7350_05.05.58.01_00_Cisco_005.005_000
International Mobile Subscriber Identity (IMSI) = 311480148770693
International Mobile Equipment Identity (IMEI) = 35616205028156
Integrated Circuit Card ID (ICCID) = 89148000001470156414
Mobile Subscriber Integrated Services Digital Network-Number (MSISDN) = 408649XXXX
Modem Status = Online
Current Modem Temperature = 37 deg C
PRI SKU ID = 1102036, PRI version = 005.029_000, Carrier = Verizon
OEM PRI version = 05.05

Profile Information
====================
Profile 1 = INACTIVE **
-------
PDP Type = IPv4v6
Access Point Name (APN) = vzwims
Authentication = None

Profile 2 = INACTIVE
-------
PDP Type = IPv4v6
Access Point Name (APN) = vzwadmin
Authentication = None

Profile 3 = ACTIVE*
-------
PDP Type = IPv4
PDP address = 72.105.31.XXX
Access Point Name (APN) = VZWINTERNET
Authentication = None
Primary DNS address = 198.224.XXX.XXX
Secondary DNS address = 198.224.XXX.XXX
Profile 4 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzwapp
Authentication = None

Profile 5 = INACTIVE
--------
PDP Type = IPv4v6
Access Point Name (APN) = vzw800
Authentication = None

Profile 6 = ACTIVE
--------
PDP Type = IPv4
PDP address = 10.1.1.18
Access Point Name (APN) = cisco.gw4.vzwentp
Authentication = None
Primary DNS address = 171.70.XXX.XXX
Secondary DNS address = 173.36.XXX.XXX

* - Default profile
** - LTE attach profile

Data Connection Information
============================
Profile 1, Packet Session Status = INACTIVE
Profile 2, Packet Session Status = INACTIVE
Profile 3, Packet Session Status = ACTIVE
Cellular0:
Data Transmitted = 2759762 bytes, Received = 1656652 bytes
IP address = 72.105.31.XXX
Primary DNS address = 198.224.XXX.XXX
Secondary DNS address = 198.224.XXX.XXX
Profile 4, Packet Session Status = INACTIVE
Profile 5, Packet Session Status = INACTIVE
Profile 6, Packet Session Status = ACTIVE
Cellular1:
Data Transmitted = 952 bytes, Received = 616 bytes
IP address = 10.1.1.18  
Primary DNS address = 171.70.XXX.XXX  
Secondary DNS address = 173.36.XXX.XXX

Network Information
====================
Current System Time = Thu Jun 1 17:50:0 2017  
Current Service Status = Normal  
Current Service = Packet switched  
Current Roaming Status = Home  
Network Selection Mode = Automatic  
Network = VzW  
Mobile Country Code (MCC) = 311  
Mobile Network Code (MNC) = 480  
Packet switch domain(PS) state = Attached  
Registration state(EMM) = Registered  
EMM Sub State = Normal Service  
Tracking Area Code (TAC) = 25856  
Cell ID = 25932320  
Negotiated network MTU is 1428

Radio Information
=================
Radio power mode = online  
LTE Rx Channel Number = 2125  
LTE Tx Channel Number = 20125  
LTE Band = 4  
LTE Bandwidth = 15 MHz  
Current RSSI = -66 dBm  
Current RSRP = -95 dBm  
Current RSRQ = -10 dB  
Current SNR = 19.0 dB  
Physical Cell Id = 0xE3  
Number of nearby cells = 3  
Idx  PCI (Physical Cell Id)
-----------------------------------
1  227
2  127
3  363

Radio Access Technology(RAT) Preference = AUTO  
Radio Access Technology(RAT) Selected = LTE
Modem Security Information
============================
Card Holder Verification (CHV1) = Disabled
SIM Status = OK
SIM User Operation Required = None
Number of CHV1 Retries remaining = 3

GPS Information
--------------------------

GPS Info
--------
GPS Feature: enabled
GPS Port Selected: Dedicated GPS port
GPS Status: GPS acquiring
GPS auto tracking status: active
GPS auto tracking config: enabled
GPS Mode Configured: standalone
Last Location Fix Error: Not Available [0x0]
Latitude: 0 Deg 0 Min 0 Sec North
Longitude: 0 Deg 0 Min 0 Sec North
Timestamp (GMT): Sun Jan  6 00:00:00 1980
Fix type index: 0, Height: 0 m
HDOP: , GPS Mode Used: not configured/unknown

Satellite Info
--------------
Satellite #16, elevation 0, azimuth 0, SNR 25

SMS Information
==============
Incoming Message Information
--------------------------------
SMS stored in modem = 0
SMS archived since booting up = 0
Total SMS deleted since booting up = 0
Storage records allocated = 25
Storage records used = 0
Number of callbacks triggered by SMS = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0

Outgoing Message Information
----------------------------
Total SMS sent successfully = 0
Total SMS send failure = 0
Number of outgoing SMS pending = 0
Number of successful archive since booting up = 0
Number of failed archive since booting up = 0
Last Outgoing SMS Status = SUCCESS
Copy-to-SIM Status = 0x0
Send-to-Network Status = 0x0
Report-Outgoing-Message-Number:
  Reference Number = 0
  Result Code = 0x0
  Diag Code = 0x0 0x0 0x0 0x0 0x0

SMS Archive URL =

Error Information
=================
This command is not supported on this platform.

Modem Crashdump Information
============================
Chassis Model Name is C819G-4G-VZ-K9
Platform is MC73xx based
Modem crashdump logging: off
819-XL#sh ip mob rou

Mobile Router
   Enabled 05/31/17 21:36:10
   Last redundancy state transition NEVER

Configuration:
   Home Address 1.2.3.22 Mask 255.255.255.255
   Home Agent 66.174.XXX.XXX Priority 100 (best) (current)
   Registration lifetime 65534 sec
Retransmit Init 1000, Max 5000 msec, Limit 3
Extend Expire 10, Retry 3, Interval 5
Reverse tunnel required
Request GRE tunnel
Multi-path denied by HA, Requested metric: bandwidth
Mobile Networks: Loopback100 (1.2.3.22/255.255.255.255)
     Vlan1 (Down)

Monitor:
   Status -Registered-
   Using collocated care-of address 10.1.1.18
   On interface Cellular1
   Tunnel0 mode GRE/IP

819-XL#