Planning Guide: Verizon Internet Access, Static IP, for Cisco LTE eHWIC/NIM/GRWIC/8x9

Overview

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

- Machine-to-Machine (M2M) price plan with Internet access and dynamic IP: This service enables a router to connect users or devices to the Internet or an enterprise network (through a customer premises equipment (CPE)-based VPN such as IP Security [IPsec], generic routing encapsulation [GRE], Dynamic Multipoint VPN [DMVPN], etc.).
- M2M price 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 3G or 4G IP address.
- Mobile Private Network (MPN): This service enables a router to connect to an enterprise network. It requires a customer premises-based VPN or Network Address Translation (NAT) for users behind the remote router to access the network.
- Mobile Private Network (MPN) with Dynamic Mobile Network Routing (DMNR): This service enables a router to connect users to an enterprise 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.

This planning guide outlines the process to plan for Internet LTE service with static IP addressing. Relevant documents are also referenced.

1. No special service is needed outside of an approved pricing plan for Internet access. 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, Verizon SKU "DIRECTSIM4G-D") for the LTE eHWIC/GRWIC/819 with an approved pricing plan. Your Verizon account manager is the appropriate contact for obtaining a SIM.
   a. The SIM must be provisioned and associated with international mobility equipment identity (IMEI) of the LTE eHWIC/GRWIC/819 modem before activation on an approved plan.
      i. 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. No username or password needs to be set or defined. The LTE network should set the APN without configuration. If this does not occur, you must know the APN for this service. Your Verizon Wireless representative can provide this information (ne01.vzwstatic, so01.vzwstatic, we01.vzwstatic, etc.).

3. Check the LTE eHWIC or NIM (may be in a separate box) to see if the SIM is inserted. If not, insert the SIM using the instructions found at


The GRWIC on CGR is similar. The 819 has a small SIM panel underneath.

4. Install the eHWIC/NIM into the ISR (or GRWIC into the CGR-2010).
   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. LE eHWIC

5. Install the antenna cables to the LTE eHWIC/NIM/GRWIC/8x9 and the antennas onto the extension cables.
   a. Instructions can be found in the section “Additional Information”.

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. Power up the ISR. Hit Enter, and at the console prompt type “enable”. No ID or password should be set. If there is, follow the instructions to reset the password at:
      ii. 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 0/0/0 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 0/0/0 hardware” command).

<table>
<thead>
<tr>
<th>ISR LTE SKU</th>
<th>LTE Modem</th>
<th>Recommended firmware</th>
<th>Recommended IOS Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHWIC-4G-LTE-VZ</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>C819G-4G-VZ-K9</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>C899G-LTE-VZ-K9</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>C819G-LTE-MNA-K9</td>
<td>MC7354</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>C819GW-LTE-MNA-K9</td>
<td>MC7354</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</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:** Even with static IP the cell interface remains “IP address negotiated”.

b. If a new SIM is installed, it may take up to 10 minutes after ISR power-up before the LTE interface becomes active because the SIM must connect to the network and start a process that may reconfigure the LTE modem. The ISR should not be powered down for at least 10 minutes after initial power-up (with antennas attached). This process provisions the appropriate data APN. If the network-based process (SIM-Over-the-Air/Over-the-Air Device Management [SIM-OTA/OTA-DM]) does not change the APN as expected, either the SIM is not properly activated or provisioned (Call Verizon Wireless Customer Care), or the SIM was installed in the LTE eHWIC without this network process completed and the ISR powered down. If the latter, there are two ways to address the problem: 1) Power down the ISR, remove the SIM, and put the SIM into another LTE device (MiFi device, USB LTE modem, LTE eHWIC, etc.). When that device connects, reinsert the SIM into the LTE eHWIC, connect the antennas, power up, and wait 10 minutes. 2) Use the 1-line IOS enable mode command (shown in step 8). The Cisco IOS Software command `show cellular 0/x/0 profile` displays the APN (`show cellular 0 profile` for the 819).

<table>
<thead>
<tr>
<th>Model</th>
<th>Module</th>
<th>Version</th>
<th>IOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIM-LTEA-EA ISR4</td>
<td>EMM7455</td>
<td>02.20.03.22</td>
<td>16.3.3</td>
</tr>
<tr>
<td>NIM-4G-LTE-VZ ISR4K</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>16.3.3</td>
</tr>
<tr>
<td>NIM-LTEA-EA on ENCS</td>
<td>EMM7455</td>
<td>02.20.03.22</td>
<td>NFVIS 3.6.1 IOS 16.3.3</td>
</tr>
<tr>
<td>IR809G-LTE-VZ-K9</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>IR829GW-LTE-VZ-AK9</td>
<td>MC7350</td>
<td>5.5.58.01</td>
<td>15.6.3.M2</td>
</tr>
<tr>
<td>IR829-2LTE-EA-BK9</td>
<td>MC7455</td>
<td>02.20.03.22</td>
<td>15.6(3)M2</td>
</tr>
<tr>
<td>C1111-8PLTEEA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C1111-4PLTEEA</td>
<td>EMM7455</td>
<td>02.20.03.22</td>
<td>16.6.2</td>
</tr>
</tbody>
</table>

7. **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 without the LTE eHWIC IP address from leaking out.

8. The data APN for Verizon Internet with Static IP LTE service is different than for Internet/Dynamic. The APN depends on the U.S. region, and should be provided by your Verizon representative. If the value is incorrect (IOS command `show cellular 0/x/0 profile` displays the APN, `show cellular 0 profile` for the 819), OTA-DM has not changed it automatically. Change the value via the following 1-line IOS enable-mode command: `cellular 0/0/0 lte profile create 3 ne01.VZWSTATIC` (Note that the Data APN is profile 3)
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:
Configuration Guide: Verizon Internet Access, Static IP, and LTE eHWIC

1. If an LTE connection cannot be made, the Access Point Name (APN) value on the LTE eHWIC modem should be checked (ISR/CGR command `show cellular 0/x/0 profile`, for 819 `show cellular 0 profile`). If it is not the appropriate APN (xx01.VZWSTATIC, where xx is ne, so, we or mw), refer to step 8 in above planning section.

2. This guide is for the Internet NAT use case, with Verizon Internet Static IP address service. VPN would be configured as needed. Please see the Internet/VPN LTE guide under white papers at www.cisco.com/go/4g.

3. All packets leaving the ISR through the LTE interface must be sent through Port Address Translation (PAT) or VPN. If any packets are sent over LTE with the source IP address other than the LTE interface IP address, the LTE connection will be disconnected (IP address violation). Because the ISR will immediately attempt to reconnect, a flapping condition will occur and continue.

High-Level Network Diagram

Figure 2. Customer Design Scenarios
ISR LTE eHWIC, CGR LTE GRWIC Internet Configuration for Primary Access

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

```
service internal
!
hostname c1921-Internet
!
### load appropriate IOS image ###
boot system flash:c1900-universalk9-mz.SPA.156-3.M2.bin
!
ip cef
!
### If there is already a DHCP server, exclude the dhcp pool stanza below ###
ip dhcp pool vlan1
import all
network 10.20.30.0 255.255.255.0
default-router 10.20.30.1
dns-server 4.2.2.2 8.8.8.8
!
### 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 1.2.3.9 255.255.255.255
!
### The maximum TCP MSS is set to 1390 bytes to allow for any GRE, IPsec and other network overhead. The route-map clears DF bits in the IP headers. ###
!
interface GigabitEthernet0/0
  ip address 10.20.30.1 255.255.255.0
  ip nat inside
  ip tcp adjust-mss 1390
  ip policy route-map clear-df
!
interface GigabitEthernet0/1
  ip address 10.20.40.1 255.255.255.0
  ip nat inside
  ip tcp adjust-mss 1390
  ip policy route-map clear-df
!
### Interface Cellular – used to make a data call. The call will be activated using the Dialer Watch group. For static IP address services, still use “ip address negotiated”. ###
!
interface Cellular0/0/0
  ip address negotiated
  ip nat outside
```
no ip unreachables
encapsulation slip
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer enable-timeout 1
dialer string LTE
dialer watch-group LTE
async mode interactive
pulse-time 0

!### 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 Cellular0/0/0 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 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

!### This static route sends all traffic destined for other than the ISR LAN and loopback subnets out the LTE connection. ###
ip route 0.0.0.0 0.0.0.0 Cellular0/0/0

!### 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 call 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 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

line 0/0/0
  script dialer LTE
  modem InOut
  no exec
  transport input telnet

end
819/829/899 ISR Internet Configuration for Primary Access

### command allowing for “LTE test cellular” enable mode commands ###
service internal
!
hostname c819-Internet
!
### load appropriate IOS image ###
boot system flash:c800-universalk9-mz.SPA.156-3.M2.bin
!
ip cef
!###If there is already a DHCP server, exclude the dhcp pool stanza below###
ip dhcp pool vlan1
  import all
  network 10.20.40.0 255.255.255.0
  default-router 10.20.40.1
  dns-server 4.2.2.2 8.8.8.8
!
no ip domain lookup
!
### 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 1.2.3.9 255.255.255.255
  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 10.20.40.1 255.255.255.0
  ip nat inside
  ip tcp adjust-mss 1390
  ip policy route-map clear-df
!
### Interface Cellular – used to make a data call. The call will be activated using the Dialer Watch group. For static IP address services, still use “ip address negotiated”. ###
!
interface Cellular0
  ip address negotiated
  ip nat outside
  no ip unreachable
  encapsulation slip
  load-interval 30
  dialer in-band
dialer idle-timeout 0
dialer enable-timeout 1

dialer string LTE

dialer watch-group 1

async mode interactive

pulse-time 0

!### 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 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

!### This static route sends all traffic destined for other than the ISR LAN and loopback subnets out the LTE connection. ###

ip route 0.0.0.0 0.0.0.0 Cellular0

!### 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 call 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

!### For Telnet access, define users and "line VTY 0 4" stanza. ###

line 3

  script dialer LTE

  modem InOut

  no exec

  transport input telnet

end
ISR LTE NIM and ISR 1K Internet Configuration for Primary Access

!### Chat script and cellular line definitions not needed w/ISR4K 1K ###
!### command allowing for “LTE test cellular” enable mode commands ###
service internal
hostname 4331LTE

!### Load appropriate IOS Image ###
boot system bootflash:isr4300-universalk9.16.03.03.SPA.bin boot-end-marker

ip dhcp pool gi000
  import all
  network 172.20.14.0 255.255.255.0
  default-router 172.20.14.1
  dns-server 4.2.2.2 8.8.8.8

controller Cellular 0/0/0

!### 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 172.20.14.1 255.255.255.0
  ip nat inside
  ip tcp adjust-mss 1390
  ip policy route-map clear-df

!### Interface Cellular – used to make a data call. The call will be activated using the Dialer Watch group. For static IP address services, still use “ip address negotiated”. ###

interface Cellular0/0/0
  ip address negotiated
  ip nat outside
dialer in-band
dialer idle-timeout 0
dialer enable-timeout 1
dialer watch-group 1
  pulse-time 0

!### 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 Cellular0/0/0 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 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
!
### This static route sends all traffic destined for other than the ISR LAN and loopback subnets out the LTE connection. ###
ip route 0.0.0.0 0.0.0.0 Cellular0/0/0
!
### 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 call 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
!
### For Telnet access, define users and “line VTY 0 4” stanza. ###
!
Operation and Show Commands

4331LTE#

*Aug 22 03:50:01.235: %LINK-3-UPDOWN: Interface Cellular0/2/0, changed state to up
*Aug 22 03:50:02.235: %LINEPROTO-5-UPDOWN: Line protocol on Interface Cellular0/2/0, changed state to up

4331LTE#**term len 0**

4331LTE#

4331LTE#**sh ip route**

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

S* 0.0.0.0/0 is directly connected, Cellular0/2/0
   166.148.0.0/32 is subnetted, 1 subnets
C 166.148.x.y is directly connected, Cellular0/2/0
   172.20.0.0/16 is variably subnetted, 2 subnets, 2 masks
C 172.20.14.0/24 is directly connected, GigabitEthernet0/0/0
L 172.20.14.1/32 is directly connected, GigabitEthernet0/0/0

4331LTE#

4331LTE#**sh ip int brief**

<table>
<thead>
<tr>
<th>Interface</th>
<th>IP-Address</th>
<th>OK? Method Status</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>GigabitEthernet0/0/0</td>
<td>172.20.14.1</td>
<td>YES NVRAM</td>
<td>up</td>
</tr>
<tr>
<td>GigabitEthernet0/0/1</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
</tr>
<tr>
<td>GigabitEthernet0/0/2</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
</tr>
<tr>
<td>Cellular0/2/0</td>
<td>166.148.x.y</td>
<td>YES IPCP</td>
<td>up</td>
</tr>
<tr>
<td>GigabitEthernet0</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
</tr>
<tr>
<td>Vlan1</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down</td>
</tr>
</tbody>
</table>

4331LTE#

4331LTE#**ping 4.2.2.2 source gi0/0/0**
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.2.2.2, timeout is 2 seconds:
Packet sent with a source address of 172.20.14.1

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 38/83/247 ms

4331LTE#

4331LTE# sh ip nat trans

<table>
<thead>
<tr>
<th>Pro</th>
<th>Inside global</th>
<th>Inside local</th>
<th>Outside local</th>
<th>Outside global</th>
</tr>
</thead>
<tbody>
<tr>
<td>udp</td>
<td>166.148.x.y:4507</td>
<td>172.20.14.2:61120</td>
<td>4.2.2.2:53</td>
<td>4.2.2.2:53</td>
</tr>
<tr>
<td>tcp</td>
<td>166.148.x.y:4098</td>
<td>172.20.14.2:54283</td>
<td>66.163.x.y:443</td>
<td>66.163.x.y:443</td>
</tr>
<tr>
<td>udp</td>
<td>166.148.x.y:4505</td>
<td>172.20.14.2:49610</td>
<td>4.2.2.2:53</td>
<td>4.2.2.2:53</td>
</tr>
</tbody>
</table>

...icmp 166.148.x.y:1 172.20.14.1:2 4.2.2.2:1 4.2.2.2:1
udp 166.148.36.219:4574 172.20.14.2:58638 4.2.2.2:53 4.2.2.2:53

Total number of translations: 44

4331LTE#

4331LTE# sh cell 0/2/0 all

Hardware Information

=================================
Modern Firmware Version = SWI9X15C_05.05.58.01
Modern Firmware built = 2015/03/05 00:02:40
Hardware Version = 1.0
Device Model ID: MC7350
Package Identifier ID: 1102036_9903208_MC7350_05.05.53.01_00_Cisco_005.003_000
International Mobile Subscriber Identity (IMSI) = 311480008312026
International Mobile Equipment Identity (IMEI) = 356732060030176
Integrated Circuit Card ID (ICCID) = 8914800000083183898
Mobile Subscriber Integrated Services
Digital Network-Number (MSISDN) = 215806xxxx
Current Modem Temperature = 34 deg C
PRI SKU ID = 9903208, PRI version = 05.03

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 = 166.148.x.y
Access Point Name (APN) = ne01.VZWSTATIC
Authentication = None
   Primary DNS address = 198.224.x.y
   Secondary DNS address = 198.224.x.y

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
Data Connection Information
===========================
Profile 1, Packet Session Status = INACTIVE
Profile 2, Packet Session Status = INACTIVE
Profile 3, Packet Session Status = ACTIVE
    Cellular0/2/0:
        Data Transmitted = 26377 bytes, Received = 322912 bytes
        IP address = 166.148.x.y
        Primary DNS address = 198.224.x.y
        Secondary DNS address = 198.224.x.y
Profile 4, Packet Session Status = INACTIVE
Profile 5, Packet Session Status = INACTIVE
Profile 6, Packet Session Status = INACTIVE

Network Information
===================
Current Service Status = Normal
Current Service = Packet switched
Current Roaming Status = Home
Network Selection Mode = Automatic
Network = Verizon Wireless
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) = 25860
Cell ID = 25905409

Radio Information
=================
Radio power mode = ON
LTE Rx Channel Number = 5230
LTE Tx Channel Number = 23230
LTE Band = 13
LTE Bandwidth = 10 MHz
Current RSSI = -76 dBm
Current RSRP = -104 dBm
Current RSRQ = -11 dB
Current SNR = 3.6 dB
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 State: GPS acquiring
GPS Mode Configured: standalone
Last Location Fix Error: Offline [0x0]
Latitude: 0 Deg 0 Min 0 Sec North
Longitude: 0 Deg 0 Min 0 Sec East
Timestamp (GMT): Sun Jan  6 00:00:00 1980
Fix type index: 0
HDOP: , GPS Mode Used: unknown

Satellite Info
----------

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  
4331LTE#sh dialer  

Ce0/2/0 - dialer type = DIALER CWAN  
Idle timer (never), Fast idle timer (20 secs)
Wait for carrier (30 secs), Re-enable (15 secs)
Dialer state is data link layer up
Dial reason: Dialing on watched route loss
Time until disconnect never
Current call connected 00:18:48
Connected to lte

<table>
<thead>
<tr>
<th>Dial String</th>
<th>Successes</th>
<th>Failures</th>
<th>Last DNIS</th>
<th>Last status</th>
</tr>
</thead>
<tbody>
<tr>
<td>lte</td>
<td>2</td>
<td>6</td>
<td>00:18:48</td>
<td>successful</td>
</tr>
<tr>
<td>4331LTE#</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4331LTE#</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

```
sh version
Cisco IOS XE Software, Version 03.16.00.S - Extended Support Release
Cisco IOS Software, ISR Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.5(3)S, RELEASE SOFTWARE (fc6)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled Sun 26-Jul-15 21:46 by mcre
```

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ROM: IOS-XE ROMMON

```
4331LTE uptime is 11 minutes
Uptime for this control processor is 12 minutes
System returned to ROM by reload
System image file is “bootflash:isr4300-universalk9.03.16.00.S.155-3.S-ext.SPA.bin”
Last reload reason: PowerOn
```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: http://www.cisco.com/c/dam/cisco/docs/ios/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to export@cisco.com.

Suite License Information for Module: 'esg'

<table>
<thead>
<tr>
<th>Suite</th>
<th>Suite Current</th>
<th>Type</th>
<th>Suite Next reboot</th>
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<td>securityk9</td>
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<td></td>
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</tr>
<tr>
<td>appxk9</td>
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<tr>
<td>AdvUCSuiteK9</td>
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<td>None</td>
<td>None</td>
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<tr>
<td>uck9</td>
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Technology Package License Information:

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<tr>
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<td>ipbasek9</td>
<td>Permanent</td>
</tr>
</tbody>
</table>

cisco ISR4331/K9 (1RU) processor with 1659588K/6147K bytes of memory.
Processor board ID FLM1927W10P
3 Gigabit Ethernet interfaces
1 Cellular interface
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
3223551K bytes of flash memory at bootflash.

Configuration register is 0x2102