Planning Guide: Verizon Internet Access, Dynamic 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 with dynamic 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 ISR) 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 and 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 enhanced high-speed WAN interface 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 other information is required. No username or password needs to be set or defined.

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

www.cisco.com/en/US/docs/routers/access/interfaces/ic/hardware/installation/guide/EHWIC-4G-LTEHW.html#wp1147248

www.cisco.com/c/en/us/td/docs/routers/access/interfaces/NIM/hardware/installation/guide/4GLTENIM_HIG.html#pgfld-1201912.

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
   www.cisco.com/en/US/docs/routers/access/interfaces/ic/hardware/installation/guide/inst_ic.html#wp1037332
   www.cisco.com/c/en/us/td/docs/routers/access/interfaces/NIM/hardware/installation/guide/4GLTENIM_HIG.html#pgfld-1209630.
   The CGR-2010 is similar. The 8x9s 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

5. Install the antenna cables to the LTE eHWIC/NIM/GRWIC/819 and the antennas onto the extension cables.

   a. Instructions are in the section "Additional Information".

6. Power up the Cisco ISR, and ensure that the antennas are positioned appropriately.

   a. With terminal or console access to the ISR (logging the terminal console is recommended):

      i. Power up the ISR. Hit Enter and at the console prompt type "enable". There should be no ID or password set. If there is, follow the following instructions to reset the password:
      www.cisco.com/en/US/products/ps5855/products_password_recovery09186a0080b3911d.shtml

      ii. Position antennas for the best RSSI signal > -80 dBm with the **show cell 0/x/0 radio** command (where "x" is the slot number for the LTE eHWIC, or **show cell 0 radio** for 819).

      iii. Type "sh cell 0/x/0 hardware (cell 0 for 819) and "show ver" to check if the recommended LTE firmware and Cisco IOS® Software releases are running. The generally recommended Cisco IOS software release depends on the LTE modem firmware level (seen via IOS command "show cell 0/x/0|0 hardware" command).

ISR LTE SKU	LTE Modem	Recommended firmware	Recommended IOS Release
EHWIC-4G-LTE-V	MC7750	3.5.10.6	15.5.3M4
EHWIC-4G-LTE-VZ	MC7350	5.5.58.01	15.5.3M4
C819G-4G-V-K9	MC7750	3.5.10.6	15.5.3M4
C819HG-4G-V-K9	MC7750	3.5.10.6	15.5.3M4
C819G-4G-VZ-K9	MC7350	5.5.58.01	15.5.3M4
C899G-LTE-VZ-K9	MC7350	5.5.58.01	15.5.3M4
NIM-4G-LTE-VZ	MC7350	5.5.58.01	XE 3.16.4
C819G-LTE-MNA-K9	MC7354	5.5.58.01	15.6.1T
C819GW-LTE-MNA-K9	MC7354	5.5.58.01	15.5.3M4

iv. Type "show run" to see if the configuration matches the configuration guide on the next 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.

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 the 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 Dynamic IP LTE service must be "VZWINTERNET" and is the default. If the value is incorrect (IOS command **show cellular 0/x/0 profile** displays the APN, **show cellular 0 profile** for the 819), change the value manually via the appropriate 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
- Verizon planning/configuration documents:
  www.cisco.com/en/US/products/ps5949/products_installation_and_configuration_guides_list.html
- LTE eHWIC hardware overview, SIM install, antenna connection, module install:
  www.cisco.com/en/US/docs/routers/access/interfaces/ic/hardware/installation/guide/EHWIC-4G-LTEHW.html
- LTE NIM hardware overview, SIM install, antenna connection, and module install:
  www.cisco.com/c/en/us/td/docs/routers/access/interfaces/NIM/hardware/installation/guide/4GLTENIM_HIG.html
- LTE eHWIC Cisco IOS Software configuration (use the Verizon planning/configuration documents), monitoring, and troubleshooting:
  www.cisco.com/en/US/docs/routers/access/interfaces/software/feature/guide/EHWIC-4G-LTESW.html.
- LTE NIM Cisco IOS Software configuration (use the Verizon planning/configuration documents):
  www.cisco.com/c/en/us/td/docs/routers/access/interfaces/NIM/software/configuration/guide/4GLTENIM_SW.html
- LTE eHWIC antenna, cabling, and lightning arrestor instructions:
  - www.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/4G3G_ant.html
  - www.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/4Gantex15-10r.html
  - www.cisco.com/en/US/docs/routers/access/wireless/hardware/notes/4Glar.html

Configuration Guide: Verizon Internet Access, Dynamic IP, 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 (VZWINTERNET), refer to step 8 in the above planning section.

2. This guide is for the Internet NAT use case, with Verizon Internet dynamic 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
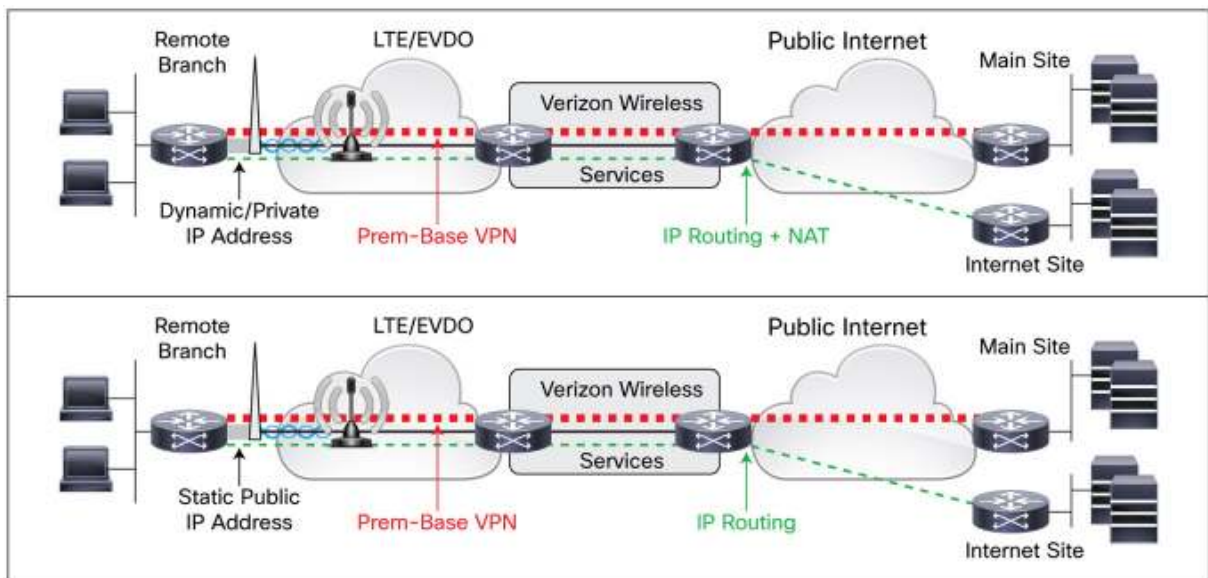
ISR LTE eHWIC, CGR LTE GRWIC Internet Configuration for Primary Access

```
!### 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.155-2.T.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
!
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 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. ###
!
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 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 Cellular0/0/0 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
!### 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 0/0/0
 script dialer LTE
 modem InOut
 no exec
 transport input telnet
!
end
```

819/829/899 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.155-2.T.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". ###
!
interface Cellular0
 ip address negotiated
 ip nat outside
 no ip unreachables
 encapsulation slip
 load-interval 30
 dialer in-band
 dialer idle-timeout 0
 dialer enable-timeout 6
 dialer string LTE
 dialer watch-group 1
 async mode interactive
```

```
!
!### 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. ###
!
line 3
 script dialer LTE
 modem InOut
 no exec
 transport input telnet
!
end
```

ISR LTE NIM Internet Configuration for Primary Access

```
!### command allowing for "LTE test cellular" enable mode commands ###
service internal
hostname 4331LTE
!
!### Load appropriate IOS Image ###
boot-start-marker
boot system bootflash:isr4300-universalk9.03.16.00.S.155-3.S-ext.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 0/2/0
!
!### 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. ###
!
interface Cellular0/2/0
 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 Cellular0/2/0 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
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0/0   172.20.14.1     YES NVRAM  up                    up
GigabitEthernet0/0/1   unassigned      YES NVRAM  administratively down down
GigabitEthernet0/0/2   unassigned      YES NVRAM  administratively down down
Cellular0/2/0          166.148.x.y YES IPCP    up                    up
GigabitEthernet0       unassigned      YES NVRAM  administratively down down
Vlan1                  unassigned      YES NVRAM  administratively down down
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#
```

```
4331LTE#sh ip nat trans
Pro  Inside global        Inside local       Outside local       Outside global
udp  166.148.x.y:4507    172.20.14.2:61120   4.2.2.2:53          4.2.2.2:53
tcp  166.148.x.y:4098    172.20.14.2:54283   66.163.x.y:443      66.163.x.y:443
udp  166.148.x.y:4505    172.20.14.2:49610   4.2.2.2:53          4.2.2.2:53
tcp  166.148.x.y:4096    172.20.14.2:54282   173.243.x.y:443     173.243.x.y:443
...
icmp 166.148.x.y:1       172.20.14.1:2       4.2.2.2:2           4.2.2.2:1
udp  166.148.x.y:4508    172.20.14.2:58967   92.242.x.y:3544     92.242.x.y:3544
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
====================
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_05.05.53.01_00_Cisco_005.003_000
International Mobile Subscriber Identity (IMSI) = 311480008312026
International Mobile Equipment Identity (IMEI) = 356732060030176
Integrated Circuit Card ID (ICCID) = 89148000000083183898
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) = vzwinternet
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 System Time = Sat Aug 22 3:50:16 2015
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


Dial String      Successes   Failures    Last DNIS   Last status
lte                 2          6        00:18:48      successful  Default
4331LTE#
4331LTE#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 mcpre

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documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

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/wwl/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'

Suite	Suite Current	Type	Suite Next reboot
FoundationSuiteK9 securityk9 appxk9	None	None	None
AdvUCSuiteK9 uck9 cme-srst cube	None	None	None

Technology Package License Information:

Technology	Technology-package Current	Type	Technology-package Next reboot
appxk9	appxk9	EvalRightToUse	appxk9
uck9	None	None	None
securityk9	None	None	None
ipbase	ipbasek9	Permanent	ipbasek9

cisco ISR4331/K9 (1RU) processor with 1659588K/6147K bytes of memory.
Processor board ID FLM1927W10P
3 Gigabit Ethernet interfaces