Planning Guide: Verizon Internet Access with VPN for Cisco LTE eHWIC/GRWIC/819

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 and 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 a 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 Verizon Internet LTE service with customer premises-based VPN (GRE, IPsec, IPsec with GRE, DMVPN, Easy VPN, etc.). Relevant documents are also referenced. Do not power up the integrated services router (ISR) until you have read these instructions.

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 the Verizon demonstration loan program or by your organization. For the CGR-2010 the LTE GRWIC is required. For the C819G-4G-V, 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.
i. If the service is Internet with dynamic IP addressing, the Access Point Name (APN) will already be correct for the LTE eHWIC. Skip to the following step.

ii. If the service is Internet with static IP addressing, 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 (in the separate box) to see if the SIM is inserted. If not, insert the SIM using the instructions found at: http://www.cisco.com/en/US/docs/routers/access/interfaces/ic/hardware/installation/guide/EHWIC-4GLTEHW.html#wp1147248. The GRWIC on CGR is similar. The 819 has a small SIM panel underneath.

4. Install the LTE eHWIC into the ISR G2 (or GRWIC into the CGR-2010).
   a. The instructions to physically install the LTE eHWIC into the ISR are available at: http://www.cisco.com/en/US/docs/routers/access/interfaces/ic/hardware/installation/guide/inst_ic.html#wp1037332. The CGR-2010 is similar. The C819G-4G-V has the LTE already integrated.
   b. Install the LTE eHWIC into the right-most eHWIC slot (looking at the rear of the ISR, slot 0/0) (Figure 1).

Figure 1. LTE eHWIC

5. Install the antenna cables to the LTE eHWIC/GRWIC/819 and the antennas onto the extension cables.
   a. Instructions are 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 G2 (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 instructions to reset the password at: http://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 0/0/0 radio command (show cell 0 radio for 819).
      iii. Type “show ver” and ensure that the recommended Cisco IOS® Software version is running. The minimum Cisco IOS software release depends on the LTE modem firmware level (seen via IOS command “show cell 0/0/0 hardware”). For firmware 1.0.9.3 The IOS LTE Interim image is required (to access send an email to interim_lte_image@cisco.com include your cisco.com user ID). For firmware release 3.5.10.6 (recommended), IOS 15.2(4)M3 is required. Firmware 3.5.10.6 is available at: http://software.cisco.com/download/release.html?i=!y&mdfid=284772061&softwareid=284285628&release=3.5.10.6&os=
      iv. Type “show run” to see if the configuration matches the key values shown in the appropriate configuration example as provided later in this document.
      v. If the configuration does not match the appropriate configuration example, add or change the appropriate lines through the command-line interface (CLI) config t, etc. Note: Even with the Internet with static IP service, the cell interface remains address negotiated.
   b. If the service is Internet with dynamic IP addressing, skip to the next step.
c. If the service is Internet with static IP addressing, 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 to configure the LTE modem appropriately. The ISR should not be powered down for at least 10 minutes after initial power-up (with antennas attached). This process provisions the appropriate APN. If the network-based process (SIM-Over-the-Air/Over-the-Air-Device Management [SIM-OTA/OTA-DM]) does not change the APN, 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 then put the SIM into another LTE device (Novatel Mifi hotspot, 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 local APN change script bundled with the recovery script (the link follows). The Cisco IOS Software command `show cellular 0/x/0 profile` displays the APN (`show cellular 0 profile` for the 819).

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. Cisco IOS 15.2(4)M3 (for ISR G2) or 15.3(1)T1 (for CGR-2010) (both require LTE modem firmware 3.5.10.6) or the IOS LTE Interim Special Software Release (if LTE modem firmware is still at 1.0.9.3) mitigates the LTE eHWIC out-of-sync condition.
   The ISR LTE auto-recovery script should NOT be used and should be removed after installing and running the IOS Interim image or 15.2(4)M3. The links with the ISR script & instructions for LTE auto-recovery will be maintained, as it includes the local APN change script (only required for LTE Internet/Static IP service, only if OTA-DM fails, and only if using the IOS interim image, for 15.2(4)M3 the 1-line IOS command is used:
   a. 15.2(4)M3 IOS enable-mode command example: `cellular 0/0/0 lte profile create 1 ne01.VZWSTATIC`

Additional Information
- Cisco LTE Portal: [http://www.cisco.com/go/4g](http://www.cisco.com/go/4g) (Verizon documents for configuration under “white papers”)
- LTE eHWIC antenna, cabling, and lightning arrestor instructions:
Configuration Guide: Verizon Internet Access, Static IP, LTE eHWIC

1. For ISR, the recommended Cisco IOS release is 15.2(4)M3 or later (first requires LTE eHWIC firmware 3.5.10.6). For CGR-2010 it is 15.3(1)T1 (LTE GRWIC firmware 3.5.10.6); To load LTE modem firmware 3.5.10.6, the ISR must be running 15.2(4)M2 (or the IOS LTE Interim Image special release). For CGR 15.2(4)M2 must be running to load the firmware. Then immediately upgrade IOS to the aforementioned release, depending on platform.
   a. LTE eHWIC firmware level can be checked with the Cisco IOS Software enable mode command `show cellular 0/x/0 profile` (where 0/x/0 is the cellular interface number seen in the `show ip interface brief` Cisco IOS Software enable mode command).

2. For ISR, The Cisco IOS LTE Interim Special Software Release or 15.2(4)M3 (or 15.3(1)T1 for CGR) mitigates the LTE eHWIC out-of-sync condition with its on-board LTE modem. The ISR LTE auto-recovery script should NOT be used and should be removed after installing and running these releases.

3. 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.

4. This guide is for the Internet NAT use case, with Verizon Internet dynamic IP address service. VPN would be configured as needed with the crypto map placed on the cellular interface (or other method as required using GRE tunnel interfaces, etc.).

5. 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 (because of an 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
Because the configurations vary greatly depending on VPN type, listed will be the basic Internet configuration, followed by Easy VPN, followed by DMVPN. These configurations are only examples; your configuration should match your enterprise policies and best practices. However, routing protocol timers must be within Verizon Wireless guidelines (minimum 5 minute hello time).
ISR LTE eHWIC 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.SSA.V152_4_M_LTE_LINK_REC
ip cef

### CHAT Script to make a data call ###
chat-script ltescript "" "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 1300 bytes to allow for 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 1300
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 1300
ip policy route-map clear-df

### Interface Cellular – used to make a data call. Receives Pool/WAN IP (dynamic or static) from P-GW. The call will be activated using the Dialer Watch group. Note that the "dialer idle-timeout" is set to never (0). For static IP address services, still use “ip address negotiated“. ###

interface Cellular0/0/0
ip address negotiated
ip nat outside
no ip unreachable
encapsulation slip
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer string ltescript
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 all traffic leaving the cell interface ###
access-list 100 permit ip any 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 the DF-bit in packets 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

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

end
CGR-2010 with LTE GRWIC is configured similarly to the ISR with LTE eHWIC.

C819G-4G-V is configured similarly to the ISR with LTE eHWIC with these caveats:

- The cell interface is “cellular 0”
- The line interface representing LTE is “line 3”
- The following configuration must be added until Bug ID: CSCud06180 is resolved in a future IOS release (target date is July 2013).

```
cellular 0
  lte modem link-recovery enable
  lte modem link-recovery monitor-timer 60

!interface Cellular0
  dialer enable-timeout 60
```

### ISR LTE eHWIC Internet Configuration for Primary Access with DMVPN, No NAT, and No Split Tunnel

```
!### command allowing for "LTE test cellular" enable mode commands ###
  service internal
!
  hostname c1921-Internet
!

!### load the appropriate IOS image ###
  boot system flash:c1900-universalk9-mz.SSA.V152_4_M_LTE_LINK_REC
!
  ip cef
!

!### CHAT Script to make a data call ###
  chat-script ltescript "" "AT!CALL1" TIMEOUT 20 "OK"
!

!### IKE/IPsec Definition to DMVPN Hub – IP addresses must be replaced ###
  crypto isakmp policy 1
    encr 3des
    authentication pre-share
    group 2
  crypto isakmp key IkEkEy address 4.300.400.500
!
  crypto ipsec transform-set SDM_TRANSFORMSET_1 esp-3des esp-sha-hmac
!
  crypto ipsec profile SDM_Profile1
    set transform-set SDM_TRANSFORMSET_1!
!

!### Tunnel interface for DMVPN – Change Tunnel Destination IP Address ###
!### EIGRP hello interval must be changed, conform to Verizon Contract ###
```
### Head end DMVPN, EIGRP peer timer values should match what’s below ###

```plaintext
interface Tunnel0
    description $FW_INSIDE$
    bandwidth 1000
    ip address 10.10.1.8 255.255.255.0
    no ip redirects
    no ip unreachables
    no ip proxy-arp
    ip helo-interval eigrp 1 300
    ip hold-time eigrp 1 600
    ip policy route-map clear-df
    ip nhrp authentication NhRpKeY
    ip nhrp map 10.10.1.1 4.300.400.500
    ip nhrp network-id 123451
    ip nhrp holdtime 3600
    ip nhrp nhs 10.300.400.500
    ip nhrp registration no-unique
    ip route-cache flow
    delay 1000
    qos pre-classify
    tunnel source GigabitEthernet0/0
    tunnel destination 4.300.400.500
    tunnel key 100000
    tunnel protection ipsec profile SDM_Profile1

!### 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 1300 bytes to allow for 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 tcp adjust-mss 1300
    ip policy route-map clear-df

!interface GigabitEthernet0/1
    ip address 10.20.40.1 255.255.255.0
    ip tcp adjust-mss 1300
    ip policy route-map clear-df

!### Interface Cellular – used to make a data call. Receives Pool/WAN IP (dynamic or static) from P-GW. The call will be activated using the Dialer Watch group."
```
Note that the "dialer idle-timeout" is set to never (0). For static IP address services, still use "ip address negotiated". ###

```
interface Cellular0/0/0
 ip address negotiated
 no ip unreachable
 encapsulation slip
 load-interval 30
 dialer in-band
 dialer idle-timeout 0
 dialer string ltescript
 dialer watch-group 1
 async mode interactive

```

!### This stanza represents the IP routing protocol of choice and definitions ###
```
router eigrp 1
 network 10.0.0.0
 no auto-summary

```

!### This static route only allows traffic destined for the DMVPN head end out the LTE connection. No other traffic is permitted to exit the LTE interface ###
```
interface Cellular0/0/0
 ip route 4.300.400.500 255.255.255.255 Cellular0/0/0

```

!### Route-map clears the DF-bit in packets exiting the LTE 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

```

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

```
end
CGR-2010 with LTE GRWIC is configured similarly to the ISR with LTE eHWIC.

C819G-4G-V is configured similarly to the ISR with LTE eHWIC with these caveats:

- The cell interface is “cellular 0”
- The line interface representing LTE is “line 3”
- The following configuration must be added until Bug ID: CSCud06180 is resolved in a future IOS release (target date is July 2013).

```
cellular controller Cellular 0
    lte modem link-recovery enable
    lte modem link-recovery monitor-timer 60

interface Cellular0
dialer enable-timeout 60
```

ISR LTE eHWIC Internet Configuration for Primary Access: Easy VPN, Split Tunnel + NAT

```
!### command allowing for “LTE test cellular” enable mode commands ###
service internal
!
hostname c1921-Internet
!
!### load the appropriate IOS image ###
boot system flash:c1900-universalk9-mz.SSA.V152_4_M_LTE_LINK_REC
!
ip cef
!
!### CHAT Script to make a data call ###
chat-script ltescript "" "AT!CALL1" TIMEOUT 20 "OK"
!
!### IKE/IPsec Definition to DMVPN Head end – IP addresses must be replaced: :-)###
crypto isakmp policy 1
    encr 3des
    authentication pre-share
    group 2
crypto isakmp key IkeKeY address 0.0.0.0 0.0.0.0
crypto isakmp keepalive 60
!
crypto ipsec client ezvpn ez
    connect auto
    group ezdemo key ezdemo
    mode network-extension
    peer 4.300.400.500
```
virtual-interface 2
username ezclient password ezclientpw
xauth userid mode local
!
### 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 1300 bytes to allow for 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 1300
ip policy route-map clear-df
crypto ipsec client ezvpn ez inside
!
interface GigabitEthernet0/1
ip address 10.20.40.1 255.255.255.0
ip nat inside
ip tcp adjust-mss 1300
ip policy route-map clear-df
crypto ipsec client ezvpn ez inside
!
### Interface Cellular – used to make a data call. Receives Pool/WAN IP (dynamic or static) from P-GW. The call will be activated using the Dialer Watch group. Note that the “dialer idle-timeout” is set to never (0). 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 string ltescript
dialer watch-group 1
async mode interactive
crypto ipsec client ezvpn ez
!
!### 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 all traffic leaving the cell interface ###

access-list 100 permit ip any 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 the DF-bit in packets exiting 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
!

line 0/0/0
  script dialer ltescript
    modem InOut
    no exec
    transport input telnet
!
end
CGR-2010 with LTE GRWIC is configured similarly to the ISR with LTE eHWIC.

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- The following configuration must be added until Bug ID: CSCud06180 is resolved in a future IOS release (target date is July 2013).

```
controller Cellular 0
  lte modem link-recovery enable
  lte modem link-recovery monitor-timer 60

! interface Cellular0
  dialer enable-timeout 60
```

Sample Operation and Show Commands

**LTE Call Comes Up**

```
c1921-Internet#test cellul 0/0/0 modem-power
Modem Power cycled successfully

c1921-Internet#
 Mar 12 21:54:23.334: %CELLWAN-2-MODEM_UP: Modem in HWIC slot 0/0 is now UP
 Mar 12 21:54:51.514: %LINK-3-UPDOWN: Interface Cellular0/0/0, changed state to up
 Mar 12 21:54:52.514: %LINEPROTO-5-UPDOWN: Line protocol on Interface Cellular0/0/0, changed state to up
```

```
c1921-Internet#show 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
       + - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

S* 0.0.0.0/0 is directly connected, Cellular0/0/0
  1.0.0.0/32 is subnetted, 1 subnets
C  1.2.3.9 is directly connected, Loopback1
  10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C  10.20.30.0/24 is directly connected, GigabitEthernet0/0
```
L 10.20.30.1/32 is directly connected, GigabitEthernet0/0
C 166.158.61.41/32 is directly connected, Cellular0/0/0

C1921-Internet#sh ip int brie

<table>
<thead>
<tr>
<th>Interface</th>
<th>IP-Address</th>
<th>OK? Method Status</th>
<th>Status</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedded-Service-Engine0/0</td>
<td>unassigned</td>
<td>YES NVRAM</td>
<td>administratively down down</td>
<td>down down</td>
</tr>
<tr>
<td>GigabitEthernet0/0</td>
<td>10.20.30.1</td>
<td>YES NVRAM</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>GigabitEthernet0/1</td>
<td>10.20.40.1</td>
<td>YES NVRAM</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>GigabitEthernet0/1/0</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>GigabitEthernet0/1/1</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>GigabitEthernet0/1/2</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>GigabitEthernet0/1/3</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>Cellular0/0/0</td>
<td>166.158.61.41</td>
<td>YES IPCP</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>Cellular0/0/1</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
<tr>
<td>Cellular0/0/2</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
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</tr>
<tr>
<td>Loopback1</td>
<td>1.2.3.9</td>
<td>YES NVRAM</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>NVIO</td>
<td>10.20.30.1</td>
<td>YES unset</td>
<td>up</td>
<td>up</td>
</tr>
<tr>
<td>Vlan1</td>
<td>unassigned</td>
<td>YES unset</td>
<td>down</td>
<td>down</td>
</tr>
</tbody>
</table>

C1921-Internet#sh dialer

Ce0/0/0 - dialer type = IN-BAND ASYNC NO-PARITY
Idle timer (never), Fast idle timer (20 secs)
Wait for carrier (30 secs), Re-enable (10 secs)
Dialer state is data link layer up
Dial reason: Dialing on watched route loss
Time until disconnect never
Current call connected 00:01:24
Connected to newchat

Dial String | Successes | Failures | Last DNIS | Last status |
-------------|-----------|----------|-----------|-------------|
ltechat      | 1         | 1        | 00:01:24  | successful  |

C1921-Internet#ping 4.2.2.2 source lo1

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 1.2.3.9
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/69/76 ms
C1921-Internet#**ping 4.2.2.2 source gi0/0**
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 10.20.30.1
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = **56/60/64 ms**

C1921-Internet#**sh ip nat trans**
Pro        Inside global    Inside local    Outside local    Outside global
icmp 166.158.61.41:9309  1.2.3.9:9309  4.2.2.2:9309  4.2.2.2:9309
icmp 166.158.61.41:9310  1.2.3.9:9310  4.2.2.2:9310  4.2.2.2:9310
icmp 166.158.61.41:9311  10.20.30.1:9311 4.2.2.2:9311  4.2.2.2:9311
udp 166.158.61.41:123   10.20.30.3:123 173.244.211.10:123 173.244.211.10:123

C1921-Internet#

C1921-Internet#**sh cell 0/0/0 all**
Hardware Information
====================
Modem Firmware Version = SWI9600M_01.00.09.03
Modem Firmware built = 2011/07/01 19:31:09
Hardware Version = 20460000
International Mobile Subscriber Identity (IMSI) = 311480003046872
International Mobile Equipment Identity (IMEI) = 990000820020925
Electronic Serial Number (ESN) = 0x8002A36C [12800172908]
Integrated Circuit Card ID (ICCID) = 89148000000030771738
Mobile Subscriber International Subscriber IDentity Number (MSISDN) = +12675657329

Profile Information
====================
Profile 1 = ACTIVE*
-------
PDP Type = IPv4
PDP address = **166.158.61.41**
Access Point Name (APN) = ne01.VZWSTATIC
Authentication = None
Username:
Password:
    Primary DNS address = 198.224.188.236
    Secondary DNS address = 198.224.189.236
* - Default profile

Data Connection Information
================================
Data Transmitted = 0 bytes, Received = 0 bytes
Profile 1, Packet Session Status = ACTIVE
   IP address = 166.158.61.41
   Primary DNS address = 198.224.188.236
   Secondary DNS address = 198.224.189.236
Profile 2, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 3, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 4, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 5, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 6, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 7, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 8, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 9, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 10, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 11, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 12, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 13, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 14, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 15, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown
Profile 16, Packet Session Status = INACTIVE
   Inactivity Reason = Unknown

Network Information
====================
Current Service Status = No service, Service Error = None
Current Service = Packet switched
Current Roaming Status = Home
Network Selection Mode = Automatic
Mobile Country Code (MCC) = 27296
Mobile Network Code (MNC) = 0

Radio Information
==================
Radio power mode = ON
Current RSSI = -60 dBm
LTE Technology Preference = AUTO
LTE Technology Selected = LTE

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

C1921-Internet#

Cisco IOS Software, C1900 Software (C1900-UNIVERSALK9-M), Version 15.1(4)M4, MAINTENANCE INTERIM SOFTWARE
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Sun 04-Mar-12 01:07 by prod_rel_team

ROM: System Bootstrap, Version 15.0(1r)M12, RELEASE SOFTWARE (fc1)

C1921-Internet uptime is 6 days, 5 hours, 4 minutes
System returned to ROM by power-on
System restarted at 17:56:21 UTC Tue Mar 6 2012
System image file is "flash:c1900-universalk9-mz.SPA.151-4.M4"
Last reload type: Normal Reload

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.
Cisco CISCO1921/K9 (revision 1.0) with 487424K/36864K bytes of memory.
Processor board ID FTX155180ES
6 Gigabit Ethernet interfaces
2 terminal lines
1 Virtual Private Network (VPN) Module
4 Cellular interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
250864K bytes of USB Flash usbflash0 (Read/Write)

License Info:

License UDI:

-------------------------------------------------
Device#  PID               SN
-------------------------------------------------
*0        CISCO1921/K9      FTX155180ES

Technology Package License Information for Module:'c1900'

------------------------------------------------------------------
Technology  Technology-package    Technology-package
            Current       Type         Next reboot
------------------------------------------------------------------
ipbase      ipbasek9   Permanent   ipbasek9
security    securityk9 Permanent   securityk9
data        datak9     Permanent   datak9
------------------------------------------------------------------

Configuration register is 0x2102
DM VPN Show Commands with LTE (From show debug)

-------------------- show dmvpn detail --------------------

Legend: Attrb --> S - Static, D - Dynamic, I - Incomplete
        N - NATed, L - Local, X - No Socket
        # Ent --> Number of NHRP entries with same NBMA peer
        NHS Status: E --> Expecting Replies, R --> Responding, W --> Waiting
        UpDn Time --> Up or Down Time for a Tunnel

==========================================================================

Interface: Tunnel0, IPv4 NHRP Details
IPv4 Registration Timer: 30 seconds

IPv4 NHS:
10.249.248.1   E priority = 0 cluster = 0
Type:Spoke, Total NBMA Peers (v4/v6): 1

# Ent  Peer NBMA Addr  Peer Tunnel Add State  UpDn Tm Attrb    Target Network
-----  ---------------  ---------------  -----  -----  ------  --------------------
1  4.300.400.500  10.249.248.1  IKE 00:05:54    S    10.249.248.1/32
<<IP@ changed>>

Interface: Tunnel1, IPv4 NHRP Details
IPv4 Registration Timer: 30 seconds

IPv4 NHS:
10.249.244.2  RE priority = 0 cluster = 0
Type:Spoke, Total NBMA Peers (v4/v6): 1

# Ent  Peer NBMA Addr  Peer Tunnel Add State  UpDn Tm Attrb    Target Network
-----  ---------------  ---------------  -----  -----  ------  --------------------
1  4.300.207.59  10.249.244.2  UP 00:03:01    S    10.249.244.2/32
<<IP@ changed>>

Crypto Session Details:
--------------------------------------------------------------------------------
-------------------- show crypto map --------------------

Crypto Map: "HSC_DMVPN-head-1" idb: Cellular0/0/0 local address: 166.142.300.400
Crypto Map IPv4 "HSC_DMVPN-head-1" 65536 ipsec-isakmp
Profile name: HSC_DMVPN
Security association lifetime: 4608000 kilobytes/3600 seconds
Responder-Only (Y/N): N
PFS (Y/N): N
Transform sets={
    HSC_DMVPN: { esp-256-aes esp-md5-hmac }, { comp-lzs },
}

Crypto Map IPv4 "HSC_DMVPN-head-1" 65537 ipsec-isakmp
Map is a PROFILE INSTANCE.
Peer = 4.300.207.59
Extended IP access list
    access-list permit gre host 166.142.300.400 host 300.400.207.59
Current peer: 72.20.207.59
Security association lifetime: 4608000 kilobytes/3600 seconds
Responder-Only (Y/N): N
PFS (Y/N): N
Transform sets={
    HSC_DMVPN: { esp-256-aes esp-md5-hmac }, { comp-lzs },
}

Crypto Map IPv4 "HSC_DMVPN-head-1" 65538 ipsec-isakmp
Map is a PROFILE INSTANCE.
Peer = 4.300.400.500
Extended IP access list
    access-list permit gre host 166.142.156.185 host 62.189.229.67
Current peer: 4.300.400.500
Security association lifetime: 4608000 kilobytes/3600 seconds
Responder-Only (Y/N): N
PFS (Y/N): N
Transform sets={
    HSC_DMVPN: { esp-256-aes esp-md5-hmac }, { comp-lzs },
}
Interfaces using crypto map HSC_DMVPN-head-1:
    Tunnel1
    Tunnel0

------------------ show crypto isakmp policy ------------------
Global IKE policy
Protection suite of priority 10
  hash algorithm: Message Digest 5
  authentication method: Pre-Shared Key
  Diffie-Hellman group: #2 (1024 bit)
  lifetime: 86400 seconds, no volume limit

------------------ show crypto ipsec transform ------------------

Transform set HSC_DMVPN: { esp-256-aes esp-md5-hmac }
  will negotiate = { Tunnel, },
  { comp-lzs }
  will negotiate = { Tunnel, },

Transform set #$!default_transform_set_1: { esp-aes esp-sha-hmac }
  will negotiate = { Transport, },

Transform set #$!default_transform_set_0: { esp-3des esp-sha-hmac }
  will negotiate = { Transport, },

------------------ show crypto isakmp sa ------------------

IPV4 Crypto ISAKMP SA

<table>
<thead>
<tr>
<th>dst</th>
<th>src</th>
<th>state</th>
<th>conn-id</th>
<th>status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.300.400.500</td>
<td>166.142.300.400</td>
<td>MM_NO_STATE</td>
<td>0</td>
<td>ACTIVE (deleted)</td>
</tr>
<tr>
<td>72.300.400.59</td>
<td>166.142.300.400</td>
<td>QM_IDLE</td>
<td>1001</td>
<td>ACTIVE</td>
</tr>
</tbody>
</table>

IPV6 Crypto ISAKMP SA

------------------ show crypto engine connection active ------------------

Crypto Engine Connections

<table>
<thead>
<tr>
<th>ID</th>
<th>Type</th>
<th>Algorithm</th>
<th>Encrypt</th>
<th>Decrypt</th>
<th>LastSeqN</th>
<th>IP-Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>IKE</td>
<td>MD5+AES256</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>166.142.156.185</td>
</tr>
<tr>
<td>2001</td>
<td>IPsec</td>
<td>AES256+MD5</td>
<td>0</td>
<td>1458</td>
<td>1458</td>
<td>166.142.156.185</td>
</tr>
<tr>
<td>2002</td>
<td>IPsec</td>
<td>AES256+MD5</td>
<td>2325</td>
<td>0</td>
<td>0</td>
<td>166.142.156.185</td>
</tr>
</tbody>
</table>
Easy VPN Show Commands with LTE

ISR_LTE#  sh cry isa peer
Peer: 4.300.400.500 Port: 4500 Local: 10.170.93.251
Phase1 id: 4.300.400.500
ISR_LTE#
ISR_LTE#sh cry isa sa
IPv4 Crypto ISAKMP SA
dst src state conn-id status
4.300.400.500 10.170.93.251 QM_IDLE 1009 ACTIVE <<dst ip@ changed
to match

IPv4 Crypto ISAKMP SA

ISR_LTE#  sh cry ips client ez
Easy VPN Remote Phase: 8
Tunnel name : ez
Inside interface list: GigabitEthernet0/1, Vlan1
Outside interface: Virtual-Access2 (bound to Cellular0/0/0)
Current State: IPSEC_ACTIVE
Last Event: MTU_CHANGED
Save Password: Allowed
Split Tunnel List: 1
  Address : 192.168.0.0
  Mask : 255.255.0.0
  Protocol : 0x0
  Source Port: 0
  Dest Port : 0
Split Tunnel List: 2
  Address : 10.0.0.0
  Mask : 255.0.0.0
  Protocol : 0x0
  Source Port: 0
  Dest Port : 0
Split Tunnel List: 3
  Address : 11.0.0.0
  Mask : 255.0.0.0
  Protocol : 0x0
  Source Port: 0
  Dest Port : 0
Current EzVPN Peer: 4.300.400.500 <<address is not valid, changed to match
cfg example>>
ISR_LTE# 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
        + - replicated route, % - next hop override

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

S* 0.0.0.0/0 is directly connected, Cellular0/0/0
1.0.0.0/32 is subnetted, 1 subnets
C  1.2.3.16 is directly connected, Loopback1
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
S  10.0.0.0/8 [1/0] via 0.0.0.0, Virtual-Access2
C  10.170.93.251/32 is directly connected, Cellular0/0/0
S  4.0.0.0/8 [1/0] via 0.0.0.0, Virtual-Access2
4.300.0.0/32 is subnetted, 1 subnets <<dst ip@ changed to match
S  4.300.400.500 [1/0] via 0.0.0.0, Cellular0/0/0 <<dst ip@ changed to match

S  192.168.0.0/16 [1/0] via 0.0.0.0, Virtual-Access2
192.168.9.0/32 is subnetted, 1 subnets
C  192.168.9.9 is directly connected, Loopback0
192.168.178.0/24 is variably subnetted, 2 subnets, 2 masks
C  192.168.178.0/24 is directly connected, Vlan1
L  192.168.178.1/32 is directly connected, Vlan1

ISR_LTE#