ISR/IR/CGR LTE Applet for SMS

Site Survey, Status, Location, Usage, Out of Band Management via Text Messaging

For All Verizon Wireless LTE Services

Revision 1.4

April 2018

Overview

Cisco has a family of network devices to interconnect an organization's locations. These devices provide more than connectivity, they provide intent-based networking. This is accomplished by directing, prioritizing and securing traffic based on policies that meet an organization's business intentions. One of the characteristics a device requires to be part of intent-based networking is programmability. As part of Cisco's family, ISR, IR and CGR routers all provide multiple methods for programming.

One of those methods is via EEM (Embedded Event manager, www.cisco.com/go/eem). EEM is an engine built into IOS that provide a way to automate most any function within the router, including self-recovery, communications (via syslog, snmp, SMS), reconfiguration, enabling/disabling paths/interfaces, etc . Actions can be triggered in various ways, such as ISR log message, text messages, specific or recurring date/time, status/change of an interface or available route, a probe failure, etc. The programming can be embedded into the IOS configuration or called from device flash as a tcl script.

This applet is a tcl script leveraging EEM, and is installed on the Cisco router. The user interface is a smart phone or tablet (with cellular service). The applet provides the ability for out-of-band management of Cisco routers (809, 819, 829, 899, 1000 and 4000 series) using 4G LTE (cellular wireless) networks. The LTE plan must include SMS (text ability).

In the past, out-of-band management was accomplished using wireline circuits such as Plain-Old-Telephone Service (POTS) or Integrated Services Digital Network (ISDN) lines. LTE service provides greater speeds, potentially lower cost, fast provisioning/relocation, and media diversity (no landline, which may be co-resident with the primary wireline cables).

Traditional out-of-band management works with LTE (Telnet/SSH, HTTP, SMTP, SNMP). With LTE, an additional method is available: SMS (text messaging). *A key advantage of SMS is that communication with the router is available even if the ISR is unreachable via IP.* As long as the router has a working text-enabled SIM, SMS will work even if the ISR LTE data connection is mis-configured or unreachable via IP.

This applet combines the functions of multiple previously available applets, allowing it to be used for a variety of purposes. These functions can be done by an installer/operator/admin with a cell phone. Some functions require no technical expertise. Via SMS these can be done:

- **LTE site survey:** The radio reception quality and strength can be quickly and easily measured from the ISR itself. This allows for optimum antenna placement without the installer having IOS CLI technical skills or terminal emulation software. Page 4

- **ISR status:** Any IOS display ("show") command can be sent and a response received. If the response exceeds 160 characters, multiple text messages are returned. Page 13

- **ISR remote configuration:** IOS configuration commands can be send to the ISR, allowing for reconfiguration when the primary path is inoperative or previous configuration has caused loss of connectivity. Page 16

- **Monthly LTE Usage:** Obtain the current plan month's byte usage and percentage. This function works with an available applet that collects the usage and alerts when the monthly plan reaches a percentage of the allowance. The applet is available here:
  https://supportforums.cisco.com/document/12098671/monitor-byte-count-over-4g-cellular-interfaces Page 19

- **Dual carrier – Switchover Support:** For ISRs that support dual SIMs (C819G-LTE-MNA-K9, C819G-4G-GA-K9, CGM-4G-LTE-MNA, CGM-4G-LTE-GA, etc.) the active LTE network can be chosen by texting the new "simswap" command. Page 24

- **Reload the ISR**: By texting "reload", the router will do so, even if the running configuration has changed (without saving it). If the running configuration needs to be saved, send a text message of "wr" to the router first. Page 29

- **Seeing the router's location on a smart phone's map function:** If the router has a GPS antenna installed and GPS configured, texting "location" will return a link via text message. Clicking the link will bring up the map app with the router's location. Pg 30

SMS messaging has vulnerabilities (e.g. messages received from invalid sources, dDoS attack by text message). These can be overcome by leveraging Verizon Wireless services such as ThingSpace M2M Management Console (text messaging only from/to that cloud service), or using a white list (only accepting text messages from specific phone numbers). This applet provides for authorization via white list. User ID and Password challenge could be added.

This EEM TCL script is provided as-is without Cisco TAC support,; assistance is available via Cisco forums. To obtain the EEM TCL script and current documentation, use the link below:
https://supportforums.cisco.com/t5/network-infrastructure-documents/command-over-sms/ta-p/3340391

LTE Site Survey via SMS: Overview

4G wireless and the accompanying network devices provide flexibility and ease of placement for sites, kiosks and machines needing connectivity. However, radio signal quality and strength can differ, even with antennas being positioned differently by a few feet. Adjusting the placement of antennas can make a significant difference in the performance obtained using the 4G LTE network.

The document *"LTE Antenna Installation, Positioning and Selection Guide for ISR and CGR Using Verizon 4G LTE"* can provide guidance for antenna placement and selection.
www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/guide_100413.pdf
However, a simple method of obtaining LTE radio signal power and quality measurements would ease the task of finding the optimum placement of antennas.

This function of the ISR app provides a way to receive radio signal measurements quickly, via an SMS text message, thus allowing immediate feedback and the ability to find the optimum spots to place antennas. There is no need for Web or command line access to the ISR. A smart phone is all that is needed.

This ISR sample application (referred to hereafter as the "app") uses EEM to respond to text message requests for a radio site survey. The app is a tcl script that runs on the ISR.

This sample script can be modified to do more or different functions, however other EEM scripts available show examples of some of these methods. Please see the Router Best Practices for LTE Guide "Real World Examples" section for links to additional EEM scripts.

www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/lte_access_011414.pdf

LTE Site Survey via SMS: Details

This ISR app will respond to 2 different requests. To use the app, a text message is sent to the ISR's LTE interface Mobile Device Number (phone number, the "MSISDN" as seen from output of "show cell *x* hardware" command).

The following 2 messages can be sent (as shown below, not case sensitive):
- **survey** - The ISR will respond with multiple texts including the ISR name, detailed radio signal info, radio access technology, network information, and GPS coordinates
- **survey says** - The ISR will respond with a single text including the ISR name, RSSI, RSRP and SNR values, plus the LTE band and its width in Mhz.

Considerations:

- Radio signal strength and quality change dynamically. It is recommended to run the command multiple times per antenna placement (at least 3 times). The antenna locations chosen should "pass" all the surveys by having these minimum values.

  RSSI: Received Signal Strength Indication – a generic radio receiver technology metric for signal strength. Measures both usable signal and noise. Rated in dBm
    - **"Good" value is greater than -80 dBm** (e.g. -79 is greater than -80)

  RSRP: Received Signal Reference Power – the average of the power received of all radio resource elements that carry cell-specific reference signals. Measures usable downstream signal. Rated in dBm
    - **"Good" value is greater than – 105dBm** (e.g. -104 is greater than -105)

  RSRQ: Reference Signal Received Quality – the ratio of usable signal usable+noise signal (RSRP-RSSI). Measures how close the usable signal is to usable+noise. Rated in dBm.
    - **"Good" value is greater than -12dBm** (e.g. -11 is greater than -12)

  SNR: Signal to Noise (Interference) Ratio – The ratio of usable signal to noise (plus interfering) signal. Measures how much of the total signal is usable by comparing usable to noise. Rated in dB
    - **"Good" value is greater than 5 dB** (e.g. 6 is better than 5)

- It may be helpful to mark the antenna placement spots for each set of survey runs, to simplify recalling which survey test mapped to each placement.

- To assist in remembering the placement for each survey test, text can be added after "survey" or "survey says", and will be ignored by the app.   This helps document the test; for example, placing sticky notes where the antennas were placed with a test name, and running the surveys with that test name added after the command. See the last example of the "Sample Installation and Operation" section.

LTE Site Survey via SMS: Requirements

1. ISR 1111 or 4000 series running IOS 16.3.2 or later, ISR 1101 running 16.81 or later, ISR G2 with an LTE eHWIC or an 819 series ISR with embedded LTE running IOS 15.5(3)M2 or later.

2. An active SIM (text capable) inserted with appropriate IOS configuration, and (optionally) knowledge of the phone number where text messages are to be sent

3. The Site Survey script loaded onto ISR flash and configured (as shown below)

4. Both main and diversity antennas connected, one via an extension cable. Each LTE eHWIC, LTE GRWIC, or C819G-4G-V ships with at least one 10' extension cable.

5. Optional: An external GPS antenna connected to the ISR, with line-of-sight to the sky.

LTE Site Survey via SMS: Installation

1) Ensure that the ISR is operational (enabled SIM installed, appropriate IOS version, configured, and LTE and GPS antenna installed with at least one extension cable).
    a. Guidance for the above is available via the documents located here:
       www.cisco.com/c/en/us/support/interfaces-modules/high-speed-wan-interface-cards/products-installation-and-configuration-guides-list.html

2) Download the commandoversms.tcl script from https://supportforums.cisco.com/t5/network-infrastructure-documents/command-over-sms/ta-p/3340391

3) Copy **commandoversms.tcl** script onto the ISR flash via USB drive, TFTP, FTP, etc.

4) Define the default location and the tcl script itself
   event manager directory user policy "flash:/"

   event man pol commandoversms.tcl type user

5) (Optional) Configure SMS security (phone numbers authorized to text the ISR)

   event manager environment whitelist <regular expression>

6) (Optional) This script will send replies back to the number that is shown in the SMS syslog. Some carriers require a prefix that may not show up in the router syslog. If so, set an environmental variable to add it. There's no prefix by default.   event manager environment phoneprefix <digits> (example: phoneprefix 00)

7) (Optional) This script will send replies back to the number that is shown in the SMS syslog. Some carriers append a prefix to the calling number (of device sending the ISR the text) that show ups in the router syslog. If so, set an environmental variable to ignore it. There's no prefix by default. event manager environment removeprefix <digits> (example: phoneprefix 991)

8) An example of a complete "commandoversms" app configuration is below:

VZW-SP-MPN-1#configure terminal
VZW-SP-MPN-1(config)#event manager directory user policy "flash:/"
VZW-SP-MPN-1(config)#event manager policy commandoversms.tcl type user
VZW-SP-MPN-1(config)#event manager environment whitelist (8885550111)
VZW-SP-MPN-1(config)#end
VZW-SP-MPN-1#

*Apr 27 19:28:03.883: %SYS-5-CONFIG_I: Configured from console by cisco on console

An example of using regular expressions below allows multiple white-list numbers:
ISR(config)#event manager environment whitelist (5555551154)|(5555559659)|(5555550168)

9) Depending on the LTE subscription and country, there may be additional characters

LTE Site Survey via SMS: Sample Installation and operation

Check IOS version:

VZW-SP-MPN-1#sh ver | i IOS

Cisco IOS Software, C800 Software (C800-UNIVERSALK9-M), Version 15.3(3)M2, RELEASE SOFTWARE (fc1)

...

Copy the script to the ISR:

VZW-SP-MPN-1#copy tftp flash:

Address or name of remote host []? 172.21.12.3

Source filename []? commandoversms.tcl

Destination filename [gps_geofence.tcl]? <hit enter>

Accessing tftp://172.21.12.3/commandoversms.tcl...

Loading commandoversms.tcl from 172.21.12.3 (via Vlan1): !

[OK - 8206 bytes]

8206 bytes copied in 0.672 secs (12211 bytes/sec)

Confirm the script is on flash:

VZW-SP-MPN-1#dir flash: | i tcl

...

  18 -rw-   14801 Mar 12 2018 22:51:02 +00:00 commandoversms.tcl

...

Configure and check the configuration

VZW-SP-MPN-1#sh run | i event man

event manager directory user policy "flash:/"

event manager policy commandoversms.tcl type user

event manager whitelist (8885550111)

...

Check that the EEM script is running

VZW-SP-MPN-1#sh event man pol reg

No. Class   Type   Event Type   Trap Time Registered   Name
1   script   user   syslog   Off   Sat Mar 24 12:36:48 2014   commandoversms.tcl
 pattern { New SMS received on index .*}
 nice 0 queue-priority normal maxrun 55.000 scheduler rp_primary Secu none
...

Find the phone number (MDN) for the ISR
(This is done during initial setup, copy the number down for subsequent use)

VZW-SP-MPN-1#sh cell 0 hardware

Modem Firmware Version = SWI9600M_03.05.10.06

Modem Firmware built = 2012/11/12 15:07:45

Hardware Version = 10

International Mobile Subscriber Identity (IMSI) = 311480039221159

International Mobile Equipment Identity (IMEI) = 990000820118364

Integrated Circuit Card ID (ICCID) = 89148000000386223318

Mobile Subscriber International Subscriber

IDentity Number (MSISDN) = 14082067973

Current Modem Temperature = 29 deg C

The running configuration is saved, the ISR is powered down, taken to the location for install, and powered on. Without Web GUI or terminal access, a site survey can be done. Send a text message with the full survey ("survey") or short survey ("survey says").
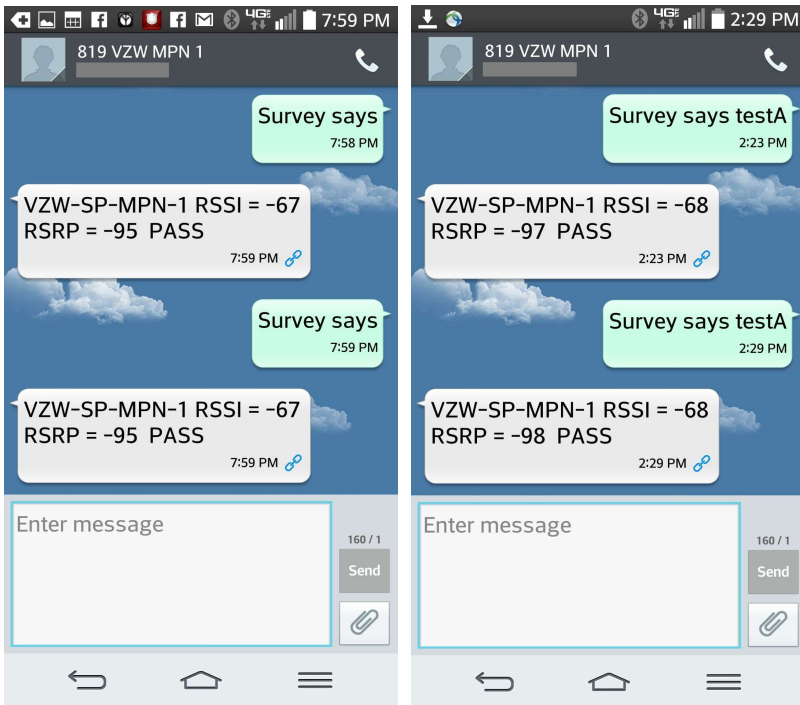
VZW-SP-MPN-1#copy running startup

Destination filename [startup-config]?
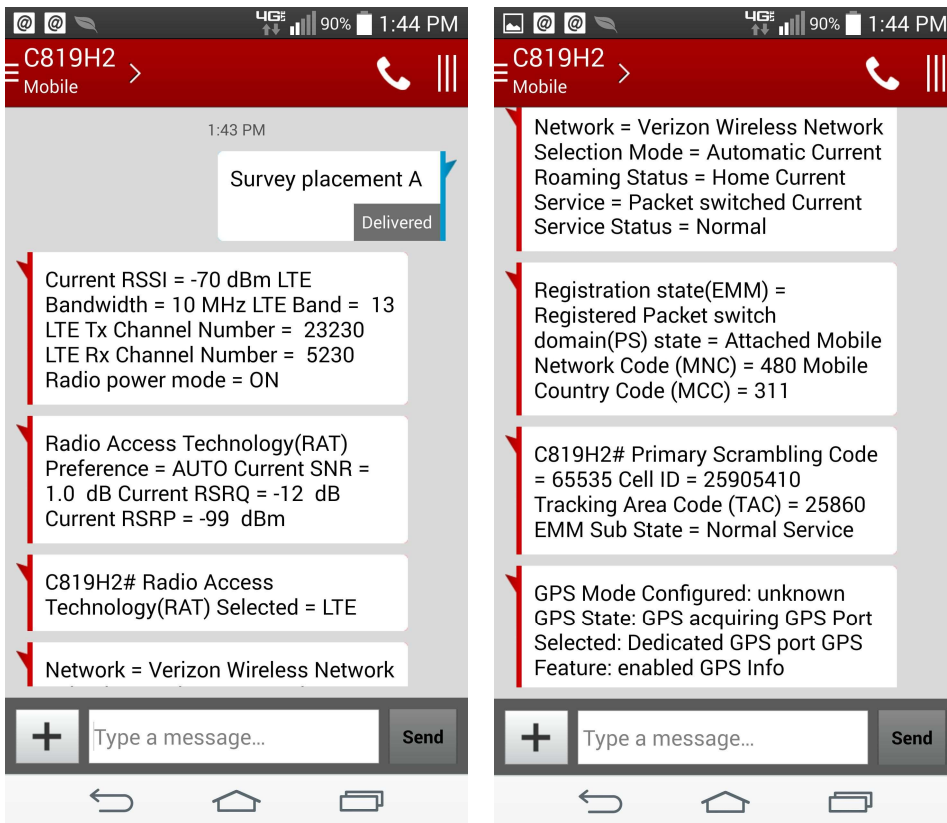
Building configuration…

WLAN_AP_SM: Config command is not supported

[OK]

Below are examples of the "survey says" command sent via SMS. Note that the second includes a comment ignored by the ISR, but helpful to someone installing (testA).
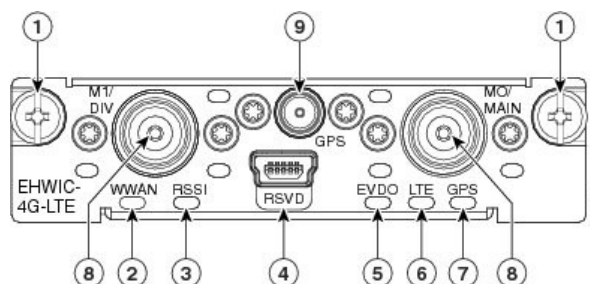
Below is an example of the "survey" command sent via SMS. Note that the text includes a comment ignored by the ISR, but helpful to someone installing ("placement A").

* All phone numbers and public IP addresses have been hidden

Before beginning a survey test, check the "WWAN" LED to ensure it is green and solid. This means the LTE interface is operational. This LED is on the LTE eHWIC, GRWIC or C819G-4G.
(#2 in the LTE eHWIC image below).

ISR Status via SMS: Overview

This function of the ISR app provides a way to query the ISR for status. Any ISR "show" command can be sent. Examples include displaying:
- The IP routing table (show ip route)
- The state and stats for any ISR interface (show interface)
- Log messages pertaining to a specific event or interface (e.g. show log | i Cellular)
- The ISR configuration, or a specific portion (e.g. show running interface Cellular0)

There is no need for ISR Web or command line access. A smart phone is all that is needed.

ISR Status via SMS: Details

Any enable mode command can be sent via text message. The script can be modified to only allow certain commands or disable-mode commands to be entered. The script can be modified to only allow non-IOS display commands (a command that is translated into actual ISR commands), further controlling access or requesting output from multiple commands via a single request. An example of the logic for this is available here:

https://supportforums.cisco.com/document/12050016/eem-tcl-script-provide-lte-status-gps-and-ping-results-sms-text-message
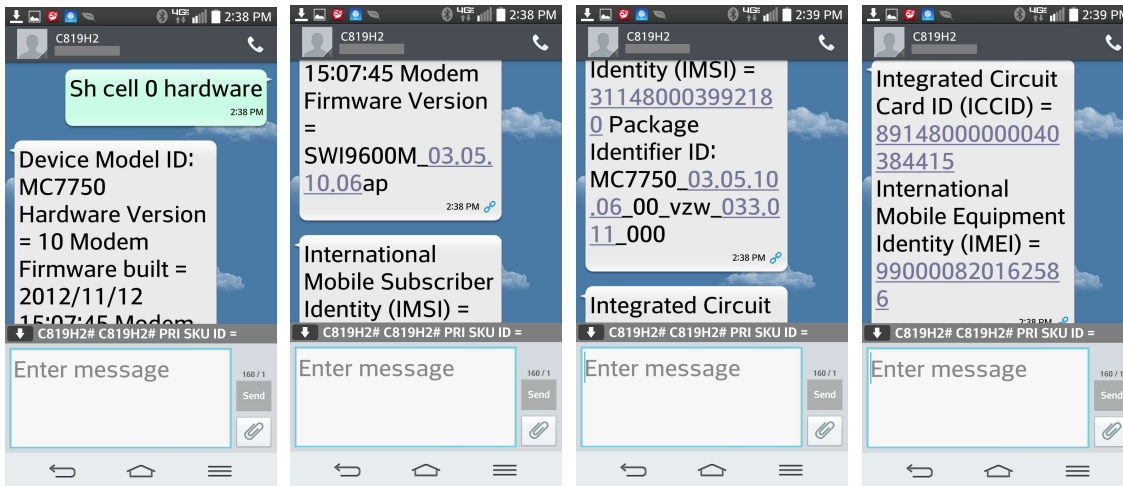
Commands requiring a confirmation are handled by adding ";y" to the text message.
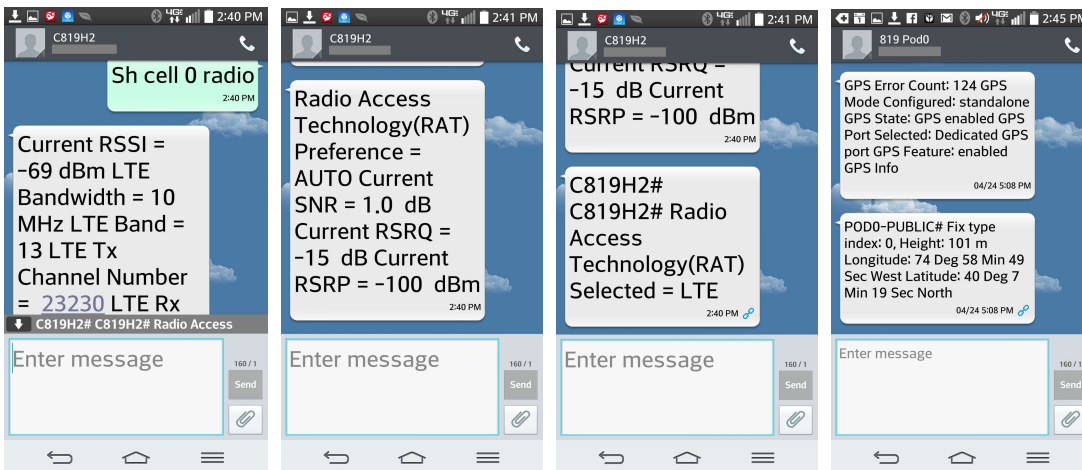
ISR Status via SMS: Sample Installation

Installation of the app has been reviewed in the previous section,
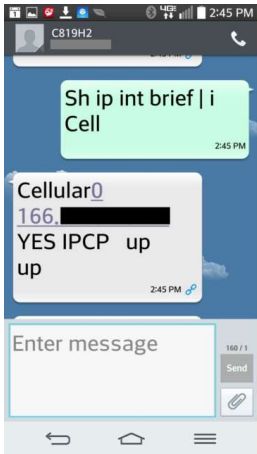
ISR Status via SMS: Sample Operation

Below is an example of a display command (show cell hardware) and a portion of replies.
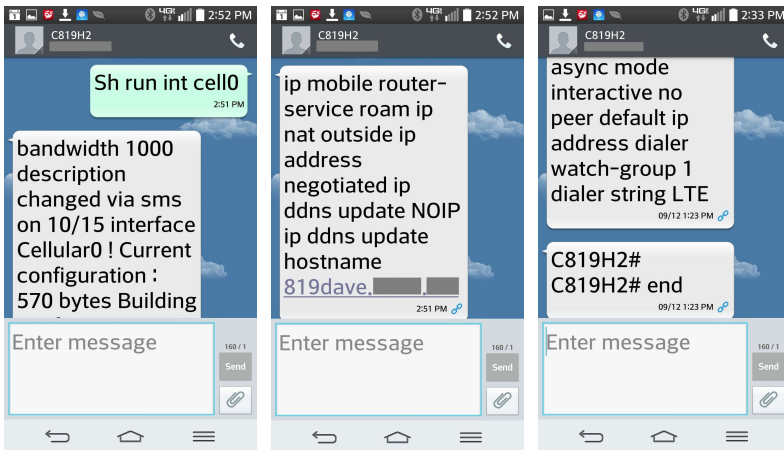

Below is an example of a display command (show cell radio) and a portion of the replies.

Below is a single text response example (show ip interface including "Cell").

The final display example shows the running configuration for the LTE interface.

ISR Remote Configuration via SMS: Overview

This function of the ISR app provides a way to remotely configure the ISR. Any ISR config mode command can be sent. As configuration changes may affect ISR operation, this function can be removed from the script. A smart phone is all that is needed to configure.

ISR Remote Configuration via SMS: Details

Any config mode command can be sent via text message. The applet determines that the text received is configuration related by sending a text that includes a comma (e.g. "config term, ip cef"). If the command is accepted, a message with "Configuration Success!" is returned via text message. If the configuration commands were not accepted (in error), the error message is returned via text message. Any other text sent (other than "usage", "survey" or "survey says" is assumed to be a display command.
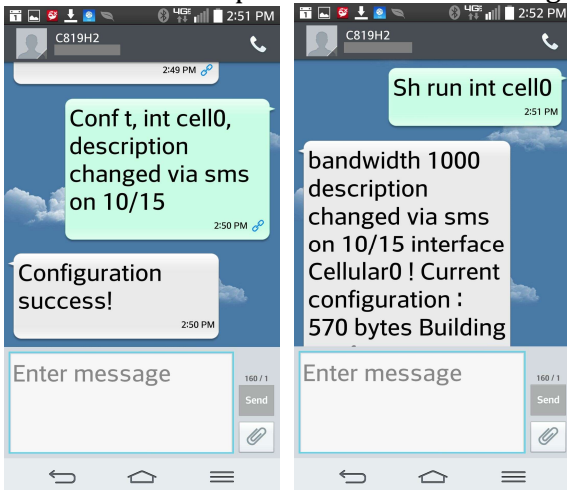
The script can be modified to only allow certain configuration commands to be entered. The script can also be modified to provide a command that represents (is translated into) multiple ISR commands, and not permitting any other commands, further controlling access. An example of the logic is shown here:
https://supportforums.cisco.com/document/12050016/eem-tcl-script-provide-lte-status-gps-and-ping-results-sms-text-message

ISR Remote Configuration via SMS: Sample Installation

Installation of the app has been reviewed in the previous section.

ISR Remote Configuration via SMS: Sample Operation

Below is an example of an interface configuration command and a portion of the reply.

Additional messages were received...

There are some 4G related commands that alter the configuration of the ISR integrated LTE modem, but are executed in IOS enable mode (versus configuration mode). Also, some commands require confirmation after being entered (i.e. an "are you sure?" confirmation).

To illustrate both in a single example, the command to manually set the data APN will be shown. This command is used if the network-based automatic setting process called OTA-DM (over the air device management) does not set the LTE modem APN value correctly based on the SIM inserted. If the service chosen is Verizon LTE public dynamic IP address, no change is needed. However, if after deployment, the service is changed to a Mobile Private Network, the APN value will change for the new service. The goal is to ensure that a site visit is not required for the change to take place, by making the change remotely.
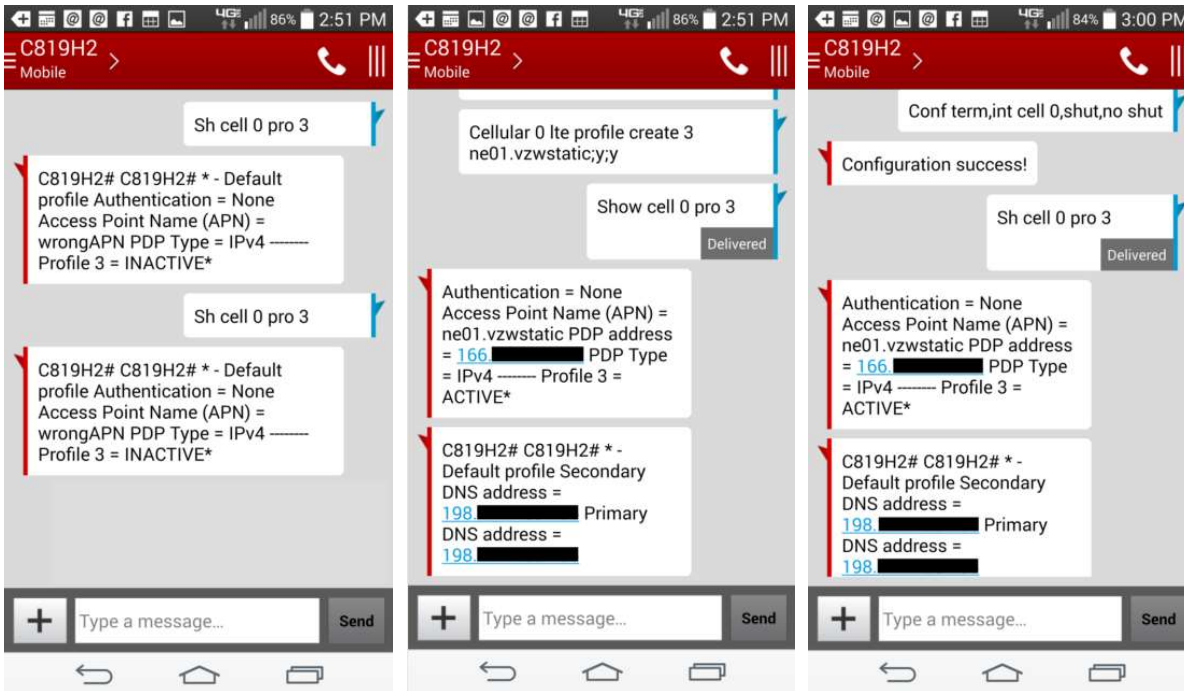
So why not simply use Telnet over LTE to make the change? If the network change has occurred, then the ISR may no longer be reachable via the LTE data connection.

This enable mode command *requires two confirmations* in order to take effect. As this is not a config-mode command, the comma is not used. Instead, a semicolon is used along with "y" per confirmation (add *;y;y*). For example, the text to send to an 819 via SMS using this applet in order to set the APN to ne01.vzwstatic is:

cellular 0 lte profile create 3 ne01.vzwstatic;y;y

Although not needed for this iteration, it may be necessary to cycle the interface after changing the data APN value. The example below shows an ISR with the wrong APN, followed by setting the APN to a

correct value, showing the results (successful connection), then a single configuration text message to "shut" then "no shut" the cellular interface.

ISR Monthly Usage via SMS: Overview

This function of the ISR app returns the current month's byte usage for the LTE plan. This function works with an available applet that collects the usage and alerts when the monthly plan reaches a percentage of the allowance.

ISR Monthly Usage via SMS: Details

When "usage" is sent via text message, the ISR returns the byte count and percentage of the LTE subscription plan used. If the prerequisite applet is not installed, nothing is returned.

The prerequisite applet is defined with the LTE plan's data quantity (e.g. 5GB) and the billing day of the month. The byte count survives ISR reloads and clear commands, and resets the byte count and percentage used on the billing day of the month.

ISR Monthly Usage via SMS: Sample Installation

Installation of the app has been reviewed in the previous section,

ISR Monthly Usage via SMS: Sample Operation

Below is an example of two requests for LTE plan bytes used and the replies.

ISR SMS Authorization (White List): Sample Operations

Below are two examples of operation, when using the white list feature. The first is an SMS OOB message from a number that is on the white list, and the second from a number that is not on the white list. The actual numbers have been replaced.

C819H2#sh run | s event man

event manager environment _dom 12

event manager environment whitelist (2155550111)

event manager directory user policy "flash:/"

event manager policy commandoversms.tcl type user

C819H2#

This is the ISR's number to send the command over SMS.

C819H2#sh cell 0 hard | I MSISDN

Digital Network-Number (MSISDN) = **12405550100**

C819H2#

SMS sent (survey says) from 215-555-0111 (authorized).

C819H2#

Feb 13 16:40:50.757: Cellular0: New SMS received on index 0. Please issue a view command to see it

Feb 13 16:40:51.537: %HA_EM-6-LOG: commandoversms.tcl: received SMS from **2155550111** : **Survey says**

Feb 13 16:40:51.541: %HA_EM-6-LOG: commandoversms.tcl: RESULT = 0 8 and zero = 1

Feb 13 16:40:51.669: %HA_EM-6-LOG: commandoversms.tcl: RSSI = -65 RSRP = -96 PASS

Feb 13 16:40:51.669: %HA_EM-6-LOG: commandoversms.tcl: txtmsg = C819H2# Current SNR = -3.1 dB Current RSRQ = -14 dB Current RSRP = -96 dBm Current RSSI = -65 dBm

Feb 13 16:40:52: %CELLWAN-2-SMS_ARCH_PATH_UNCONFIGURED: Cellular0 failed to archive SMS because 'gsm|cdma|lte sms archive path' under cellular controller is not configured.

Feb 13 16:40:52: %CELLWAN-5-OUTGOING_SMS_SENT: Cellular0 has just sent an outgoing SMS successfully.

Feb 13 16:40:52.445: %HA_EM-6-LOG: commandoversms.tcl: Successfully deleted SMS message 0 from SIM

Reconfigure the applet so the only authorized number is 888-555-0999. Deregister the app, change (remove/add) the white-list, then re-register the applet.

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C819H2#conf t

Enter configuration commands, one per line. End with CNTL/Z.

C819H2(config)#no event manager policy commandoversms.tcl type user

C819H2(config)#no event manager environment whitelist (2155550111)

C819H2(config)#event manager environment whitelist (8885550999)

C819H2(config)#event manager policy commandoversms.tcl type user

C819H2(config)#end

C819H2#

Feb 13 17:15:27: %SYS-5-CONFIG_I: Configured from console by cpe on console

C819H2#sh run | i event man

event manager environment _dom 12

event manager environment whitelist (8885550999)

event manager directory user policy "flash:/"

event manager policy commandoversms.tcl type user

C819H2#

**Send the same message again from the same SMS device, which is no longer authorized.
The message is received but ignored.**

C819H2#

Feb 13 17:16:13.397: Cellular0: New SMS received on index 0. Please issue a view command to see it

Feb 13 17:16:14.185: %HA_EM-6-LOG: commandoversms.tcl: received SMS from 2155550111 : **Survey says**

Feb 13 17:16:14.749: %HA_EM-6-LOG: commandoversms.tcl: Successfully deleted SMS message 0 from SIM

ISR SMS Authorization (White List): Regular Expression Examples

The commandsoversms applet offers optional security by limiting who can execute commands via text message on the ISR. The feature is enabled by defining an EEM variable called "whitelist".   The variable's value is a regular expression that can represent one or more phone numbers, either by defining multiple numbers, or patterns for numbers. Below are a few examples.

Match single phone number:
event manager environment whitelist 2125550101

Match any three phone numbers:

event manager environment whitelist (219555xxxx|5495550168|6195556035)

Match 3 area codes followed by any number:
event manager environment whitelist (212|540|610)[0-9]+

Match 2 area codes associated with specific prefixes followed by any number:
event manager environment whitelist (212555|540555)[0-9]+

For more information on regular expressions, see
www.cisco.com/c/en/us/td/docs/ios/termserv/configuration/guide/15-mt/tsv-15-MT-book/tsv_reg_express.html

Dual Carrier Switchover Support

An added command, "simswap", can be sent via SMS using "commandoversms" app. Usage of this command requires the ISR/IR/CGR to have two enabled SIMs installed, and be configured to support two carriers. This feature allows for manual carrier switchover in less than 2 minutes and may be used if the current carrier monthly data plan has been consumed, an RF issue with the connection is seen, or if performance is deemed insufficient.

"simswap" logic:
- If no dual sim, return a text message with "ISR does not have a 2nd SIM"
- If the ISR has dual SIMs, swap the active SIM
- Wait 130 seconds and report back success via a text message
- If the LTE profile associated with the newly swapped SIM does not become active after 130 seconds (e.g. new profile is inactive), swap the SIM back again. If reverting succeeds, send a text with "swap to other SIM failed. Reverted to original SIM". If reverting also doesn't succeed, write a syslog message (all messages syslogged anyway).

Considerations:
- "simswap" command will function only on ISRs that support dual SIMs (C819G-LTE-MNA-K9, C819G-4G-GA-K9, CGM-4G-LTE-MNA, CGM-4G-LTE-GA, etc.)
- The primary carrier SIM should be in slot 0 and configured accordingly
- The cellular carriers and attachment modes of an ISR vary depending on the LTE modem firmware active on the LTE modem. Multiple firmware images are available on an ISR's flash or can be downloaded from cisco.com. The firmware loaded by default is determined when the ISR/IR/CGR is ordered.
- Instructions for loading different firmware on the LTE modem can be found here: www.www.com The cellular attach modes for various firmware types is as follows:
    - *VZW*.spk   Verizon 3G/LTE (slot 0), AT&T UMTS (3G), slot 1
    - *GENNA*.spk   Verizon, AT&T, Sprint, TMobile, CA, MX LTE, slot 0 or 1
    - *SPRINT*.spk   Sprint 3G/LTE (slot 0), slot 1 is TBD
    - *ATT*.spk   AT&T 3G/4G (SLOT 0), slot 1 is TBD

The steps for using "simswap" command include:
- Install the SIMs, with the primary carrier SIM in SIM slot 0
- Via IOS CLI, confirm or set both carrier profiles on the LTE modem
- Configure IOS to associate each SIM to a carrier profile on the LTE modem
- Manually test that connection can be successfully made to each carrier

Below is an example of how to configure dual carrier for ISRs that have dual SIM slots:

The first step is to confirm or define that there is a valid carrier profile on the LTE modem for each of the two SIMs. This is done via IOS CLI enable-mode command and the setting survives ISR power down/reload. To change a profile, issue the enable modem command again. Below are 3 examples, the first for data APN to T-Mobile public dynamic IP address, the second for the data APN to Verizon Wireless. The 3rd example is only required if an LTE carrier uses a separate APN for attachment than data transfer. This is the case for Verizon Wireless for example.

C819G_LTE_MNA#**cell 0 lte profile create 8 fast.t-mobile.com none ipv4v6**

Profile 8 will be created with the following values:

PDP type = IPV4V6
APN = fast.t-mobile.com
Authentication = NONE

Are you sure? [confirm]
Profile 8 written to modem
C819G_LTE_MNA#
C819G_LTE_MNA#sh cell 0 pro 8

Profile 8 = INACTIVE

PDP Type = IPv4v6
Access Point Name (APN) = fast.t-mobile.com
Authentication = None

C819G_LTE_MNA#**cell 0 lte profile create 3 vzwinternet none ipv4v6**

Profile 8 will be created with the following values:

PDP type = IPV4V6
APN = vzwinternet
Authentication = NONE

Are you sure? [confirm]
Profile 8 written to modem
C819G_LTE_MNA#
C819G_LTE_MNA#**sh cell 0 profile 3**

Profile 3 = INACTIVE

PDP Type = IPv4v6
Access Point Name (APN) = vzwinternet
Authentication = None

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C819G_LTE_MNA#**cell 0 lte profile create 1 vzwims none ipv4v6**

Profile 8 will be created with the following values:

PDP type = IPV4V6
APN = vzwims
Authentication = NONE

Are you sure? [confirm]
Profile 8 written to modem
C819G_LTE_MNA#
C819G_LTE_MNA#**sh cell 0 profile 1**

Profile 3 = INACTIVE

PDP Type = IPv4v6
Access Point Name (APN) = vzwinternet
Authentication = None

The second step is to associate each SIM to a particular LTE modem profile. LTE modems can hold multiple profiles in order to allow attachment to different 3G/4G networks (one at a time, as this is for single LTE modem use). The 1st command defines which LTE modem profile is associated to the SIM in slot 0. The 2nd command defines which LTE modem profile is associated to the SIM in slot 1. The 3rd command defines which SIM slot is primary. Note that both an attach profile and data profile are associated with a SIM. These commands are executed in configuration modem (conf t).

C819G_LTE_MNA#**sh run | s controller Cell**
controller Cellular 0
 lte sim data-profile 3 attach-profile 1 slot 0
 lte sim data-profile 8 attach-profile 8 slot 1
 lte sim primary slot 1
…

The configuration and both SIMs should be tested manually before using the "simswap" command. This can be done by changing the "lte sim primary slot" number above   (i.e. conf t, controller cellular 0, lte sim primary slot 0").

C819G_LTE_MNA#**sh run | s contr**
controller Cellular 0
 lte sim data-profile 3 attach-profile 1 slot 0
 lte sim data-profile 8 attach-profile 8 slot 1
 lte sim primary slot 0
 lte gps mode standalone
 lte gps nmea ip
 lte modem link-recovery rssi onset-threshold -110

```
 lte modem link-recovery monitor-timer 20
 lte modem link-recovery wait-timer 10
 lte modem link-recovery debounce-count 6
control-plane
C819G_LTE_MNA#

C819G_LTE_MNA(config-controller)#lte sim primary slot 1

*May 23 16:05:05.791: %LINK-3-UPDOWN: Interface Cellular0, changed state to down
*May 23 16:05:14.119: %CISCO800-2-MODEM_DOWN: Cellular0 modem is now DOWN.
*May 23 16:05:15.091: %CISCO800-6-SIM_ACTIVATION: SIM in slot 1 is being activated. Please wait for modem to come UP.
*May 23 16:05:56.415: %CISCO800-2-MODEM_UP: Cellular0 modem is now UP
[Cellular0]: NMEA streaming engine switched OFF
[Cellular0]: NMEA streaming engine switched ON#
*May 23 16:07:01.727: %CELLWAN-2-MODEM_RADIO: Cellular0 Modem radio has been turned on
*May 23 16:07:05.195: %LINK-3-UPDOWN: Interface Cellular0, changed state to up

C819G_LTE_MNA#sh cell 0 pro 8

Profile 8 = ACTIVE* **
--------
PDP Type = IPv4v6
PDP address = 6.106.XXX.YYY
PDP IPV6 address = 2607:FB90:60F9:1A6E:CF9:64FF:FE03:1B08/64  Scope: Global
Access Point Name (APN) = fast.t-mobile.com
Authentication = None
        Primary DNS address = 10.177.0.0
        Secondary DNS address = 10.177.0.0
        Primary DNS IPV6 address = FD00:976A:0:0:0:0:0:9
        Secondary DNS IPV6 address = FD00:976A:0:0:0:0:0:10

 * - Default profile
```

Note, as SIM 0 is by default the primary slot, this command will not display in the IOS running configuration.

```
C819G_LTE_MNA(config-controller)#lte sim primary slot 0

*May 23 16:30:21.187: %LINK-3-UPDOWN: Interface Cellular0, changed state to down
*May 23 16:30:29.807: %CISCO800-2-MODEM_DOWN: Cellular0 modem is now DOWN.
*May 23 16:30:30.487: %CISCO800-6-SIM_ACTIVATION: SIM in slot 0 is being activated. Please wait for modem to come UP.
C819G_LTE_MNA(config-controller)#
*May 23 16:31:13.831: %CISCO800-2-MODEM_UP: Cellular0 modem is now UP
C819G_LTE_MNA(config-controller)#
C819G_LTE_MNA(config-controller)#end
C819G_LTE_MNA#
*May 23 16:31:29.519: %SYS-5-CONFIG_I: Configured from console by cisco on console
```

```
C819G_LTE_MNA#sh run | s controller
controller Cellular 0
 lte sim data-profile 3 attach-profile 1 slot 0
 lte sim data-profile 8 attach-profile 8 slot 1
 lte gps mode standalone
 lte gps nmea ip
 lte modem link-recovery rssi onset-threshold -110
 lte modem link-recovery monitor-timer 20
 lte modem link-recovery wait-timer 10
 lte modem link-recovery debounce-count 6
C819G_LTE_MNA#
C819G_LTE_MNA#### sim statement not there as it is the default
C819G_LTE_MNA#
[Cellular0]: NMEA streaming engine switched OFF
[Cellular0]: NMEA streaming engine switched ON
*May 23 16:32:19.143: %CELLWAN-2-MODEM_RADIO: Cellular0 Modem radio has been turned on
*May 23 16:32:19.411: %LINK-3-UPDOWN: Interface Cellular0, changed state to up
C819G_LTE_MNA#
C819G_LTE_MNA#ping 4.2.2.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.2.2.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 188/239/364 ms
C819G_LTE_MNA#
C819G_LTE_MNA#sh cell 0 pro 3

Profile 3 = ACTIVE*
--------
PDP Type = IPv4v6
PDP address = 10.14.12.11
Access Point Name (APN) = VZWTRVPV.GW5.VZWENTP
Authentication = None
        Primary DNS address = 10.20.45.20
        Secondary DNS address = 8.8.4.4
        Primary DNS IPV6 address = 0
        Secondary DNS IPV6 address = 0

 * - Default profile
C819G_LTE_MNA#
```
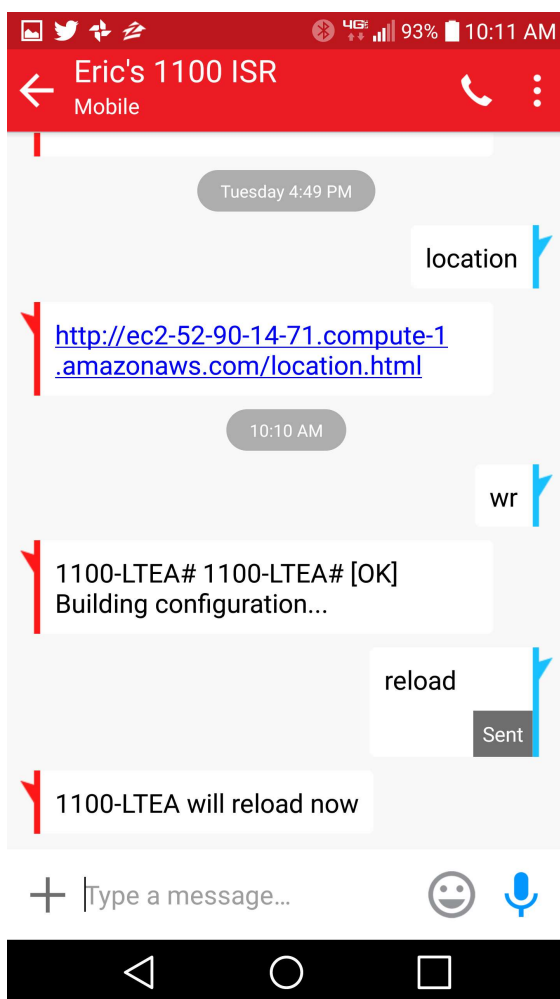
Reloading the Router via Text Message

If there is a need, perhaps due to-misconfiguration or a state causing lack of connectivity, a router can be reloaded via text message. The commandoversms app allows for rebooting the router without saving the running configuration. Simply text "reload" to the router.
If there is a need to save the running configuration, text "wr" to the router before the reload.

*Mar 30 09:08:24.219: Cellular0/2/0: New SMS received on index 9. Please issue a view command to see it
*Mar 30 09:08:24.219: %CELLWAN-2-SMS_ARCH_PATH_UNCONFIGURED: Cellular0/2/0 failed to archive SMS because 'gsm|cdma|lte sms archive path' under cellular controller is not configured.
*Mar 30 09:08:24.938: %HA_EM-6-LOG: commandoversms.tcl: received SMS from 215300xxxx : wr
*Mar 30 09:08:24.945: %HA_EM-6-LOG: commandoversms.tcl: sms-cmd: wr
*Mar 30 09:08:28.369: %SYS-2-PRIVCFG_ENCRYPT: Successfully encrypted private config file
*Mar 30 09:08:28.850: %HA_EM-6-LOG: commandoversms.tcl: SMS sent = 1100-LTEA# 1100-LTEA# [OK] Building configuration...
*Mar 30 09:08:28.850: %HA_EM-6-LOG: commandoversms.tcl: ---
*Mar 30 09:08:29.125: sms_delete_by_id, msg_id = 9 message_index = 9
*Mar 30 09:08:29.301: %HA_EM-6-LOG: commandoversms.tcl: Successfully deleted SMS message 9 from SIM
*Mar 30 09:09:15.455: Cellular0/2/0: New SMS received on index 9. Please issue a view command to see it
*Mar 30 09:09:15.456: %CELLWAN-2-SMS_ARCH_PATH_UNCONFIGURED: Cellular0/2/0 failed to archive SMS because 'gsm|cdma|lte sms archive path' under cellular controller is not configured.
*Mar 30 09:09:16.189: %HA_EM-6-LOG: commandoversms.tcl: received SMS from 215300xxxx : reload

*Mar 30 09:09:16.667: %CELLWAN-2-SMS_ARCH_PATH_UNCONFIGURED: Cellular0/2/0 failed to archive SMS because 'gsm|cdma|lte sms archive path' under cellular controller is not configured.
*Mar 30 09:09:16.667: %CELLWAN-5-OUTGOING_SMS_SENT: Cellular0/2/0 has just sent an outgoing SMS successfully.
*Mar 30 09:09:18.409: %HA_EM-6-FMS_RELOAD_SYSTEM: fh_io_ipc_msg: Policy has requested a system reload; -Process= "EEM Server", ipl= 0, pid= 490 …

Seeing Router's Location via Smart Phone/Tablet Map App

The "commandoversms" script has been enhanced to allow the location of an ISR to be show on a mobile device's map app. To enable this feature, the "findmyrouter" script is also loaded onto the ISR. Information on ISR location-based function and documentation for the "findmy router" (page 10) can be found here:
www.cisco.com/c/dam/en/us/td/docs/routers/access/interfaces/software/deployment/guide/guide_1 20913.pdf

As this application uses an ISR's built-in web server to render the map and its location, the mobile device must be able to reach the ISR via IP. This is achieved by either the mobile device running VPN into the same network as the ISR, or if the ISR LTE subscription provides a public static IP address.

Below are images of the application in use. On the left mobile phone screen capture, "location" is texted to the ISR. What's returned is a URL (ending in /location.html). Clicking the URL opens the phone's map app with the ISR's location, which can be zoomed.