



# Application Developer's Guide

## Linux QMI SDK



**SIERRA**  
WIRELESS®

4110914  
1.26  
Nov 10, 2016

## Important Notice

Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

## Safety and Hazards

Do not operate the Sierra Wireless modem in areas where cellular modems are not advised without proper device certifications. These areas include environments where cellular radio can interfere such as explosive atmospheres, medical equipment, or any other equipment which may be susceptible to any form of radio interference. The Sierra Wireless modem can transmit signals that could interfere with this equipment. Do not operate the Sierra Wireless modem in any aircraft, whether the aircraft is on the ground or in flight. In aircraft, the Sierra Wireless modem **MUST BE POWERED OFF**. When operating, the Sierra Wireless modem can transmit signals that could interfere with various onboard systems.

---

*Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.*

---

The driver or operator of any vehicle should not operate the Sierra Wireless modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces, operating such communications devices while in control of a vehicle is an offence.

## Limitations of Liability

This manual is provided "as is". Sierra Wireless makes no warranties of any kind, either expressed or implied, including any implied warranties of merchantability, fitness for a particular purpose, or noninfringement. The recipient of the manual shall endorse all risks arising from its use.

The information in this manual is subject to change without notice and does not represent a commitment on the part of Sierra Wireless. SIERRA WIRELESS AND ITS AFFILIATES SPECIFICALLY DISCLAIM LIABILITY FOR ANY AND ALL DIRECT, INDIRECT, SPECIAL, GENERAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUE OR ANTICIPATED PROFITS OR REVENUE ARISING OUT OF THE USE OR INABILITY TO USE ANY SIERRA WIRELESS PRODUCT, EVEN IF SIERRA WIRELESS AND/OR ITS AFFILIATES HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR THEY ARE FORESEEABLE OR FOR CLAIMS BY ANY THIRD PARTY.

Notwithstanding the foregoing, in no event shall Sierra Wireless and/or its affiliates aggregate liability arising under or in connection with the Sierra Wireless product, regardless of the number of events, occurrences, or claims giving rise to liability, be in excess of the price paid by the purchaser for the Sierra Wireless product.

Customer understands that Sierra Wireless is not providing cellular or GPS (including A-GPS) services. These services are provided by a third party and should be purchased directly by the Customer.

**SPECIFIC DISCLAIMERS OF LIABILITY:** CUSTOMER RECOGNIZES AND ACKNOWLEDGES SIERRA WIRELESS IS NOT RESPONSIBLE FOR AND SHALL NOT BE HELD LIABLE FOR ANY DEFECT OR DEFICIENCY OF ANY KIND OF CELLULAR OR GPS (INCLUDING A-GPS) SERVICES.

## Patents

This product may contain technology developed by or for Sierra Wireless Inc.

This product includes technology licensed from QUALCOMM®.

This product is manufactured or sold by Sierra Wireless Inc. or its affiliates under one or more patents licensed from InterDigital Group and MMP Portfolio Licensing.

## Copyright

© 2014 Sierra Wireless. All rights reserved.

## Trademarks

Sierra Wireless®, AirPrime®, AirLink®, AirVantage®, WISMO® and the Sierra Wireless and Open AT logos are registered trademarks of Sierra Wireless, Inc. or one of its subsidiaries.

Watcher® is a registered trademark of NETGEAR, Inc., used under license.

Windows® and Windows Vista® are registered trademarks of Microsoft Corporation.

Macintosh® and Mac OS X® are registered trademarks of Apple Inc., registered in the U.S. and other countries.

QUALCOMM® is a registered trademark of QUALCOMM Incorporated. Used under license.

Other trademarks are the property of their respective owners.

## Contact Information

Sales Desk:	Phone:	1-604-232-1488
	Hours:	8:00 AM to 5:00 PM Pacific Time
	Contact:	<a href="http://www.sierrawireless.com/sales">http://www.sierrawireless.com/sales</a>
Post:	Sierra Wireless 13811 Wireless Way Richmond, BC Canada V6V 3A4	
Technical Support:	<a href="mailto:support@sierrawireless.com">support@sierrawireless.com</a>	
RMA Support:	<a href="mailto:repairs@sierrawireless.com">repairs@sierrawireless.com</a>	
Fax:	1-604-231-1109	
Web:	<a href="http://www.sierrawireless.com/">http://www.sierrawireless.com/</a>	

Consult our website for up-to-date product descriptions, documentation, application notes, firmware upgrades, troubleshooting tips, and press releases: [www.sierrawireless.com](http://www.sierrawireless.com)

# Document History

Version	Date	Updates
1.0	September 09, 2011	Initial Release
1.01	October 05, 2011	Added section 5.4: Connection Manager Sample Application; Updated sections 3.1, 4.2, 4.3, 5.2, 5.3
1.02	November 04, 2011	Added Section 6.2 RAM dump tool, corrected header level for 6.1
1.03	March 15, 2012	Added section 4.2; Updated/revise sections 2 and 3.
1.04	November 07, 2012	Added SL9090 as supported device in Section 2.3; Added PDS & SWIOMA Sample App in Section 5; Update titling on Section 4.4; Update code routine at Section 3.3.1
1.05	February 05, 2013	Updated architecture diagram for multiple application support in Section 1.1; Updated connection APIs in Section 3.4; Added call handling sample application in Section 5;
1.06	June 24, 2013	Updated Section 3.3, User Application Development.
1.07	July 26, 2013	Added new section for AirVantage agent integration
1.08	October 18, 2013	Added new section for AirVantage agent auto start preprocessor section 6.2
1.09	December 04, 2013	Added section 4.5 for one command line firmware downloader
1.10	January 16, 2014	rename folder name from avagent_r8 to avagent_r8m
1.11	March 07, 2014	Added multiple module management section 3.3.1
1.12	May 07, 2014	Updated modules & PID list in Section 2.2 Supported Devices
1.13	June 12, 2014	Removed multiple modems not supported from the unsupported feature section
1.14	July 10, 2014	Updated section 6
1.15	July 22, 2014	Add remote DM log capture section 9
1.16	July 22, 2014	Add List of automatic re-register callback in section 10
1.17	October 17; 2014	Add Debug Information Section 12
1.18	February 03; 2015	Update /sys/modules path at section 2.3.7
1.19	April 09; 2015	Add SQF Filter Editing in tools section
1.20	April 28; 2015	Add EM7455 in Supported Device version
1.21	July 06; 2015	<ul style="list-style-type: none"> <li>• Add limitation section</li> <li>• Add how to blacklist qcserial &amp; qmi_wwan kernel modules</li> </ul>
1.22	September 09, 2015	Add Section 5.6 EM/MC74xx device based image switching
1.23	December 4, 2015	Updated supported devices & PID for EM/MC74xx
1.24	June 3, 2016	Add Lite APIs section
1.25	July 12, 2016	Introduce Lite APIs vs Full APIs
1.26	November 10, 2016	Update List of Tables



# Contents

<b>1. ABBREVIATIONS AND DEFINITIONS .....</b>	<b>8</b>
<b>2. INTRODUCTION .....</b>	<b>9</b>
<b>3. PREREQUISITES.....</b>	<b>10</b>
3.1. Supported Processors .....	10
3.2. Supported Devices .....	10
3.3. Device Drivers .....	11
3.3.1. Host Setup.....	11
3.3.2. Acquiring the Drivers .....	11
3.3.3. Supported Linux Kernels.....	11
3.3.4. System Dependencies .....	11
3.3.5. Building and Installing the Drivers.....	11
3.3.6. Querying Driver Versions and Supported Devices .....	12
3.3.7. Unloading the Drivers.....	12
3.3.8. Enabling and Disabling the Drivers' Diagnostic Messages.....	13
3.3.9. Verifying Proper Driver Operation .....	13
3.4. Defined Compilation Flags .....	13
3.5. Linked Libraries required for Full APIs .....	13
<b>4. FULL APIS SYSTEM ARCHITECTURE .....</b>	<b>13</b>
<b>5. FULL APIS GETTING STARTED.....</b>	<b>16</b>
5.1. QMI SDK Limitations .....	16
5.1.1. Multiple application processes limitation.....	16
5.1.2. Multi API processing within a host application .....	16
5.2. Full APIs Callback that auto re-register.....	16
5.3. User Application Development .....	17
5.3.1. SDK Process .....	17
5.3.1.1. Building the SDK Executable .....	17
5.3.1.2. Verifying SDK and Target Platform Interoperability .....	17
5.3.2. User Application Process .....	18
5.3.2.1. Building the Application Executable .....	18
5.3.2.2. Communicating with the Device .....	18
5.3.3. User Application Development.....	18
5.3.3.1. Multiple Module Management .....	18
5.3.3.2. Where to Start .....	19
5.3.3.3. QCWWANDisconnect API.....	21
5.3.3.4. Terminating the SDK Process .....	22
5.3.3.5. Device Resets .....	22
5.3.4. UMTS, LTE, and CDMA Data Sessions .....	22
5.3.4.1. Profile Configuration.....	22
5.3.4.2. Session Initiation and Termination .....	23
5.4. SLQS Image Management.....	24

5.4.1.	Firmware Upgrade Process .....	24
5.4.2.	QDL Image Download .....	25
5.4.3.	AR75xx, EM74xx, MC73xx and MC7700/10/50 Modem Image Management .....	26
5.4.3.1.	MC7xxx Image Management Sample Application .....	26
5.4.4.	MC83xx, MC9090 and SL9090 Image Management.....	27
5.4.4.1.	Gobi Image Management Sample Application.....	27
5.4.5.	One Command Line Firmware Downloader Sample Application.....	28
5.4.6.	EM/MC74xx Device based image switching .....	30
5.5.	Other Sample Applications .....	33
5.5.1.	Call Handling Sample Application.....	33
5.5.2.	Connection Manager Sample Application.....	33
5.5.3.	SMS Sample Application.....	34
5.5.4.	SLQS Tutorial Sample Application.....	34
5.5.4.1.	Using the SLQS Tutorial.....	35
5.5.5.	Connection Manager Sample Application.....	37
5.5.6.	Position Determination Service Sample Application .....	38
5.5.7.	SWIOMA Sample Application .....	38
5.6.	AirVantage Agent Integration .....	39
5.6.1.	Auto Start Preprocessor.....	39
5.6.2.	Agent Configuration File.....	39
5.6.3.	Agent Constrains.....	39
5.6.4.	Agent Source Tree .....	39
5.6.5.	Start/Stop the AirVantage Agent.....	39
5.6.6.	AirVantage M2M Cloud .....	40
5.7.	Full APIs Debug Information .....	40
<b>6.</b>	<b>LITE APIS GETTING STARTED .....</b>	<b>43</b>
6.1.	Using Lite SDK wrapper to encode/decode QMI messages .....	43
6.2.	Steps to run packing demo sample app .....	43
6.3.	Application to retrieve modem's model id.....	44
6.4.	Compile and Run.....	45
6.5.	Wrapper headers and libraries .....	45
<b>7.</b>	<b>TOOLS .....</b>	<b>46</b>
7.1.	DM Logging Tool .....	46
7.2.	RAM Dump Tool.....	46
7.3.	SQF Filter Editing .....	48
<b>8.</b>	<b>DOCUMENTATION .....</b>	<b>48</b>
<b>9.</b>	<b>REFERENCE DOCUMENTS.....</b>	<b>49</b>



## List of Figures

Figure 1.	Lite APIs vs Full APIs .....	9
Figure 2.	SLQS System Architecture.....	14
Figure 3.	SLQS API Modules .....	15
Figure 4.	SLQS Image Management Sequence Diagram.....	24
Figure 5.	QDL Service Sequence Diagram .....	25



# List of Tables

Table 1. Supported Application-Mode VID/PIDs ..... 10  
Table 2. Supported Boot-Mode VID/PIDs ..... 10

## 1. Abbreviations and definitions

Abbreviation/Acronym	Definitions
MSM	Mobile Station Modem
PRI	Product Release Instructions
QMI	Qualcomm MSM Interface
SLQS	Sierra Linux QMI SDK
WP	Work Package
SDK	Software Development Kit
SQF	Sierra Filter File
QDL	Qualcomm download mode
Image	Modem Firmware Image



## 2. Introduction

QMI is a binary protocol designed to replace the AT command based communication with modems. This protocol is used by some Sierra Wireless modules based on Qualcomm chipsets.

When a host processor based on Linux is driving such module, the Linux QMI SDK allows to ease the software integration on host side.

From Linux QMI SDK 4 version, two different architectures can be adopted depending on feature needs and constraints:

- Lite APIs: this is a tiny version adapted to low memory footprint. This layer is only managing QMI messages encoding (request) and decoding (response/indication) through function calls.
- Full APIs: this is a more complete version adapted to less constrained environment. It comes with some processes handling memory allocations, timers, machine-state to provide features such as:
  - Modem detection/scanning
  - Modem mode management: application or boot-hold(firmware download)
  - QMI port multiplex for applications & scheduling
  - Modem firmware update

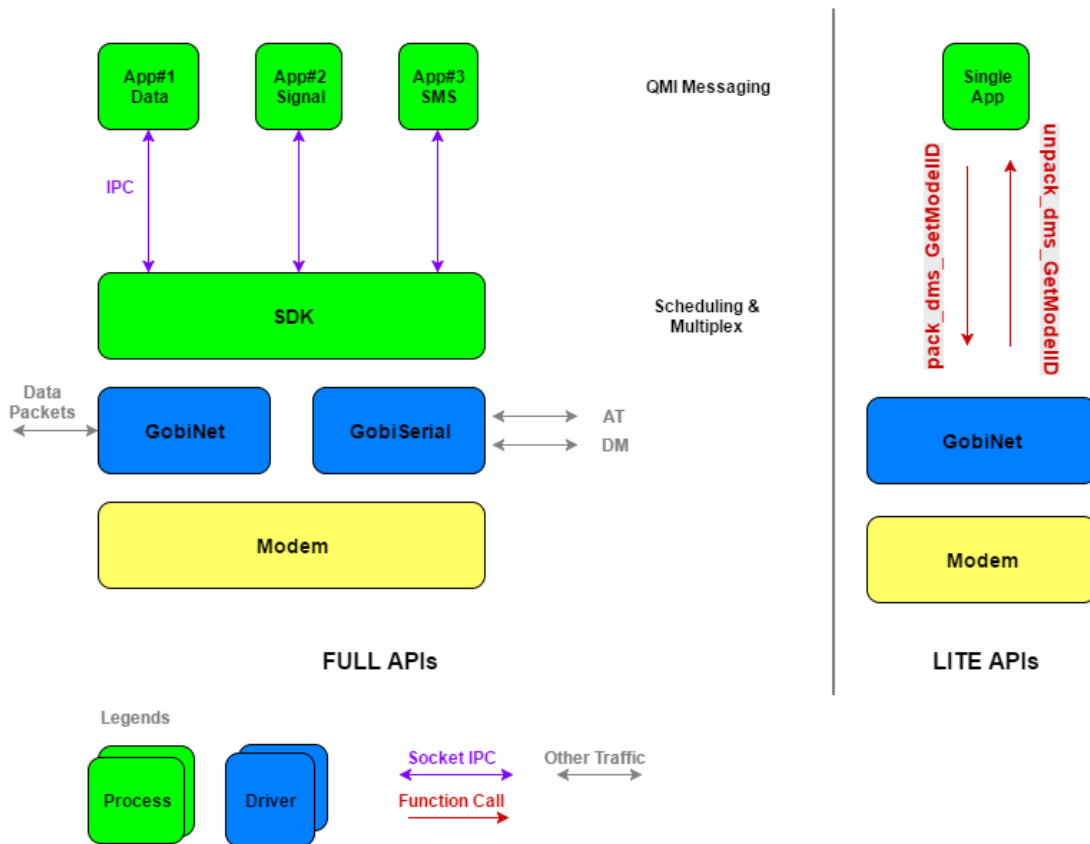


Figure 1. Lite APIs vs Full APIs



## 3. Prerequisites

### 3.1. Supported Processors

The following processors are supported:

- x86 (32bit & 64bit)
- ARM
- PPC
- MIPS

### 3.2. Supported Devices

The following devices are supported:

- MC77xx
- MC83x5
- SL/MC9090
- EM/MC73xx
- AR7554
- EM/MC74xx

---

*Note:* MC77xx devices must operate in “QMI Mode” and not in “Direct-IP” mode.

---

The tables below list the hexadecimal values of the Vendor ID (VID) and Product ID (PID) pairs supported by the QMI SDK.

**Table 1. Supported Application-Mode VID/PIDs**

<b>VID</b>	1199	1199	1199	1199	1199	1199	3F0	1199	1199	1199
<b>PID</b>	68A2	68C0	9011	9013	9015	9019	371D	9040	9041	9071

**Table 2. Supported Boot-Mode VID/PIDs**

<b>VID</b>	1199	1199	1199	1199	1199	1199	3F0	1199
<b>PID</b>	68A2	68C0	9010	9012	9014	9018	361D	9070

To check your device's VID/PID, issue the `lsusb` command. The output will present a list of USB devices with a column showing each device's manufacturer. The device VID/PID can be read from the row containing the correct device manufacturer. Additionally, on MC77xx devices, you can use the `AT!UDINFO?` command to check VID/PID information. If your VID/PID does not match any of the entries in the tables above, contact your FAE for support.

## 3.3. Device Drivers

### 3.3.1. Host Setup

The Linux distribution may have in built drivers and applications that can interfere with SDK process's execution. The below Qualcomm drivers, if present, need to be black listed.

- qcserial
- qmi\_wwan

Please black list them as below (example is for Ubuntu). Add the 2 entries to the “/etc/modprobe.d/blacklist-modem.conf” file and restart the host

```
blacklist qcserial
blacklist qmi_wwan
```

“Modem Manager” is another application that can interfere with the SDK's operation. Please remove it and restart the host. Below example is for an Ubuntu PC:

```
#sudo apt-get remove modemmanager
#sudo killall -9 modemmanager
#sudo reboot
```

During firmware upgrade, the SDK process need to read/write modem's serial ports. Please make sure there is no background process reading/writing modem's serial ports at the same time. For example, qmi\_daemon.

### 3.3.2. Acquiring the Drivers

Get in touch with your FAE for acquiring drivers for your device if you are operating in QMI mode – the mode of operation required for using the QMI SDK.

### 3.3.3. Supported Linux Kernels

Sierra Wireless supports open source kernel version 2.6.32 or newer. Both 32 bit and 64 bit versions of Linux/UNIX are supported. It is the customer's responsibility to modify the SDK and drivers for kernels outside the scope of what is supported.

### 3.3.4. System Dependencies

Make sure you have a network connection and issue the following commands:

```
sudo apt-get install build-essential make gcc
sudo apt-get install linux-headers-`uname -r`
```

### 3.3.5. Building and Installing the Drivers

```
cd GobiSerial; make; sudo make install
cd GobiNet; make; sudo make install
sudo modprobe GobiSerial [debug=Y]
```

```
sudo modprobe GobiNet [debug=Y]
```

EM/MC74xx only support RAWIP mode, please build GobiNet with RAWIP=1 switch

```
cd GobiNet; make RAWIP=1;
```

### 3.3.6. Querying Driver Versions and Supported Devices

```
modinfo GobiSerial
```

```
modinfo GobiNet
```

### 3.3.7. Unloading the Drivers

```
sudo rmmmod GobiSerial
```

```
sudo rmmmod GobiNet
```

### 3.3.8. Enabling and Disabling the Drivers' Diagnostic Messages

---

*Note:* Enabling and disabling the driver's diagnostic messages requires root privileges.

---

Enable diagnostic messages:

```
echo 1 > /sys/module/GobiSerial/parameters/debug
echo 1 > /sys/module/GobiNet/parameters/debug
```

Disable diagnostic messages:

```
echo 0 > /sys/module/GobiSerial/parameters/debug
echo 0 > /sys/module/GobiNet/parameters/debug
```

### 3.3.9. Verifying Proper Driver Operation

1. Open terminal and type **tailf /var/log/syslog**.
2. Plug in the Sierra Wireless device.
3. Check **/dev/** for existence of the following devices (check syslog in case the device nodes are static i.e. built into the kernel image and not dynamically mounted). Please note that the second QMI interface is available only when the device is in multi-pdn mode (**/dev/qcqmiy**).
  - **/dev/ttyUSB0**
  - **/dev/ttyUSB1**
  - **/dev/ttyUSB2**
  - **/dev/qcqmix** where x is an integer starting at 0
  - **/dev/qcqmiy** where y is an integer starting at 0

## 3.4. Defined Compilation Flags

Below flags are defined for SDK compilation or all architectures “-Wall -Werror -Wextra”. Specific architectures may have other flags defined.

## 3.5. Linked Libraries required for Full APIs

- rt
- pthread

# 4. Full APIs System Architecture

The Full APIs system architecture is described as follows.

- The Application process communicates with the device by executing Full APIs.
- The host application which is statically linked to the Full library

- The API calls are translated in QMI request SDUs that are sent to the SDK process over a local IPC datagram socket.
- The SDK writes the QMI PDUs to a device file named /dev/qcqm<sub>x</sub>, where x is an integer, associated with the QMI interface.
- The QMI PDUs are sent to the device over the USB control channel via the GobiNet.ko driver module
- Notifications are received over the interrupt channel, which prompts the driver to read the responses coming over the USB control channel.
- The SDK reads the QMI response from /dev/qcqm<sub>x</sub> and sends a response to the application process over a local IPC datagram socket.

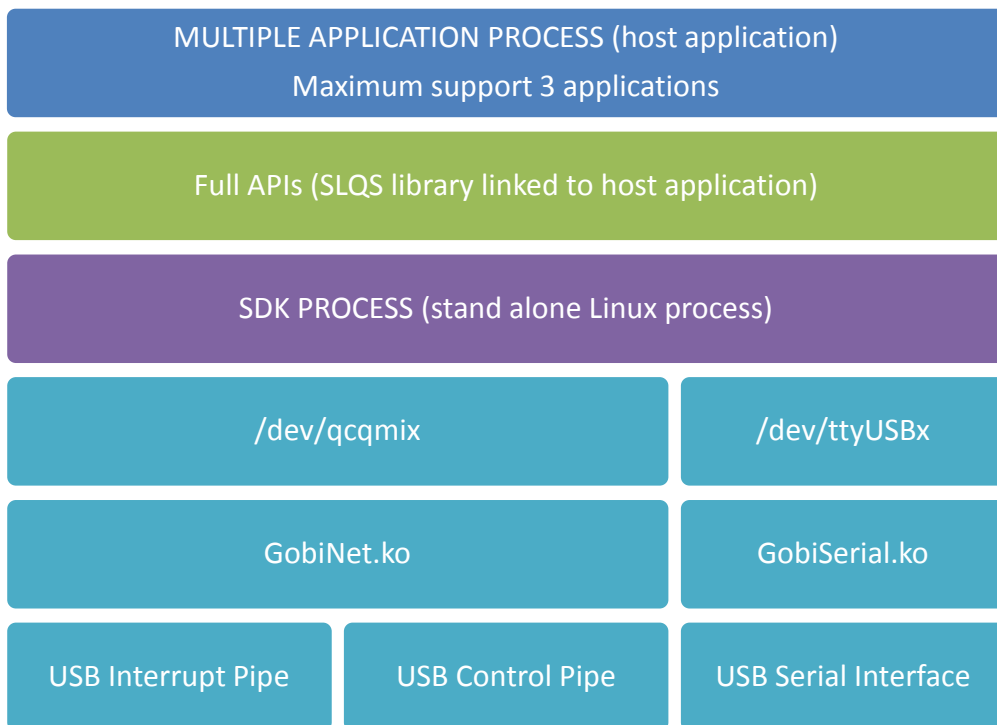


Figure 2. Full APIs System Architecture



Figure 3. Full APIs Modules

The CBK service and SWI service provides services for all modules.

## 5. Full APIs Getting Started

### 5.1. QMI SDK Limitations

#### 5.1.1. Multiple application processes limitation

- The SDK process can communicate with a maximum of 3 different host applications

#### 5.1.2. Multi API processing within a host application

- The SDK process can process only one QMI command at any point of time. Multiple calls made to the SDK will be serialized using a mutex
- The host application has to make allowances for this behavior and ensure that the thread that holds the mutex will get a time slice to release the mutex

### 5.2. Full APIs Callback that auto re-register

When Modem detach and re-attach, the SDK re-register some callback internally.

Below is the list of automatically re-register callback. For other callback, please manually re-register when modem re-attached.

- SetMobileIPStatusCallback
- SLQSSetWdsEventCallback
- SLQSSetWdsTransferStatisticCallback
- SLQSSetDUNCallInfoCallback
- SLQSSetDataSystemStatusCallback
- SetActivationStatusCallback
- SetPowerCallback
- SLQSSetModemTempCallback
- SetSignalStrengthCallback
- SetRFInfoCallback
- SLQSSetSignalStrengthsCallback
- SetLURRejectCallback
- SLQSNasSysInfoCallBack
- SLQSNasNetworkTimeCallBack
- SetNMEACallback
- SetNewSMSCallback
- SLQSSetSMSEventCallback
- SLQSWmsMemoryFullCallBack
- SLQSWmsMessageWaitingCallBack
- SetCATEventCallback
- SetOMADMStateCallback
- SetSLQSOMADMAAlertCallback
- SLQSVoiceSetSUPSNotificationCallback
- SLQSVoiceSetAllCallStatusCallBack
- SLQSVoiceSetPrivacyChangeCallBack
- SLQSVoiceSetDTMFEventCallBack
- SLQSVoiceSetSUPSCallBack
- SLQSUIMSetStatusChangeCallBack



- SLQSSetSIPConfigCallback
- SLQSSetRegMgrConfigCallback
- SLQSSetIMSSMSConfigCallback
- SLQSSetIMSUserConfigCallback
- SLQSSetIMSVoIPConfigCallback

## 5.3. User Application Development

### 5.3.1. SDK Process

#### 5.3.1.1. Building the SDK Executable

```
navigate to pkgs:  cd pkgs
clean then build: make -f pkgs.mak complete
clean:           make -f pkgs.mak clean
build:          make -f pkgs.mak
```

#### 5.3.1.2. Verifying SDK and Target Platform Interoperability

The SDK periodically checks to see if a supported device is connected to the target platform. If you do not see the following message<sup>1</sup> in your logs, then the device has not been detected and the SDK will not be able to communicate with the device. In this case, it is most likely that you are either using an unsupported device or that your drivers need to be updated to support the device.

```
usb 2-1.5: new high speed USB device using ehci_hcd and address 10
usb 2-1.5: config 1 has an invalid interface number: 8 but max is 3
usb 2-1.5: config 1 has no interface number 1
usb 2-1.5: configuration #1 chosen from 1 choice GobiSerial 2-1.5:1.0:
GobiSerial converter detected
usb 2-1.5: GobiSerial converter now attached to ttyUSB0 GobiSerial 2-
1.5:1.2: GobiSerial converter detected
usb 2-1.5: GobiSerial converter now attached to ttyUSB1 GobiSerial 2-
1.5:1.3: GobiSerial converter detected
usb2-1.5: GobiSerial converter now attached to ttyUSB2
usb0: register 'GobiNet' at usb-0000:00:1d.0-1.5, QmiNet Ethernet
Device, 3e:a6:1f:b3:66:62
SWI SDK Process: USDT:Device State Change 0 -> 1
creating qcqmi0
USDT:Device State Change 1 -> 1
```

If you see the message above but do not see the following message in your logs, then the device's interfaces have not been successfully mapped to their respective `/dev/ttyUSBx` and/or `/dev/qcqmiox` device special files and the SDK will not be able to communicate with the device.

```
USDT:Device State Change 1 -> 2
USDT:Device ready: VID 1199, PID 68a2, 4 interfaces
```

---

<sup>1</sup> SDK messages will be displayed in both `/var/log/user.log` and `/var/log/syslog`.

```
QM:qm_ds_handle_app_dev_ready: devstate 1
QM:SDK<-Mdm: ch/QMImsgid/QMImsglen/IPCmsglen: 1/0000/0/25
QM:DS Device Event Notification received 1
```

In this case, it is possible that:

1. your drivers don't support the inserted device;
2. you have not added a device node for /dev/qcqm~~ix~~ (usually 0 or 1) with the proper major and minor numbers;
3. the interface configuration of your device is not supported by the SDK; or
4. the SDK's device scanning routine requires custom modifications specific to your platform's **sysfs/sys/bus/usb/devices** entry for the device in question. The major and minor numbers of the device can be determined by issuing `ls -l /dev/qcqmix` on the command line. The fourth and fifth columns contain the major and minor numbers, respectively (see `man ls` for details).

## 5.3.2. User Application Process

### 5.3.2.1. Building the Application Executable

Refer to any one of the sample applications' make files as a starting point for writing a script for building your application. Remember to add the "`strip`" command to your script in order to remove all symbol information from your libraries and application image if your system is memory constrained.

### 5.3.2.2. Communicating with the Device

The application must adhere to the SDK's stop and wait (synchronous execution) protocol; there can be only one outstanding transaction between the application and SDK, at any time. All API function calls are blocking and execute within the context of the application process. When the application executes API function, the corresponding request is constructed and sent to the SDK process over a local IPC. The request (response) is sent to (received from) the device from within the execution context of the SDK process. The response from the device is validated and sent back to the application process over a local IPC socket. After which, the message contents are unpacked and used for populating the user supplied arguments.

Notifications, on the other hand, are asynchronous and therefore, may arrive at any time. The application receives notifications within the execution context of a dedicated notification thread that is created and used by the SDK within the application's process. Thus, it is important that minimal processing be done inside the registered callback functions.

## 5.3.3. User Application Development

### 5.3.3.1. Multiple Module Management

Since SLQS03.03.00, Sierra Wireless has introduced multiple module management, also known as multi modem support. The SLQSStart is used to select which modem to control. Passing 0, 1 and 2 will select the first, second and third modem detected. It supports a maximum of 12 modems.

The qatest is already updated to support multiple modems as an example. There is a "`-d`" command line switch to specify modem index.

The following example controls the first and second modems.

```
sudo ./pkgs/qa/qatesthostx86_64 -r -d0
sudo ./pkgs/qa/qatesthostx86_64 -r -d1
```

### 5.3.3.2. Where to Start

The Connection Manager Sample Application is a good place to start. The source code is located at **SampleApps/ Connection\_Manager/src/connectionmgr.c**.

The following outlines the recommended method for integrating SLQS initialization code into your application. Note that all variables below are assumed to have been defined.

```
/* Set the SDK executable path for your target platform */
if( SUCCESS != (resultCode = SetSDKImagePath(sdkbinpath)) )
{
    rprint( __func__, resultCode );
    return resultCode;
}

/* Launch the SDK process and create IPC sockets over which the APP and SDK
 * will exchange messages.
 */
if( SUCCESS != (resultCode = SLQSStart(modem_index)) )
{
    /* first attempt failed, kill SDK process */
    if( SUCCESS != SLQSKillSDKProcess() )
    {
        return resultCode;
    }
    else
    {
        /* start new SDK process */
        if( SUCCESS != (resultCode = SLQSStart(modem_index)) )
        {
            return resultCode;
        }
    }
}

/* Enumerate the device */
while (QCWWAN2kEnumerateDevices(&devicesSize, (BYTE *)pdev) != 0)
{
    printf ("\nUnable to find device..\n");
    sleep(1);
}
```

```
#ifdef DBG
fprintf( stderr, "#devices: %d\ndeviceNode: %s\ndeviceKey: %s\n",
        devicesSize,
        pdev->deviceNode,
        pdev->deviceKey );
#endif

/* Connect to the SDK */
resultCode = QCWWANConnect( pdev->deviceNode,
                           pdev->deviceKey );

/* Subscribe to all the required callbacks */
SubscribeCallbacks();

/* Graceful SLQS teardown */
void QuitApplication()
{
    free(sdkbinpath);
    fprintf( stderr, "Exiting Application!!!\n" );

    /* Unsubscribe all the callback which was called previously */
    UnSubscribeCallbacks();
    closeLogFile();

    /* If the application is connected to the SDK, then disconnect to (1)
     * terminate threads and free resources that have been created and allocated,
     * respectively, for communicating with the device, and (2) allow other
     * applications to communicate with the device via the SDK.
     */
    QCWWANDisconnect();
    exit( EXIT_SUCCESS );
}

/* macro used in code segments above */
#define rprint(s, u) syslog(LOG_USER, "%s: rc = 0x%lX, %s", s, u, slqserrstr(u))

/* You can add error code to error string mapping to the table below in order to
 * aid your application debugging.
 */
typedef struct{
    enum eQCWWANError e;
    const char *es;
}slqserr_s;
```

```

static slqserr_s errstr[] =
{
    { eQCWWAN_ERR_INTERNAL, "eQCWWAN_ERR_INTERNAL" },
    { eQCWWAN_ERR_MEMORY, "eQCWWAN_ERR_MEMORY" },
    { eQCWWAN_ERR_INVALID_ARG, "eQCWWAN_ERR_INVALID_ARG" },
    { eQCWWAN_ERR_BUFFER_SZ, "eQCWWAN_ERR_BUFFER_SZ" },
    { eQCWWAN_ERR_NO_DEVICE, "eQCWWAN_ERR_NO_DEVICE" },
    { eQCWWAN_ERR_SWIDCS_IOCTL_ERR, "eQCWWAN_ERR_SWIDCS_IOCTL_ERR" },
    { eQCWWAN_ERR_QMI_MISSING_ARG, "eQCWWAN_ERR_QMI_MISSING_ARG" },
    { eQCWWAN_ERR_SWICM_SOCKET_IN_USE, "eQCWWAN_ERR_SWICM_SOCKET_IN_USE" },
    { eQCWWAN_ERR_SWIDCS_DEVNODE_NOT_FOUND, "eQCWWAN_ERR_SWIDCS_DEVNODE_NOT_FOUND" },
    { eQCWWAN_ERR_SWIDCS_IOCTL_ERR, "eQCWWAN_ERR_SWIDCS_IOCTL_ERR" },
    { eQCWWAN_ERR_SWIDCS_APP_DISCONNECTED, "eQCWWAN_ERR_SWIDCS_APP_DISCONNECTED" },
    { eQCWWAN_ERR_SWICM_QMI_SVC_NOT_SUPPORTED, "eQCWWAN_ERR_SWICM_QMI_SVC_NOT_SUPPORTED" },
    { 0, "" }
};

static const char *slqserrstr(ULONG er)
{
    int count = 0;
    while( errstr[count].e ){
        if( errstr[count].e == er )
        {
            return errstr[count].es;
        }
        count++;
    }
    return "";
}

```

### 5.3.3.3. QCWWANDisconnect API

When your application no longer needs to communicate with the device it should execute the **QCWWANDisconnect API** in order to:

1. free the resources allocated by the SDK for communicating with the device;
2. deregister from all but the device state change callback; and
3. allow other applications to use the services of the SDK. As long as the device is connected to the target and the SDK process is alive, an application can always reconnect at a later time.

### 5.3.3.4. Terminating the SDK Process

To kill the SDK process, execute the **SLQSKillSDKProcess API**. Note that this API requires that the SDK image be named **slqssdk**, as is the case for the images located in the build/bin sub-directories of the SDK release.

### 5.3.3.5. Device Resets

Assuming the application has registered for the device state change callback, it will be notified whenever a device is disconnected or detected. Following a device reset, once the device has been detected by the SDK, all of the callback functions that the application had registered for will be re-registered by the SDK on the application's behalf. Thus, the application need not take any action on a device reset aside from managing itself.

## 5.3.4. UMTS, LTE, and CDMA Data Sessions

This section describes the APIs for configuring profiles for use in a data session call; as well as starting and stopping data session calls. For details of the API parameters, refer to the doxygen documentation of the APIs.

### 5.3.4.1. Profile Configuration

Profiles must be set before a data call can be made. Some carriers fix the profiles that can be used on their network. Without the use of SDK APIs, profiles can be created or modified using AT commands. The SDK provides the following APIs for profile configuration:

- GetDefaultProfile
- SetDefaultProfile
- GetDefaultProfileLTE
- SetDefaultProfileLTE

The APIs above write and get the default profile to and from the device, respectively. The default profile will be the one used to establish a data session. The LTE version supports IPV6 in addition to IPV4.

The following APIs perform the same functionality as the APIs above, but allow a profile ID to be specified. Valid profile ID values are 1 to 16.

- SLQSGetProfile
- SLQSSetProfile

The following API deletes a configured profile stored on the device. The deletion of a profile does not affect profile index assignments.

- SLQSDeleteProfile

The following API is used to create a new profile with the specified parameters. Note that some firmware versions do not support the optional Profile ID parameter. In this case an error will be returned and the caller can subsequently create a profile by specifying a NULL pointer for the Profile ID parameter. The Profile ID pertaining to the newly created profile is returned in the response structure parameter.

- SLQSCreateProfile

This API is used to create a new profile with the specified parameters.

- SLQSModifyProfile

### 5.3.4.2. Session Initiation and Termination

The API, **SLQSStartStopDataSession**, will use the default profile set up as described above to make a data connection. Some networks may require authentication fields.

To start a data session after a device has been enumerated, the following API may be used. Note that technology should be changed for the appropriate network – UMTS or CDMA; and that the optional parameters below are left as NULL for simplicity. Some of the optional parameters are supplied by the user as preferred information. The network may not be able to assign the preferred values and assign other values instead. In that case, the **SLQSGetRuntimeSettings** API may be used to retrieve some of this information once a data session has been established. This API supports IPV4, IPV6, and IPV4V6 data sessions specified by ipfamily member of struct ssdatasession\_params.

```
ULONG technology = 1; //3GPP
ULONG profile_idx = 1;
struct ssdatasession_params session;
session.action = 1; //start data session
session.pTechnology = &technology;
session.pProfileId3GPP = &profile_idx;
session.pProfileId3GPP2 = NULL;
session.ipfamily = 4; //IPv4
rc = SLQSStartStopDataSession( &session );
```

To terminate any currently active data session given the session pointer, the following API is used.

```
session.action = 0; //stop data session
rc = SLQSStartStopDataSession( &session );
```

## 5.4. SLQS Image Management

The Gobi Image Management and MC77xx Image Management sample applications can be used to:

1. Query information about the firmware stored on the device
2. Query information about firmware images stored on the host
3. Download firmware to the device

### 5.4.1. Firmware Upgrade Process

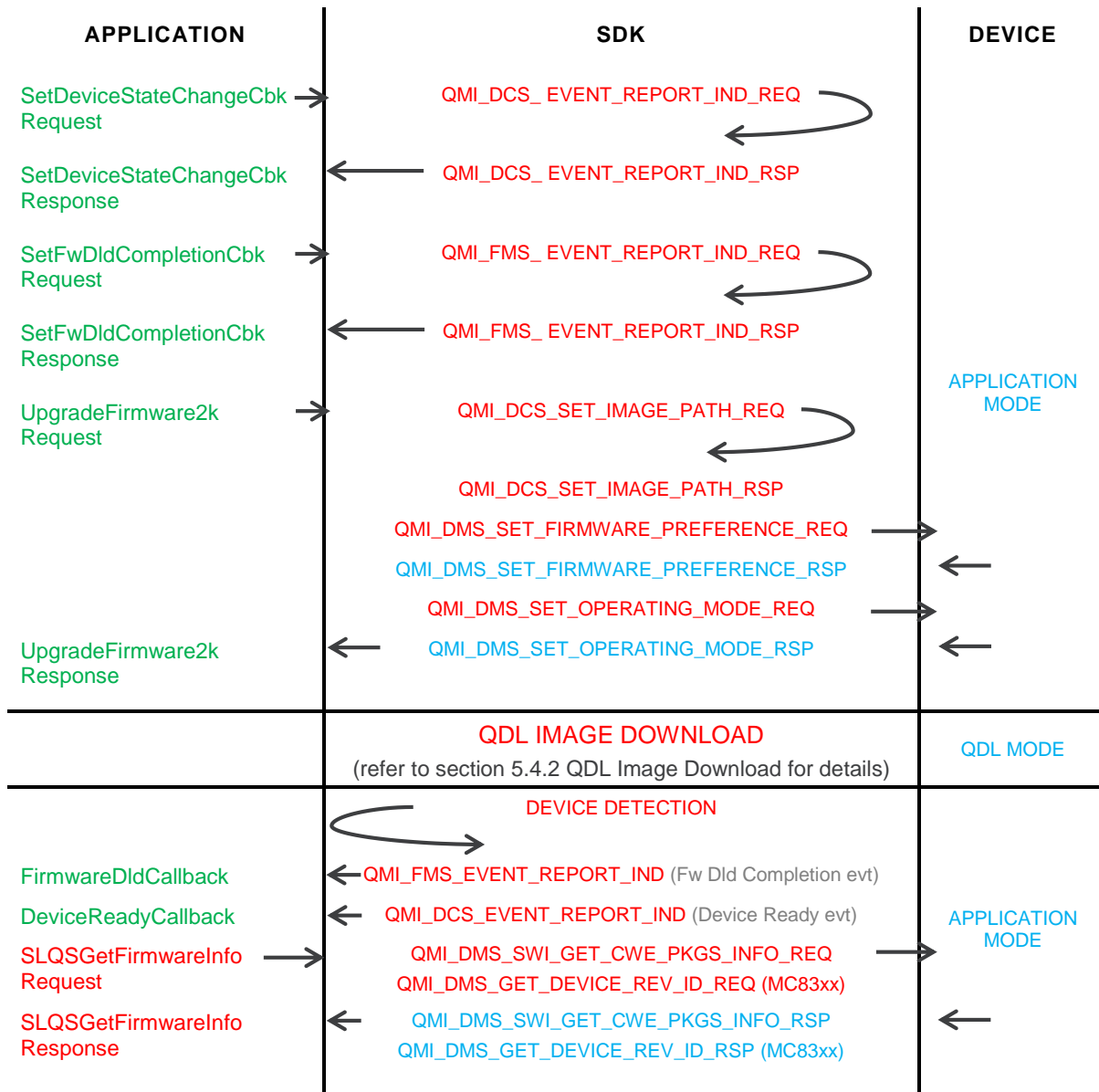


Figure 4. SLQS Image Management Sequence Diagram



Based on the figure above:

1. The Application may choose to register for a firmware download completion callback in order to be notified when the image download process has completed. Additionally, the application should register for the device state change callback in order to be notified of when the device has entered application mode subsequent to the image download, and is ready to communicate with the host.
2. To upgrade the firmware on the device, the application must issue the **UpgradeFirmware2k** API.
3. The Application should not issue any further API requests until the firmware download has completed and the device is ready.
4. Reception of the firmware download completion callback does not guarantee that the download process was successful. Once the device is ready, the application should issue the **GetFirmwareRevisions** API (for MC83xx devices) or the **SLQSGetFirmwareInfo** API (for MC77xx devices) to determine if the upgrade was successful.

### 5.4.2. QDL Image Download

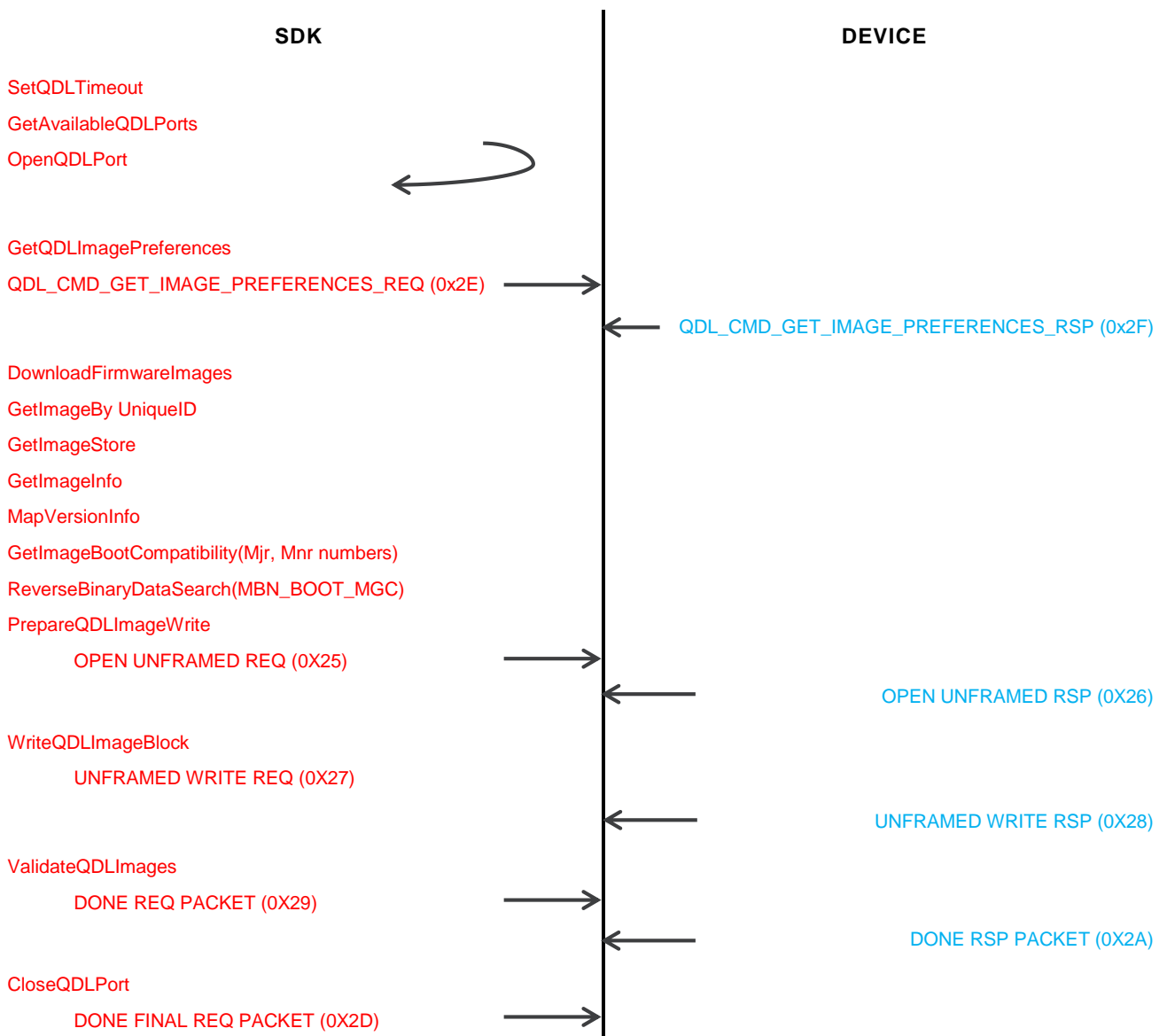


Figure 5. QDL Service Sequence Diagram

## 5.4.3. AR75xx, EM74xx, MC73xx and MC7700/10/50 Modem Image Management

### 5.4.3.1. MC7xxx Image Management Sample Application

Location: SampleApps/MC77xx\_Image\_Management/  
Purpose: Query image information for a MC7xx image located on the host  
Query image information for the image running on a MC77xx device  
Download firmware to a MC77xx device

Build: i686: make  
ARM: make CPU=arm9  
Power PC: make CPU=ppc  
MIPS BE: make CPU=mips  
MIPS LE: make CPU=mipsel

Execute:  
i686: sudo ./bin/mc7xximgmgmtosti686 ../../build/bin/osti686/slqssdk  
ARM: sudo ./bin/mc7xximgmgmtarm9 ../../build/bin/arm/slqssdk  
PPC: sudo ./bin/mc7xximgmgmtppc ../../build/bin/ppc/slqssdk  
MIPS BE: sudo ./bin/mc7xximgmgmtmips ../../build/bin/mips/slqssdk  
MIPS LE: sudo ./bin/mc7xximgmgmtmipsel ../../build/bin/mipsel/slqssdk

Reference: SampleApps/MC77xx\_Image\_Management/readme.txt

The only supported file is a \*\_SPKG.cwe file.

The program must be executed from the SampleApps/MC77xx\_Image\_Management directory with the instructed execute command above.

There must only be one \*.cwe or \*.spk file in the path specified for any option which requires the user to specify a path.

If errors are encountered when specifying a relative path, specify the fully qualified path instead. For more details, refer to the readme.txt file

## 5.4.4. MC83xx, MC9090 and SL9090 Image Management

### 5.4.4.1. Gobi Image Management Sample Application

Location: SLQSub.cd.ef /SampleApps/Gobi\_Image\_Management/  
Purpose: Query carrier image information for Gobi images located on the host  
Query carrier image information for the images stored on a device  
Download firmware to a device

Build: i686: make  
ARM: make CPU=arm9  
Power PC: make CPU=ppc  
MIPS BE: make CPU=mips  
MIPS LE: make CPU=mipsel

Execute:  
i686: sudo ./bin/gobiimgmgmthosti686 ../../build/bin/hosts686/slqssdk  
ARM: sudo ./bin/gobiimgmgmtarm9 ../../build/bin/arm/slqssdk  
PPC: sudo ./bin/gobiimgmgmtppc ../../build/bin/ppc/slqssdk  
MIPS BE: sudo ./bin/gobiimgmgmtmips ../../build/bin/mips/slqssdk  
MIPS LE: sudo ./bin/gobiimgmgmtmipsel ../../build/bin/mipsel/slqssdk

Reference: SLQSub.cd.ef /SampleApps/Gobi\_Image\_Management/readme.txt

The only supported file types are \*.mbn files.

The program must be executed from the SampleApps/Gobi\_Image\_Management directory with the instructed execute command above.

If errors are encountered when specifying a relative path, specify the fully qualified path instead. For more details, refer to the readme.txt file

## 5.4.5. One Command Line Firmware Downloader Sample Application

Location: SLQSab.cd.ef /SampleApps/Firmware\_Download/

Purpose: Perform a firmware download for the supported module by one command line.

Build:           i686:        make  
                   ARM:         make CPU=arm9  
                   Power PC:  make CPU=ppc  
                   MIPS BE:    make CPU=mips  
                   MIPS LE:    make CPU=mipsel

Execute:

```
i686:            sudo ./bin/fwldldhosti686 -s ../../build/bin/hosti686/slqssdk -d [9x00/9x15/g3k] -p [pathname]
ARM:             sudo ./bin/fwldldhostarm -s ../../build/bin/arm/slqssdk -d [9x00/9x15/g3k] -p [pathname]
PPC:             sudo ./bin/fwldldppc -s ../../build/bin/ppc/slqssdk -d [9x00/9x15/g3k] -p [pathname]
MIPS BE:         sudo ./bin/fwldldmips -s ../../build/bin/mips/slqssdk -d [9x00/9x15/g3k] -p [pathname]
MIPS LE:         sudo ./bin/fwldldmipsel -s ../../build/bin/mipsel/slqssdk -d [9x00/9x15/g3k] -p [pathname]
```

Please note that the command highlighted in red above depends on the module you are trying to perform firmware download on. For example, if it is an MDM9x15 module such as AR7554, MC7304, MC7355 etc. you have to specify the device with **-d 9x15**, then the path (folder of firmware images) such as **-p /tmp/firmware/AR7554**.

Inside the firmware folder **/tmp/firmware/AR7554**, there should be two files: one is a .nvu file of the particular firmware version. The other one can be a firmware file either with a .cwe or .spk file extension.

Taking the AR7554 as an example, the whole procedure should be as enumerated below:

1. Prepare the firmware files (.nvu + .cwe or .spk) for the update, for example, by creating a folder **/tmp/firmware/AR7554**.

```
tester@Ubuntu12.04:/tmp/firmware/AR7554$ ls
1101831_9902428_SWI9X15A_06.00.01.00_00_GENEU_006.000_000-field.spk
NVUP-9999999_9902428_GENEU-4G_006.000_000.nvu
cd SampleApps/Firmware_Download
```

2. Type command **"sudo ./bin/fwldldhosti686 -s ../../build/bin/hosti686/slqssdk -d 9x15 -p /tmp/firmware/AR7554"**

3. Once the firmware download starts, the console log should look like the following:

```
tester@Ubuntu12.04:~/projects/Linux_QMI_SDK/tags/SLQS03.02.03/SampleApps/Firmware_Download$ sudo ./bin/fwldldhosti686 -s ../../build/bin/hosti686/slqssdk -d 9x15 -p /tmp/firmware/AR7554
```

INFO: Running with device in application mode

INFO: Path: /tmp/AR7554

INFO: Device Type( 0,1,2->9x00,9x15,G3K ): 1

Downloading Firmware.....

Firmware Download Completed

INFO: Firmware Download Succeeded

INFO: Device successfully recovered to Application mode

Exiting Application!!!

For more details on the usage of this Firmware\_Download sample application, please read the readme.txt file under the same directory **SampleApps/Firmware\_Download**.

Also, note that:

- The only supported file types are \*.nvu, \*.cwe and \*.spk files.
- The program must be executed from the **SampleApps/Firmware\_Download/** directory

## 5.4.6. EM/MC74xx Device based image switching

The MC7xxx\_Image\_Switching sample application supports device based image switching on EM/MC74xx. Below example switch from Verizon to ATT without host downloading firmware to modem. The device image & host image have Storage Type of 0 and 1 respectively.

```

7. Image Switching on MC/EM74xx
Option: 7

Please specify the path (upto 510 Characters) or press <Enter> to return to the main menu: /tmp/invalid

Current Firmware info
-----
Model ID: EM7455
BOOT Version: SWI9X30C_01.08.07.00
AMSS Version: SWI9X30C_01.08.07.00
SKU ID: 9101012
Package ID:
Carrier: 5
PRI version: 001.000

All Carrier Images on Host and Device
-----
Index  CarrierId  FolderId  Storage Type  PriImageId  PriBuildId  FwImageId
FwBuildId
1      4            2         0             001.007_000  01.09.06.00_ATT  ?_?
01.09.06.00_?
2      5            1         0             000.004_000  01.08.07.00_VERIZON  ?_?
01.08.07.00_?

Please select from one of the above index or press <Enter> to return to main menu:
Option: 1

Do you want to switch the firmware of your choice (Y/N):
Option: y

Downloading
Firmware.....

No Firmware download needed!
Applying SPKG updates - please wait 20 seconds...
    
```

You can verify the switching with "AT!PRIID?"



**Before image switching Active image**

ati  
Manufacturer: Sierra Wireless, Incorporated  
Model: EM7455  
Revision: SWI9X30C\_01.08.07.00 r3743 CARMD-EV-FRMWR2 2015/08/13 23:07:36  
ESN: 11601589393, 74184091  
IMEI: 359073060004045  
IMEI SV: 1  
FSN: LF504300170302  
+GCAP: +CGSM  
  
OK  
at!priid?  
PRI Part Number: 5501012  
Revision: 001.000  
Customer: DevKit  
  
Carrier PRI: 9999999\_9904780\_SWI9X30C\_01.08.07.00\_00\_VERIZON\_000.004\_000

**After Image switching active image**

ati  
Manufacturer: Sierra Wireless, Incorporated  
Model: EM7455  
Revision: SWI9X30C\_01.09.06.00 r4004 CARMD-EV-FRMWR2 2015/09/01 20:44:43  
ESN: 11601589393, 74184091  
IMEI: 359073060004045  
IMEI SV: 2  
FSN: LF504300170302  
+GCAP: +CGSM  
  
OK  
at!priid?  
PRI Part Number: 5501012  
Revision: 001.000  
Customer: DevKit  
  
Carrier PRI: 9999999 9904594 SWI9X30C 01.09.06.00 00 ATT 001.007 000

Inside the sample application, the API UpgradeFirmware2K is used to switch image within device.

```
tree /tmp/swisscom
/tmp/swisscom
+-- 16
  +-- SWI9X30C_01.08.07.00.cwe
  +-- SWI9X30C_01.08.07.00_SWISSCOM_001.007_000.nvu

All Carrier Images on Host and Device
-----
Index  CarrierId  FolderId  Storage Type  PriImageId  PriBuildId
FwImageId  FwBuildId
1      210        16        1             001.007_000  01.08.07.00_SWISSCOM  ?_?
01.08.07.00_?
2      4          2         0             001.007_000  01.09.06.00_ATT      ?_?
01.09.06.00_?
3      5          1         0             000.004_000  01.08.07.00_VERIZON  ?_?
01.08.07.00_?
```

When the path input to UpgradeFirmware2K is invalid, the inner most folder name will be parsed as image slot index.

UpgradeFirmware2K input path	Device/Host Image	Carrier
/tmp/Swisscom/16	Host Image	Swisscom
/tmp/Swisscom/2	Device Image	ATT
/tmp/Swisscom/1	Device Image	Verizon

The API to list device & host images is SLQSSwiGetAllCarrierImages



## 5.5. Other Sample Applications

Information for Call Handling, Connection Manager, SMS and Developer Tutorial sample applications are provided in the following sub-sections.

### 5.5.1. Call Handling Sample Application

Location: SampleApps/CallHandling\_Application/

Purpose: Voice call testing includes dialing, answering and ending a call.

Build:           i386:        make  
                  ARM:        make CPU=arm9  
                  Power PC:  make CPU=ppc  
                  MIPS BE:   make CPU=mips  
                  MIPS LE:   make CPU=mipsel

Execute:

    i386:        sudo ./callhandlinghosti386  
    ARM:         sudo ./callhandlinghostarm9  
    PPC:         sudo ./callhandlinghostppc  
    MIPS BE:     sudo ./callhandlinghostmips  
    MIPS LE:     sudo ./callhandlingmipsel

Reference: SampleApps/CallHandling\_Application/readme.txt

### 5.5.2. Connection Manager Sample Application

Location: SampleApps/Connection\_Manager/

Purpose: Starting and stopping data session for LTE, UMTS & CDMA

Build:           i386:        make  
                  ARM:        make CPU=arm9  
                  Power PC:  make CPU=ppc  
                  MIPS BE:   make CPU=mips  
                  MIPS LE:   make CPU=mipsel

Execute:

    i386:        sudo ./connectionmanagerhosti386

ARM:       sudo ./ connectionmanagerhostarm9  
PPC:       sudo ./ connectionmanagerhostppc  
MIPS BE:   sudo ./ connectionmanagerhostmips  
MIPS LE:   sudo ./ connectionmanagerhostmipsel

Reference: SampleApps/Connection\_Manager/readme.txt

### 5.5.3. SMS Sample Application

Location:       SampleApps/Gobi\_Image\_Management/  
Purpose:       Send, read, and delete SMS messages

Build:         i386:       make  
               ARM:        make CPU=arm9  
               Power PC:  make CPU=ppc  
               MIPS BE:   make CPU=mips  
               MIPS LE:   make CPU=mipsel

Execute:

i386:        sudo ./SMSSampleAppi386  
ARM:         sudo ./SMSSampleApparm9  
PPC:         sudo ./SMSSampleAppppc  
MIPS BE:     sudo ./SMSSampleAppmips  
MIPS LE:     sudo ./SMSSampleAppmipsel

Reference: SampleApps/SMSSampleApp/readme.txt

### 5.5.4. SLQS Tutorial Sample Application

Location:       SampleApps/SLQS\_Tutorial/  
Purpose:       Familiarize Application Developers with the SDK and provide a starting point for writing an application.

Build:         i386:       make  
ARM:         make CPU=arm9  
Power PC:     make CPU=ppc  
MIPS BE:     make CPU=mips  
MIPS LE:     make CPU=mipsel

Execute:     i386:        sudo ./slqstutoriali386

```
ARM:      sudo ./slqstutorialarm9
PPC:      sudo ./slqstutorialppc
MIPS BE:  sudo ./slqstutorialmips
MIPS LE:  sudo ./slqstutorialmipsel
```

### 5.5.4.1. Using the SLQS Tutorial

Open two terminals, one for running the application, the other for viewing the message log.

In the message log terminal execute `tailf /var/log/syslog | grep slqstuotrial`.

In the application terminal execute `sudo ./slqstutorial`.

Two example sessions are shown below with interleaved explanations. Messages in green were echoed to `/var/log/syslog` from a third terminal to explain what is being done.

#### 5.5.4.1.1. Execution with Root Privileges

**slqstutorial: Run the Application ( sudo ./slqstutorial )**

```
slqstutorial: cigetnumappclients: count: 1
slqstutorial: wSLQSStart: APP<->SDK IPC init successful
slqstutorial: wSLQSStart: APP registered for Device State Change notification
The application has set the SDK image path, registered for the device state change
callback, and started the SDK i.e. called SLQSStart which creates the SDK process
and local IPC sockets.
```

**slqstutorial: Physically Remove the Device**

```
slqstutorial: Device State Change Callback Invoked: rc = 0x0,
slqstutorial: appstatechange: device disconnected, APP disconnected from SDK
slqstutorial: appstatechange: device ready, APP disconnected from SDK
slqstutorial: appstatechange: device ready, APP connected to SDK
The two messages above illustrate that the application will continue to receive
device state change notifications even after calling the QCWWANDisconnect API.
```

**slqstutorial: Attempt to Enumerate the device while it is absent ( Option 1 )**

```
slqstutorial: wQCWWANEnumerateDevices: rc = 0x6, eQCWWAN_ERR_NO_DEVICE
slqstutorial: #devices: 1 deviceNode: deviceKey:
slqstutorial: wQCWWANConnect: rc = 0x6, eQCWWAN_ERR_NO_DEVICE
Device enumeration has failed as the SDK did not detect a device
```

**slqstutorial: Physically plug in the device**

```
slqstutorial: Device State Change Callback Invoked: rc = 0x1,
slqstutorial: appstatechange: device ready, APP disconnected from SDK
The application is notified of the device state change
```

**slqstutorial: Attempt to Enumerate the device ( Option 1 )**

```
slqstutorial: Enumerate, Connect, Connect/Disconnect device
slqstutorial: wQCWWANEnumerateDevices: rc = 0x0,
slqstutorial: #devices: 1 deviceNode: /dev/qcqmio deviceKey: 00000000000000
slqstutorial: appstatechange: device ready, APP disconnected from SDK
```

Device enumeration is successful but note that the application is still not bound to the SDK (APP disconnected from SDK).

**slqstutorial: Attempt to Connect to the enumerated device ( Option 2 )**

slqstutorial: wQCWWANConnect: rc = 0x0

slqstutorial: appstatechange: device ready, APP connected to SDK

The application is now bound to the SDK (APP connected to SDK) and may therefore issue any API function hereon.

**slqstutorial: Physically remove the device while the application is bound to the SDK**

slqstutorial: Device State Change Callback Invoked: rc = 0x0,

slqstutorial: appstatechange: device disconnected, APP connected to SDK

The application is notified of the device state change

**slqstutorial: Plug in the device while the application is still bound to the SDK**

slqstutorial: Device State Change Callback Invoked: rc = 0x1,

slqstutorial: appstatechange: device ready, APP connected to SDK

The application is notified of the device state change

**slqstutorial: Execute some APIs to confirm that the application is still bound to the SDK**

slqstutorial: wGetSessionState: rc = 0x0, ( Option 5 )

slqstutorial: wStartDataSession: rc = 0x0, ( Option 6 )

slqstutorial: wStopDataSession: rc = 0x0, ( Option 7 )

Successful execution of APIs as indicated by a return code of 0x0

**slqstutorial: Kill the SDK Process ( option 10 )**

slqstutorial: wSLQSKillSDKProcess: rx = 0x0,

SDK process has been terminated (issue `ps -eT | grep slqs` to confirm the process is no longer running)

**slqstutorial: Restart the SDK process ( option 0 )**

slqstutorial: Device State Change Callback Invoked: rc = 0x1,

slqstutorial: appstatechange: device ready, APP disconnected from SDK

The application has set the SDK image path, registered for the device state change callback, and started the SDK i.e. called SLQSStart which creates the SDK process and local IPC sockets.

**slqstutorial: Exit the application ( option 11 )**

slqstutorial: cleanup: Good bye! (0x0)

### 5.5.4.1.2. Execution without Root Privileges

Note that there must not be an SDK daemon running with root privileges or you will not see the same behaviour as described for below. Issue `sudo killall slqssdk` to make sure this is the case.

**slqstutorial: Run the application w/o root privileges**

slqstutorial: cigetnumappclients: count: 1

slqstutorial: wSLQSStart: APP<->SDK IPC init successful

slqstutorial: wSLQSStart: APP registered for Device State Change notification

slqstutorial: wSLQSStart: APP<->SDK IPC init successful

slqstutorial: wSLQSStart: APP registered for Device State Change notification

The application has set the SDK image path, registered for the device state change callback, and started the SDK i.e. called SLQSSstart which creates the SDK process and local IPC sockets.

**slqstutorial: Attempt to Enumerate the device ( Option 1 )**

```
slqstutorial: wQCWWANEnumerateDevices: rc = 0xE901, eQCWWAN_ERR_SWIDCS_IOCTL_ERR
```

Notice that an error is returned because anyone trying to access the /dev/qcqmix device special file must have root privileges.

```
slqstutorial: #devices: 1 deviceNode: deviceKey:
```

Since the IOCTL issued by the SDK to the driver fails, the device key is not returned and the returned values are blank.

**slqstutorial: Attempt to Connect to the non-enumerated device ( Option 2 )**

```
slqstutorial: wQCWWANConnect: rc = 0x6, eQCWWAN_ERR_NO_DEVICE
```

No device has been enumerated as indicated by the error above

**slqstutorial: Attempt to execute other APIs**

```
slqstutorial: wQCWWANGetConnectedDevice: rc = 0x6, eQCWWAN_ERR_NO_DEVICE  
( Option 4 )
```

```
slqstutorial: wGetSessionState: rc = 0xE903, eQCWWAN_ERR_SWIDCS_APP_DISCONNECTED  
( Option 5 )
```

```
slqstutorial: wStartDataSession: rc = 0xE903, eQCWWAN_ERR_SWIDCS_APP_DISCONNECTED  
( Option 6 )
```

```
slqstutorial: wStopDataSession: rc = 0xE903, eQCWWAN_ERR_SWIDCS_APP_DISCONNECTED  
( Option 7 )
```

The application is not bound to the SDK and errors are received as shown above

## 5.5.5. Connection Manager Sample Application

Location: SampleApps/Connection\_Manager/

Purpose: Create, delete, view, and modify profiles. Start/stop data sessions.

Build:

i386:	make
ARM:	make CPU=arm9
Power PC:	make CPU=ppc
MIPS BE:	make CPU=mips
MIPS LE:	make CPU=mipsel

Execute:

i386:	sudo ./connectionmgri386
ARM:	sudo ./connectionmgrarm9
PPC:	sudo ./connectionmgrppc
MIPS:	sudo ./connectionmgmips
MIPS BE:	sudo ./connectionmgmipsel

## 5.5.6. Position Determination Service Sample Application

Location: SampleApps/PDS\_Service/  
Purpose: Set and Get GPS Service State. Start/stop tracking session.

Build:           i386:        make  
                  ARM:        make CPU=arm9  
                  Power PC:  make CPU=ppc  
                  MIPS BE:   make CPU=mips  
                  MIPS LE:   make CPU=mipsel

Execute:  
          i386:        sudo ./pdsservicehosti386  
          ARM:        sudo ./pdsservicearm9  
          PPC:        sudo ./pdsserviceppc  
          MIPS:       sudo ./pdsservicemips  
          MIPS BE:   sudo ./pdsservicemipsel

## 5.5.7. SWIOMA Sample Application

Location: SampleApps/SWIOMA\_Application/  
Purpose: Set and Get SWIOMADM setting. Start/cancel SWIOMADM session.

Build:           i386:        make  
                  ARM:        make CPU=arm9  
                  Power PC:  make CPU=ppc  
                  MIPS BE:   make CPU=mips  
                  MIPS LE:   make CPU=mipsel

Execute:  
          i386:        sudo ./SWIOMASampleApphosti386  
          ARM:        sudo ./SWIOMASampleApparm9  
          PPC:        sudo ./SWIOMASampleAppppc  
          MIPS:       sudo ./SWIOMASampleAppmips  
          MIPS BE:   sudo ./SWIOMASampleAppmipsel

## 5.6. AirVantage Agent Integration

The AirVantage agent was fully integrated to SLQS starting from version 3.2. It is a default service running in the background when SLQS starts. Users don't need to explicitly start the service.

To disable the service, the user needs to properly setup SLQS through a configuration file. SLQS will not start if AirVantage service is missing or not properly setup.

### 5.6.1. Auto Start Preprocessor

AGENT\_AUTO\_START is by default disabled at `pkgs/slqscmpile.mak`. To enable, uncomment command line: `CFLAGS += -DAGENT_AUTO_START`.

### 5.6.2. Agent Configuration File

Location: Same directory of slqssdk

Name: `.sdk_config`

Syntax: `AVA_PATH=absolute path of runtime folder of agent`

e.g. `AVA_PATH=/home/SDK/AirVantageAgent/build.arm/runtime`

To disable the agent, set `AVA_PATH=NO_AVA` (only first line of config file will be read)

If the configuration file is missing, SLQS will try to search for "**AirVantageAgent/runtime**" in the slqssdk folder. If it is still not found, SDK will not start.

### 5.6.3. Agent Constrains

SLQS supports a maximum of three simultaneous applications and AirVantage service uses two of them. Only one extra application is supported when AirVantage is started.

### 5.6.4. Agent Source Tree

Location: `SampleApps/AirVantageAgent/avagent_r8m`

Build: `i386: build_avagent.sh`  
`arm: build_avagent.sh arm`

Output: `i386: build.default`  
`arm: build.arm`

### 5.6.5. Start/Stop the AirVantage Agent

To start, run "`start_sdk_hosti686.sh`" or start any sample application.

To stop, run "`stop_sdk_hosti686.sh`".

## 5.6.6. AirVantage M2M Cloud

Address: <http://eu.airvantage.net/>

Usage: Please refer to document **Error! Reference source not found. Error! Reference source not found.**

## 5.7. Full APIs Debug Information

When SDK is compiled with `DEBUG_IPC_MSG_FLAG` defined. Additional logs will be captured in syslogs. These logs will print useful information like if a REQ/RESP/NOTIF is sent/received and also prints svc and msg id for that transaction at following points of code flow.

1. When request sent from API process to SDK process

Eg: [swi\_osapiipcwrite] REQ svc 3 msgid 0x2

2. When request received by SDK process

Eg: [amiprcrvhandler] REQ svc 3 msgid 0x2

3. When response sent from SDK process to API process

Eg: [swi\_ossdkipcwrite] RESP svc 3 msgid 0x2

4. When response received by API process

Eg: [amsendnwait] RESP svc 3 msgid 0x2

5. When notification sent from SDK process to API process

Eg: [amapiwaitnotif] NOTIF svc 3 msgid 0x2

6. When notification received by API process

Eg: [swi\_osapiipcread] NOTIF svc 3 msgid 0x2

7. A log when a mutex is obtained and released by the API process

Eg: [amgetreqbufp] Mutex Locked

[amrelreqbufp] Mutex Unlocked

8. A log with the timeout value for a particular API

Eg: [SwiQmiMISendnWait]Timeout 2000 seconds**For Example:**

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: SetSignalStrengthCallback - START

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [amgetreqbufp] Mutex Locked

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [SwiQmiMISendnWait]Timeout 2000 seconds

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [swi\_osapiipcwrite] REQ svc 3 msgid 0x2

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 0 msgid 0x0

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: [amiprcrvhandler] REQ svc 3 msgid 0x2

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: [swi\_ossdkipcread] NOTIF svc 0 msgid 0x0

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:qmqmireq/1390: Request: QMI Instance 0

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:SDK->Mdm: request received :  
ipcch/svctype/xactionlen/clientnum: 0/0003/14/2

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:SDK->Mdm: request validated :  
ipcch/svctype/xactionlen/clientnum: 0/0003/14/2

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:Launching QMI DS shell: service 3(NAS)



Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:qmqmireq/1501: WDS Request: Active Client 2, WDS Client 0

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: UDIAG:DS Shell launched

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QMURR1:Endpoint DS shell instance created

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: USB read: bytes2read = 14, read 14 bytes

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Resp: ch/Msgid/Msglen/IPCmsglen: 0/0002/11/29

Sep 8 13:49:29 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] RESP svc 3 msgid 0x2

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [amsendnwait] RESP svc 3 msgid 0x2

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: [amrelreqbufp] Mutex Unlocked

Sep 8 13:49:29 infy-desktop qatesthostx86\_64: SetSignalStrengthCallback - END

Sep 8 13:52:00 infy-desktop SWI0 SDK Process: USB read: bytes2read = 12, read 12 bytes

Sep 8 13:52:00 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 1/0002/9/27

Sep 8 13:52:00 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x2

Sep 8 13:52:00 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 3/0002/9/27

Sep 8 13:52:00 infy-desktop kernel: [869620.269915] GobiNet::UpSem 0x0103

Sep 8 13:52:00 infy-desktop kernel: [869620.270156] GobiNet::FindClientMem Found client's 0x103 memory

Sep 8 13:52:00 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 5/0002/9/27

Sep 8 13:52:00 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x2

Sep 8 13:52:00 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x2

Sep 8 13:52:03 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 1/0002/9/27

Sep 8 13:52:03 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x2

Sep 8 13:52:03 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 3/0002/9/27

Sep 8 13:52:03 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 5/0002/9/27

Sep 8 13:52:03 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x2

Sep 8 13:52:03 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x2

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: USB read: bytes2read = 45, read 45 bytes

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 1/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 3/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif: ch/Msgid/Msglen/IPCmsglen: 5/0024/42/60

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: USB read: bytes2read = 45, read 45 bytes

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 1/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 3/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 5/0024/42/60

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: USB read: bytes2read = 45, read 45 bytes

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 1/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 3/0024/42/60

Sep 8 13:52:04 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 5/0024/42/60

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x36

Sep 8 13:52:04 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x36

Sep 8 13:52:07 infy-desktop SWI0 SDK Process: USB read: bytes2read = 28, read 28 bytes

Sep 8 13:52:07 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 1/0024/25/43

Sep 8 13:52:07 infy-desktop SWI0 SDK Process: [swi\_ossdkipcwrite] NOTIF svc 3 msgid 0x36

Sep 8 13:52:07 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 3/0024/25/43

Sep 8 13:52:07 infy-desktop SWI0 SDK Process: QM:SDK<-Mdm Notif:  
ch/Msgid/Msglen/IPCmsglen: 5/0024/25/43

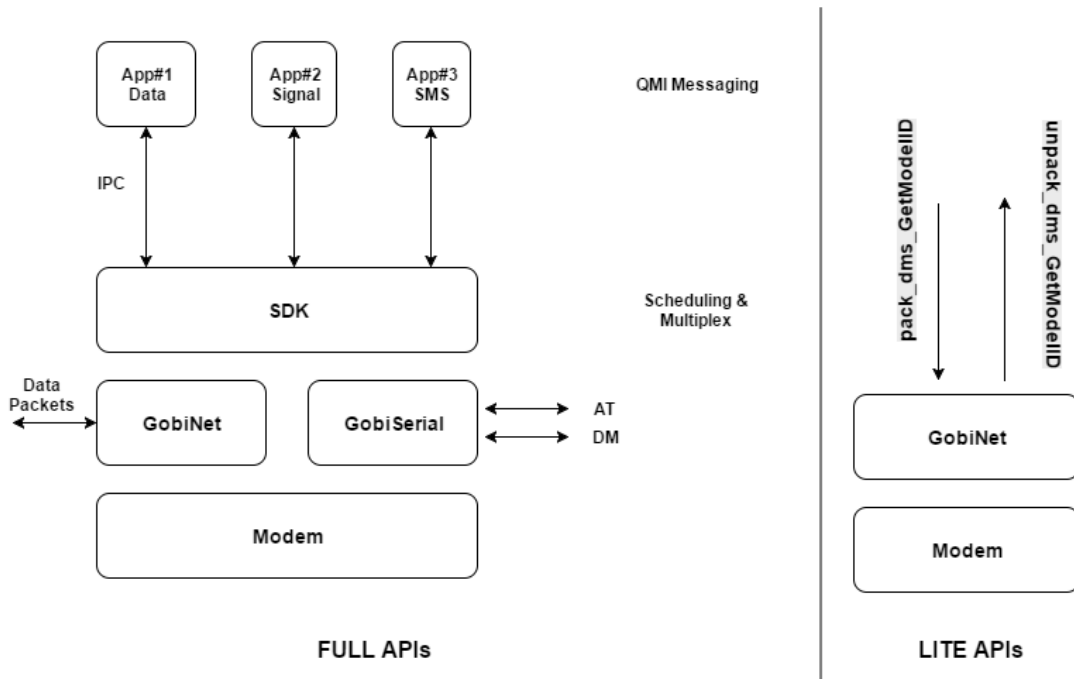
Sep 8 13:52:07 infy-desktop qatesthostx86\_64: [amapiwaitnotif] NOTIF svc 3 msgid 0x36

Sep 8 13:52:07 infy-desktop qatesthostx86\_64: [swi\_osapiipcread] NOTIF svc 3 msgid 0x36



## 6. Lite APIs Getting Started

With revision 4.0.0, we introduce a set of Lite APIs which to encode or decode QMI messages.



### 6.1. Using Lite SDK wrapper to encode/decode QMI messages

These Lightweight API allows developer to pack/unpack QMI messages directly. Developers have to handle the QMI device (/dev/qcqm#) read/write. The packing demo is an utility that exercise most of these lightweight APIs. Later section show a how to implement an application to retrieve model id from modem

### 6.2. Steps to run packing demo sample app

```
mkdir 400
cd 400
tar xf ../SLQS04.00.10/SLQS04.00.00.tar.gz
make -C SampleApps/packingdemo
./SampleApps/packingdemo/bin/packingdemohostx86_64
```

## 6.3. Application to retrieve modem's model id

```
#include <fcntl.h>
#include <unistd.h>
#include <stdio.h>
#include "dms.h"
#define QMI_GET_SERVICE_FILE_IOCTL 0x8BE0 + 1

int
main()
{
    pack_qmi_t context;
    uint8_t request[255], response[255];
    uint16_t req_len, resp_len;
    unpack_dms_GetModelID_t model_t;

    int qmi_fd = open("/dev/qcqmio", O_RDWR);
    //register DMS QMI client via ioctl
    ioctl(qmi_fd, QMI_GET_SERVICE_FILE_IOCTL, eDMS);

    //encode qmi request
    context.xid = 0xabcd; // xid must be non-zero
    pack_dms_GetModelID(&context, request, &req_len, NULL);
    write(qmi_fd, request, req_len);
    read(qmi_fd, response, 255);

    //decode qmi response
    unpack_dms_GetModelID( response, resp_len, &model_t );
    printf("model id: %s\n", model_t.modelid);

    close(qmi_fd);
}
```

**The source above:**

- Register Device Management Service (DMS) QMI client
- Encode Get Model ID QMI request
- Write request to Modem
- Decode Get Model ID QMI response
- Print Model Id to stdout

## 6.4. Compile and Run

```
cc get-model-id.c -I libpack/inc -lpack -Llibpack/lib/hostx86_64 -lpthread
-o get-model-id
./get-model-id
model id: EM7455
```

## 6.5. Wrapper headers and libraries

```
→ 400 tree libpack
libpack
├── inc
│   ├── common.h
│   ├── dms.h
│   ├── fms.h
│   ├── loc.h
│   ├── msgid.h
│   ├── nas.h
│   ├── qmerrno.h
│   ├── qos.h
│   ├── sms.h
│   ├── swiloc.h
│   ├── swioma.h
│   ├── uim.h
│   └── wds.h
└── lib
    ├── arm
    └── libpack.a
```

```
|— hosti686
|   └─ libpack.a
|— hostx86_64
|   └─ libpack.a
└─ ppc
    └─ libpack.a
```

6 directories, 17 files

## 7. Tools

### 7.1. DM Logging Tool

Location: /tools/logging/dm

Purpose: This tool can be used to send DM filters to the device and log raw DM packets for real-time analysis with QPST (remote logging option) or post-hoc analysis (local or remote logging).

Build:

- i386: make
- ARM: make CPU=arm9
- Power PC: make CPU=ppc
- MIPS BE: make CPU=mips
- MIPS LE: make CPU=mipsel

Usage: Navigate to **tools/logging/dm** and execute **./dmcapture.sh** in a shell.

### 7.2. RAM Dump Tool

Location: /tools/logging/ramdump

Purpose: This tool supports the capturing of the device RAM contents when the device is in boot and hold mode. RAM contents are saved in files written to the current working directory.

Build:

- i386: make
- ARM: make CPU=arm9
- Power PC: make CPU=ppc
- MIPS BE: make CPU=mips

```
MIPS LE: make CPU=mipsel
```

Usage:

**Prior to Execution:**

1. Enter the following AT commands:  

```
at!entercmd="A710"  
at!eroption=0
```
2. Either reproduce a crash you are investigating, or reset the device

**Execution:**

Within a shell, execute the following (for i386):

```
./ramdumptooli386 -c<digit>
```

Where /dev/ttyUSB<digit> = DM interface ttyUSB device file in boot and hold mode (usually /dev/ttyUSB0).

---

*Note: This tool works independent of the SDK.*

---

## 7.3. SQF Filter Editing

Location: /tools/logging/dm/filter/src

Purpose: This tool supports modifying SQF filter via api

Usage:

1. Include header file : sqf.h
2. Create Gobal variable : sqf\_t sqf
3. Create buffer for sqf : sqf\_createbuffer()
4. Load sqf file (optional) : sqf\_load\_file()
5. Edit Filter : sqf\_set() / sqf\_clear()
6. Save sqf file : sqf\_save\_file()
7. Free Buffer for sqf : sqf\_destroybuffer().

---

*Note: This tool works independent of the SDK.*

---

## 8. Documentation

To view the Full APIs documentation:

1. Navigate to **docs/SwiApiReference** and open index.html.
2. Click on the modules tab.
3. Select the module of interest e.g. "Short Message Service (SMS)" module.
4. Select the header file e.g. "qaGobiApiSms.h".

For Lite APIs, please refer to **docs/lite**

---

*Note: An API function header's "Device Supported" section contains a list of devices that have been successfully tested against that API.*

---



## 9. Reference Documents

- [1] SLQS Release Notes
- [2] 80-VF459-1 Supplement to Streaming Download Protocol
- [3] AirVantage Agent SLQS Integration Guide  
Reference: 4115927