mangOH™ Red

Getting Started—WPx5xx + Linux Dev Machine + CLI

41110481
Rev 2
Contents subject to change

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Revision History

Revision number	Release date	Changes
1	August 2017	Document created

Contents

1: Getting Started

Now that you have your mangOH™ Red, it’s time to start using it.

Important: *Use this guide only if you are using a native Linux development system (Ubuntu is recommended).*

This guide includes instructions for native Linux® development machines using CLI (Command Line Interpreter).

This Getting Started guide takes you from assembling your mangOH Red and setting up your computer for mangOH development, through to installing and running applications and sending data to the IoT Cloud via AirVantage, Sierra Wireless’ cloud-based services platform for over-the-air (OTA) device management.

To get started with Windows systems, or for other mangOH Red resources (guides, tutorials, etc.), visit mangoh.io/mangoh-red-resources.

1.1 Minimum System Requirements

Make sure your computer meets the minimum suggested requirements for application development with the mangOH Red.

Table 1-1: Minimum System Requirements

	Linux
O/S	Ubuntu 16.04
CPU	Dual core @ 2.6 GHz
RAM	4 GB
HDD	10 GB free space

Note: The instructions in this guide have been tested on Ubuntu 16.04. If you choose to use a different distribution (e.g. Debian, Fedora, etc.), you may need to adjust commands, set permissions, etc. If you need assistance, please check out the forum at forum.mangoh.io.

1.2 Quick Start Contents

Important: *Carefully follow the procedures as described—each section builds on earlier procedures and results. If you skip steps or use alternate methods, you may have difficulty completing the tutorial.*

This quick start guide includes:

- Before You Begin on page 8
- Step-by-step tutorial:
  - Set Up Your mangOH Red Hardware on page 9
  - Prepare Your Linux Dev Machine For Legato Development on page 17
  - Prepare Your mangOH Red For Development on page 23
  - Develop and Test applications on page 42Connect To Mobile Networks on page 29
  - Connect to the IoT Cloud on page 34
- Things to do after the tutorial:
  - Develop and Test applications on page 42
  - Update Legato Application Framework on page 50
- Tips on page 53

2: Before You Begin

Before you begin, here are a few items that you might find helpful:

- Some terminology:
    - "CF3"—The mangOH Red supports CF3 (Common Form Factor) embedded modules, such as the WP8548 and HL8548.
      Throughout this tutorial, "CF3" refers to the module that comes with your mangOH Red kit.
    - "Dev(elopment) machine"—Your Linux computer
    - "Target"—The CF3 module in your mangOH Red.
- Some symbols:
    - ’$’, ’#’— Command prompts.
        - ’$’—Command prompt when you are logged in to a device as a regular user.
        - ’#’—Command prompt when you are logged in as the ’root’ user.

        Note: In the examples in this document, you will be logged in as a regular user on your dev machine (command prompt will be ’$’), and logged in as the root user on the target (command prompt will be ’#’).
    - ’~’, "$HOME"—Your ’home directory’ on your dev machine.
- Command examples—Many steps in this guide require you to enter commands in a terminal window. These commands are shown like this:

    ```
    $ ping 192.168.2.2
    # cd ~
    ```

    Note: You can copy commands from this guide and paste them in to your terminal window to save time and avoid typing errors. Do not include the command prompt when you copy/enter commands. (In the first example above, you would enter "ping 192.168.2.2", not "$ ping 192.168.2.2".)
- CF3 module default credentials and IP address (used to connect to the target from the dev machine):
    - USB ECM IP address—192.168.2.2
    - User name—root
    - Password—<none>
- Terminal window tips:
    - Shortcut to open a terminal window (on the default Unity desktop used in Ubuntu Linux)—Ctrl+Alt+T
    - Cancel command to break out of a running process—Ctrl+C
    - minicom exit command—Ctrl+A, then press X

3: Set Up Your mangOH Red Hardware

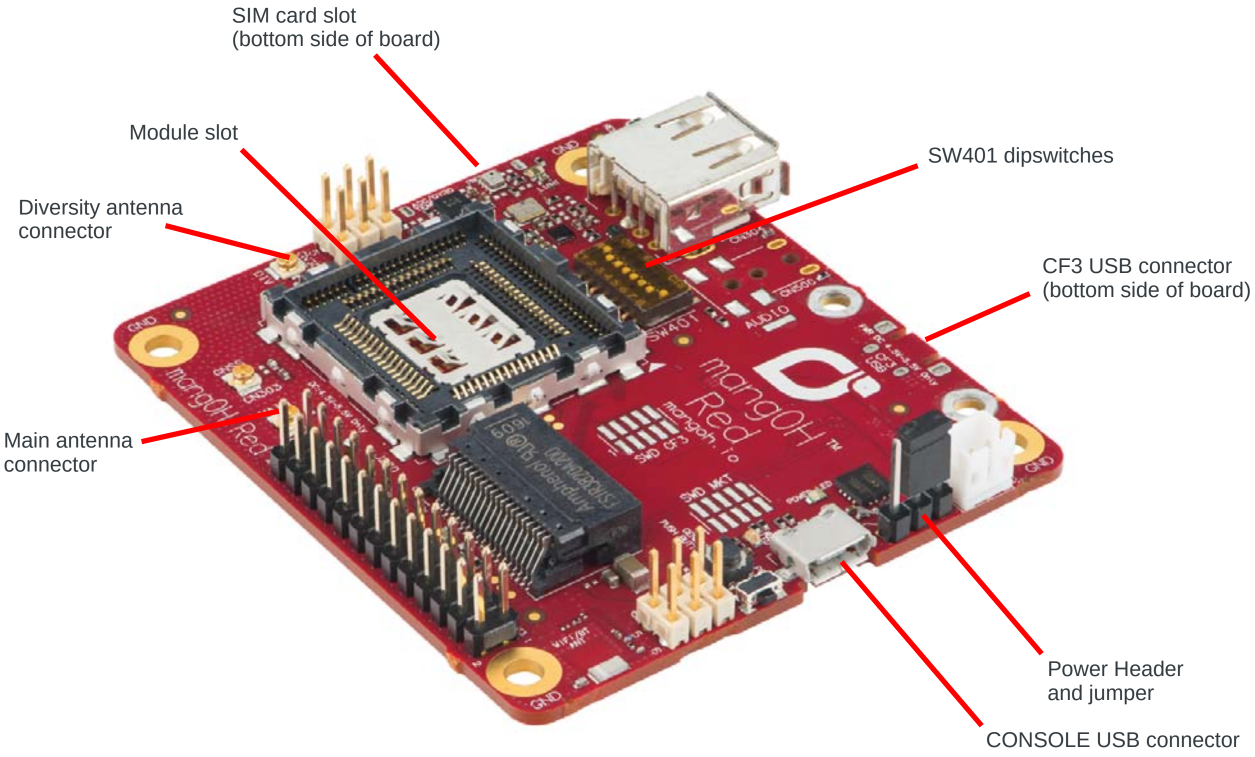
In this chapter, you will set up your mangOH Red to begin developing applications.

A typical mangOH Red kit includes:

- mangOH Red board
- CF3 (Common Form Factor) module, cover, and release tool
- micro-USB cables (2)
- Antenna (main)
- Antenna (diversity)—Included if the CF3 module supports LTE
- Sierra Wireless micro-SIM

3.1 mangOH Layout

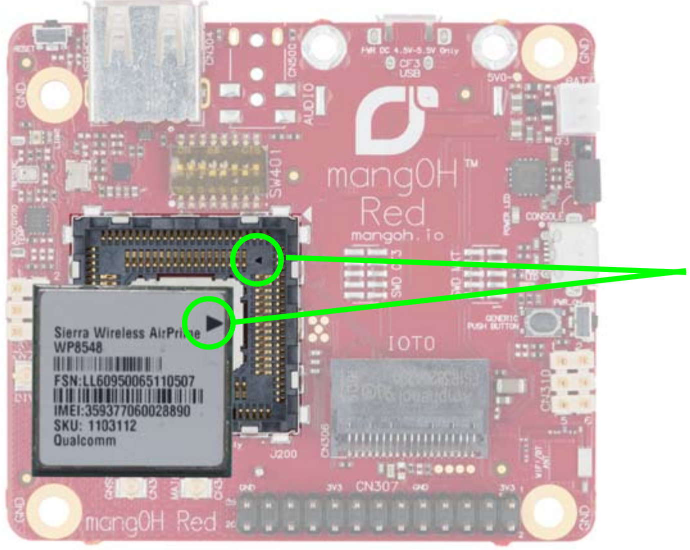
The following image indicates where you will connect typical kit components to the mangOH Red— follow the instructions in Hardware Setup on page 10 for the proper setup procedure.



3.2 Hardware Setup

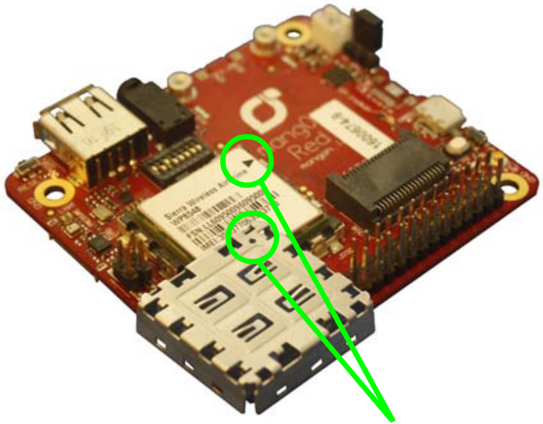
To set up the mangOH Red board:

1. Insert the CF3 module—Hold the module above the socket and line up the triangles on the module and socket. The module will drop straight into the socket. (Position matters!)

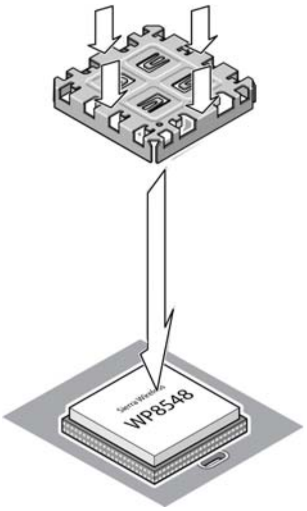


The triangle on the label matches the position of the triangle on the socket.

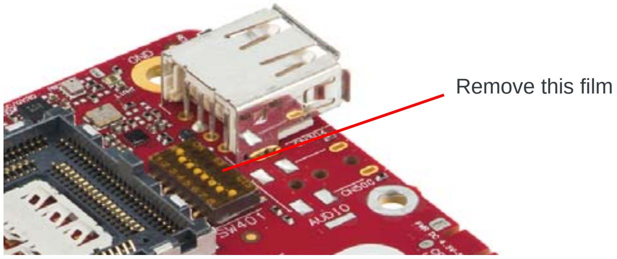
2. Hold the module cover over the module and line up the circle on the cover with the triangle on the label, then press the cover (on the edges) into place.



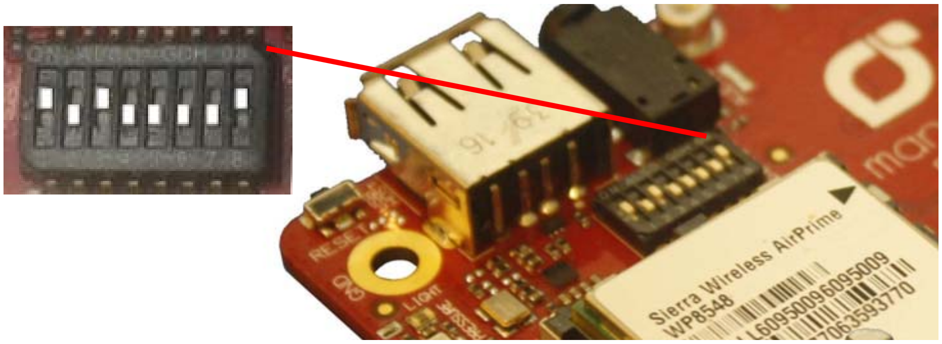
The triangle on the label matches the position of the circle on the cover.



3. Remove the protective film from the dipswitches:

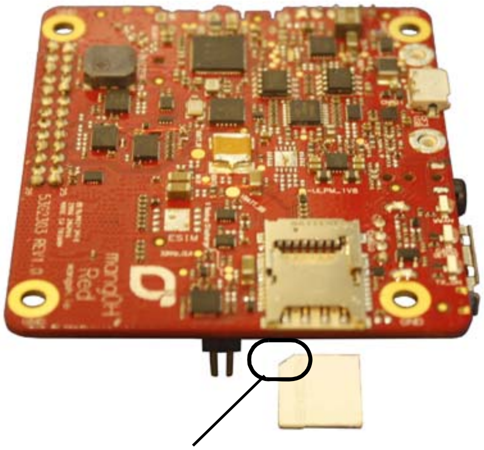


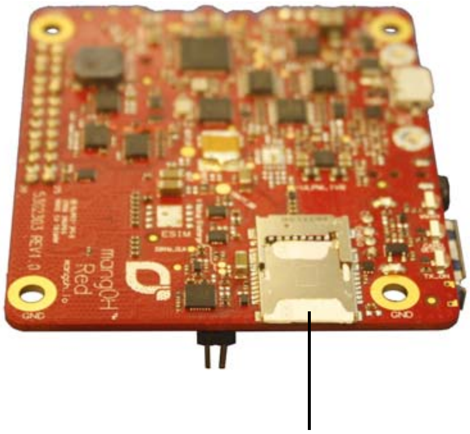
4. Make sure the dipswitches are set as follows:
   - ON—1,3,8
   - OFF—2,4,5,6,7



5. Insert a micro-SIM in the slot on the bottom side of the mangOH Red. You can use the Sierra Wireless micro-SIM that is included in the kit, or another micro-SIM that has been activated by a mobile network provider.

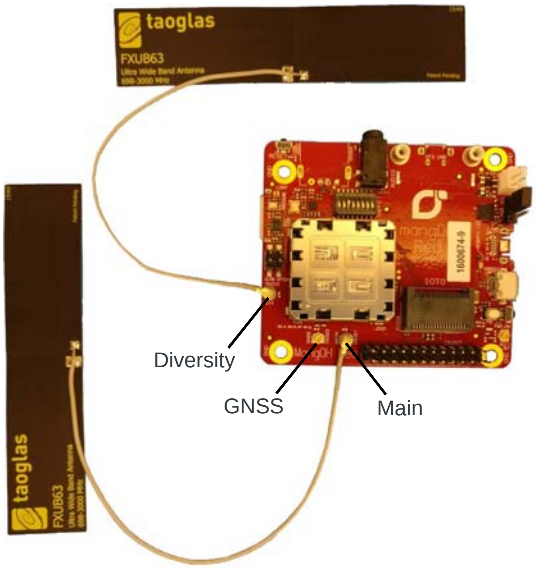
Note: If you do not have an activated micro-SIM, you can still continue with the tutorial, but will not be able to complete the following sections: Connect To Mobile Networks on page 29 and Connect to the IoT Cloud on page 34.





6. Attach the main antenna and (for LTE CF3 modules) the diversity antenna.

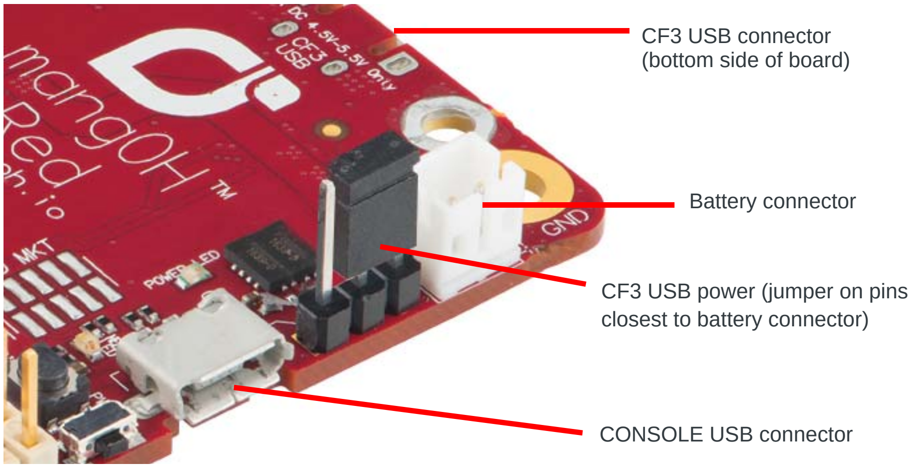
Note: The main antenna is required if you want to connect the mangOH Red to a mobile network in Connect To Mobile Networks on page 29.



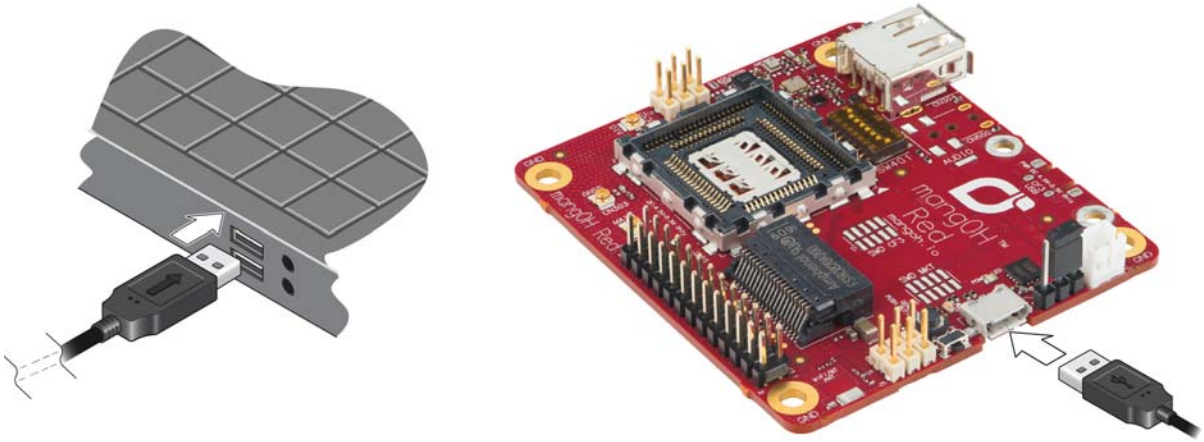
Tip: *If you have trouble connecting an antenna, make sure it is positioned directly on the connector and push straight down. The antenna will not connect at an angle.*

Note: The mangOH Red has two USB connectors. CF3 USB is used for SSH connections, AT commands, and firmware downloads, and CONSOLE_USB is used for serial USB connections for debugging and to access the module's console.

7. Move the power select jumper to select the CF3 USB connector—in this guide, power is supplied from the dev machine's USB port to this connector.


CF3 USB connector (bottom side of board)
Battery connector
CF3 USB power (jumper on pins closest to battery connector)
CONSOLE USB connector

8. Use a micro-USB cable to connect the CONSOLE USB connector to a USB port on your dev machine.



9. Open a terminal window on the dev machine—this window will be used to display the target’s console messages (kernel messages, warnings, etc.).

Note: Depending on your desktop, a terminal window may be opened using a keyboard shortcut (e.g. Ctrl+Alt+T for the Ubuntu Unity desktop), or an icon or menu item.

10. Connect to the target’s Linux console as follows:

   a. In the terminal window, enter the following command to install the minicom application on your dev machine (if it is not already there), and follow any prompts that may appear:

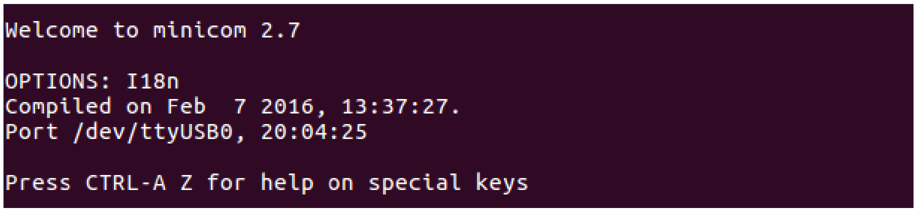
```
$ sudo apt-get install minicom
```

   Note: ’sudo’ tells the dev machine to run the command as the ’superuser’. Each time you use sudo, you must enter your dev machine’s password to continue.

   b. Connect to the target’s Linux console via the USB serial port (which enumerated when you connected the CONSOLE USB connector to the dev machine):

```
$ minicom -D /dev/ttyUSB0
```

   A welcome message appears, and the window will show console messages when the mangOH Red powers on in the next step.



```
Welcome to minicom 2.7

OPTIONS: I18n
Compiled on Feb  7 2016, 13:37:27.
Port /dev/ttyUSB0, 20:04:25

Press CTRL-A Z for help on special keys
```

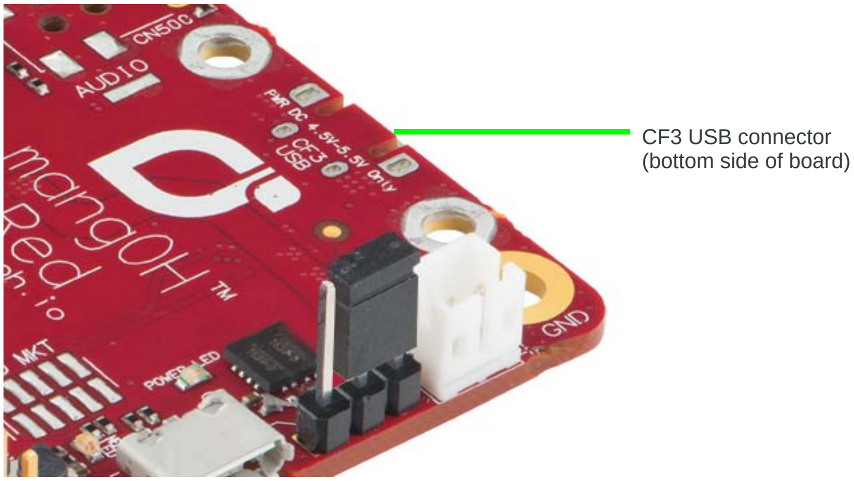
Note: The USB serial port enumerates as ttyUSB0 because you connected CONSOLE USB to the host before connecting CF3 USB to the host (which you will do later). However, if you connected CF3 USB first, it would enumerate ttyUSB0, ttyUSB1, and ttyUSB2. Then when CONSOLE USB is connected, it will enumerate as ttyUSB3.

Note: You can exit minicom at any time—the purpose of showing it here is to demonstrate how to display console messages for debugging purposes. To exit minicom, press Ctrl+A, then press X. When prompted, select Yes to leave minicom.

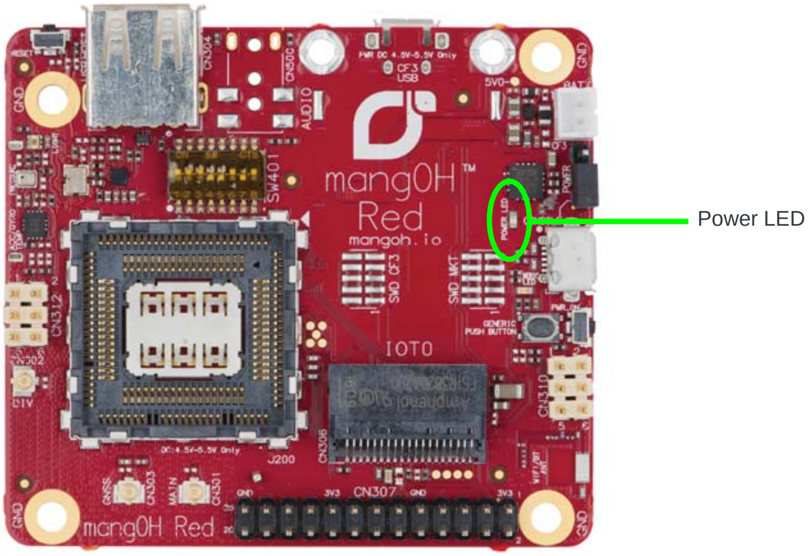
Note: Through the rest of this guide, examples use terminal windows connected via ssh, but a console connection could also be used. However, only one console connection can be opened at any time since it locks the USB serial port.

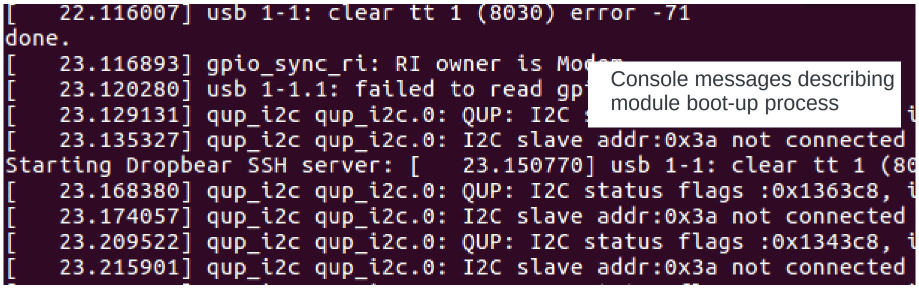
11. Power up the mangOH Red:

a. Use a micro-USB cable to connect the CF3 USB connector to a USB port on the dev machine.



When the mangOH Red is powered, the Power LED turns solid green and startup messages will appear in the terminal window that you connected to the target's console in Step 10.





```
[    22.116007] usb 1-1: clear tt 1 (8030) error -71
done.
[    23.116893] gpio_sync_ri: RI owner is Mod
[    23.120280] usb 1-1.1: failed to read gp
[    23.129131] qup_i2c qup_i2c.0: QUP: I2C s                          i
[    23.135327] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
Starting Dropbear SSH server: [    23.150770] usb 1-1: clear tt 1 (80
[    23.168380] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1363c8, i
[    23.174057] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
[    23.209522] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1343c8, i
[    23.215901] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
```

Console messages describing module boot-up process

Note: For future reference, the mangOH Red's power supply (USB port on your dev machine, or an AC adapter) connects to the board via either USB connector—CF3 USB or CONSOLE USB (depending on the jumper position on the power header). If an AC adapter is connected to CF3 USB, SSH/AT connections are not possible; if it is connected to CONSOLE USB, serial USB connections are not possible.

12. On the dev machine, open another terminal window.

13. Make sure the modemmanager package is removed from your system (this package causes problems with mangOH Red if it is not removed):

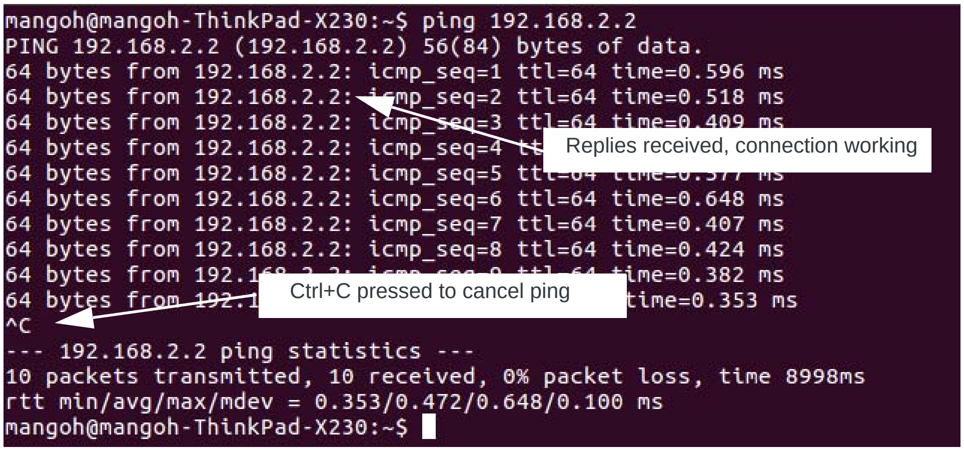
```
$ sudo apt-get remove modemmanager
```

14. Wait 10-15 seconds for the mangOH Red to enumerate.

15. Test the CF3_USB connection:

```
$ ping 192.168.2.2
```

You should receive ping responses. Press Ctrl+C to cancel the ping request and return to the command prompt.



```
mangoh@mangoh-ThinkPad-X230:~$ ping 192.168.2.2
PING 192.168.2.2 (192.168.2.2) 56(84) bytes of data.
64 bytes from 192.168.2.2: icmp_seq=1 ttl=64 time=0.596 ms
64 bytes from 192.168.2.2: icmp_seq=2 ttl=64 time=0.518 ms
64 bytes from 192.168.2.2: icmp_seq=3 ttl=64 time=0.409 ms
64 bytes from 192.168.2.2: icmp_seq=4 tt
64 bytes from 192.168.2.2: icmp_seq=5 ttl=64 time=0.377 ms
64 bytes from 192.168.2.2: icmp_seq=6 ttl=64 time=0.648 ms
64 bytes from 192.168.2.2: icmp_seq=7 ttl=64 time=0.407 ms
64 bytes from 192.168.2.2: icmp_seq=8 ttl=64 time=0.424 ms
64 bytes from 192.168.2.2: icmp_seq=9 ttl=64 time=0.382 ms
64 bytes from 192.1                           time=0.353 ms
^C
--- 192.168.2.2 ping statistics ---
10 packets transmitted, 10 received, 0% packet loss, time 8998ms
rtt min/avg/max/mdev = 0.353/0.472/0.648/0.100 ms
mangoh@mangoh-ThinkPad-X230:~$
```

Replies received, connection working

Ctrl+C pressed to cancel ping

Now you are ready to Prepare Your Linux Dev Machine For Legato Development on page 17.

4: Prepare Your Linux Dev Machine For Legato Development

In this chapter, you will prepare your dev machine for Legato application development by setting up the development environment with required applications and packages.

Important: *To install and use the development environment, your dev machine must meet the requirements in Table 1-1 on page 6.*

4.1 Prepare Dev Machine For Application Development

After preparing your mangOH Red hardware in Set Up Your mangOH Red Hardware on page 9, you can prepare your dev machine for application development:

Important: *Download, installation and use of Legato Application Framework and Platform Services is subject to the Legato License and Open Source Licenses. (Note: These links automatically download the licenses as PDF files.)*

4.2 Build and Install the Development Environment

In this section you will build and install the environment to develop applications for the CF3 module used in your mangOH Red. The environment includes:

- Legato toolchain—Tools and libraries used to build the Legato Platform for your CF3 module. The Legato toolchain is module-specific; you must make sure you install the toolchain designed for your module.
- mangOH Red platform—Drivers for on-board components, and a basic device-to-cloud application.

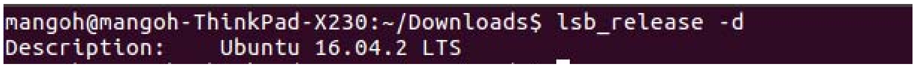
To build and install the development environment on your dev machine:

1. Open a terminal window.

2. Install packages required for the development environment:

a. Display your Ubuntu version:

```
$ lsb_release -d
```

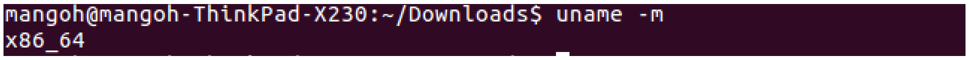


```
mangoh@mangoh-ThinkPad-X230:~/Downloads$ lsb_release -d
Description:    Ubuntu 16.04.2 LTS
```

Note: If the version is less than 16.04, upgrade your operating system to 16.04 or higher, then continue with these instructions.

3. Check whether your dev machine is 32-bit or 64-bit:

```
$ uname -m
```



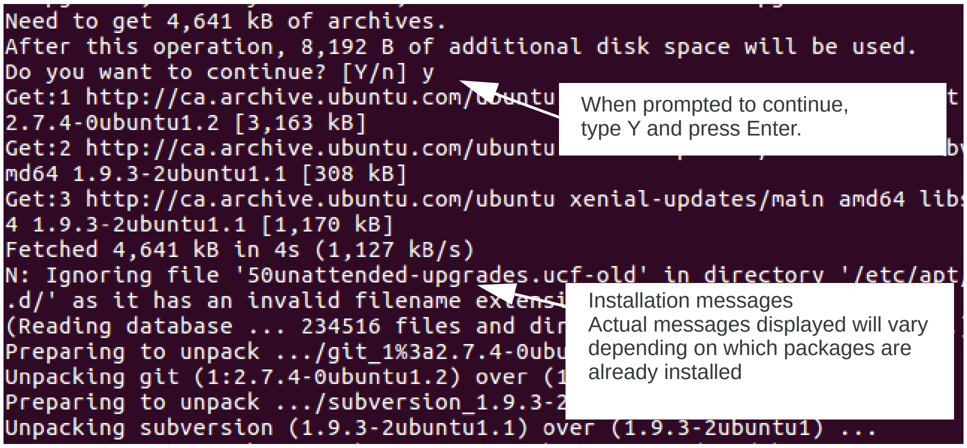
```
mangoh@mangoh-ThinkPad-X230:~/Downloads$ uname -m
x86_64
```

The dev machine's hardware type appears —e.g. "x86_64" is a 64-bit system.

4. Install several packages that are required for the Legato Platform and the mangOH Red platform—enter the following command and follow any prompts that appear:

```
$ sudo apt-get install build-essential openjdk-8-jre \
        libwebkitgtk-1.0-0 python python-jinja2 cmake \
        git subversion libsdl-dev diffstat texinfo gawk \
        chrpath wget cpio vim zsh bash ninja-build screen \
        sshpass bc python-git unzip libxml2-utils gcovr \
        libcurl4-gnutls-dev zlib1g-dev libbz2-dev \
        bsdiff libssl-dev zip autoconf automake
```

Note: The '\' at the ends of the lines tells the system that the command continues on the next line. When you run this command (and any others in this guide that use the '\'), you can copy and paste the full command (including '\' characters) in your terminal window. If you type the command manually all on one line, do not type the '\' characters.



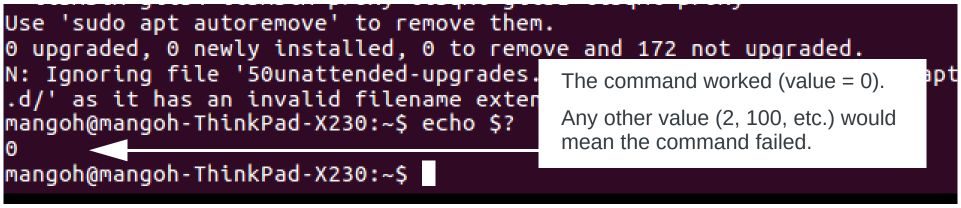
```
Need to get 4,641 kB of archives.
After this operation, 8,192 B of additional disk space will be used.
Do you want to continue? [Y/n] y
Get:1 http://ca.archive.ubuntu.com/ubuntu                                t
2.7.4-0ubuntu1.2 [3,163 kB]
Get:2 http://ca.archive.ubuntu.com/ubuntu                                b
md64 1.9.3-2ubuntu1.1 [308 kB]
Get:3 http://ca.archive.ubuntu.com/ubuntu xenial-updates/main amd64 lib
4 1.9.3-2ubuntu1.1 [1,170 kB]
Fetched 4,641 kB in 4s (1,127 kB/s)
N: Ignoring file '50unattended-upgrades.ucf-old' in directory '/etc/apt
.d/' as it has an invalid filename extensi
(Reading database ... 234516 files and dir
Preparing to unpack .../git_1%3a2.7.4-0ubu
Unpacking git (1:2.7.4-0ubuntu1.2) over (1
Preparing to unpack .../subversion_1.9.3-2
Unpacking subversion (1.9.3-2ubuntu1.1) over (1.9.3-2ubuntu1) ...
```

When prompted to continue, type Y and press Enter.

Installation messages
Actual messages displayed will vary depending on which packages are already installed

5. As shown in the previous step, the output you see when you run some commands may be different from the examples shown. To check if a command succeeded or failed, enter the following command:

```
$ echo $?
```



```
Use 'sudo apt autoremove' to remove them.
0 upgraded, 0 newly installed, 0 to remove and 172 not upgraded.
N: Ignoring file '50unattended-upgrades.                              apt
.d/' as it has an invalid filename exten
mangoh@mangoh-ThinkPad-X230:~$ echo $?
0
mangoh@mangoh-ThinkPad-X230:~$ 
```

The command worked (value = 0).

Any other value (2, 100, etc.) would mean the command failed.

If the value returned is ’0’, the command succeeded. If it is any other value, the command failed.

6. If your dev machine is 64-bit, install additional dependencies:

```
$ sudo apt-get install lib32z1 lib32ncurses5
```

7. Build the Legato toolchain (SDK):

a. If you have previously installed Legato toolchains, make sure you do not have any old toolchain files ("poky*.sh") in your Downloads directory (e.g. ~/Downloads), and remove any changes that may have been made to your .bashrc file:

i. Go to your Downloads directory:

```
$ cd ~/Downloads
```

ii. Either move or delete any old toolchain files:

Delete files:

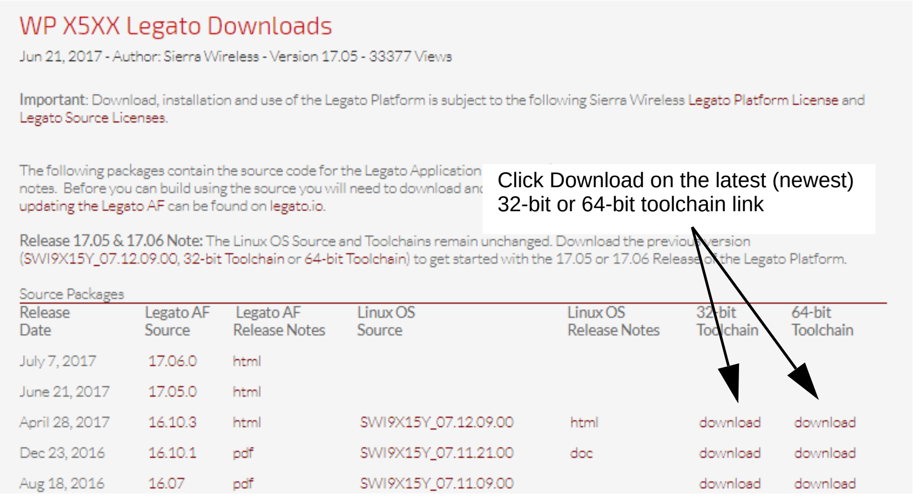
```
$ rm poky*
```

Move files:

```
$ mkdir old_toolchains
$ mv poky* old_toolchains
```

iii. Edit your ~/.bashrc file, comment out any items at the bottom of the file that begin with "LEGATO", and save and close the file.

b. Go to http://source.sierrawireless.com/resources/legato/downloads and click the latest Legato (32-bit or 64-bit) toolchain download link (the link is to a .sh file).



WP X5XX Legato Downloads

Jun 21, 2017 - Author: Sierra Wireless - Version 17.05 - 33377 Views

Important: Download, installation and use of the Legato Platform is subject to the following Sierra Wireless Legato Platform License and Legato Source Licenses.

The following packages contain the source code for the Legato Application
notes. Before you can build using the source you will need to download and
updating the Legato AF can be found on legato.io.

Release 17.05 & 17.06 Note: The Linux OS Source and Toolchains remain unchanged. Download the previous version (SWI9X15Y_07.12.09.00, 32-bit Toolchain or 64-bit Toolchain) to get started with the 17.05 or 17.06 Release of the Legato Platform.

Source Packages

Release Date	Legato AF Source	Legato AF Release Notes	Linux OS Source	Linux OS Release Notes	32-bit Toolchain	64-bit Toolchain
July 7, 2017	17.06.0	html				
June 21, 2017	17.05.0	html				
April 28, 2017	16.10.3	html	SWI9X15Y_07.12.09.00	html	download	download
Dec 23, 2016	16.10.1	pdf	SWI9X15Y_07.11.21.00	doc	download	download
Aug 18, 2016	16.07	pdf	SWI9X15Y_07.11.09.00		download	download

Click Download on the latest (newest) 32-bit or 64-bit toolchain link

Note: You must register on the Source for an account before you can download files.

c. Click Download.

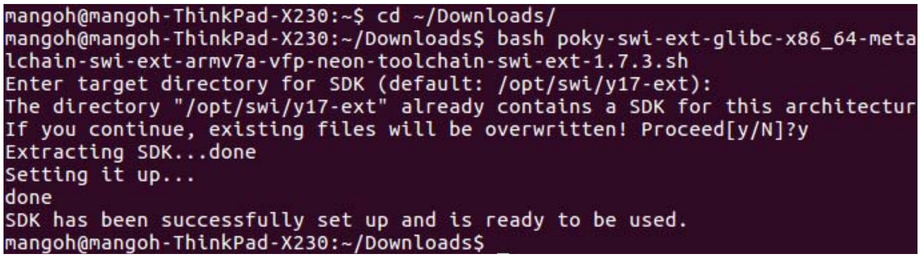
d. If prompted, save the file to your Downloads folder. (e.g. ~/Downloads)

e. In the terminal window, open the folder and run the file.

(In the command below, replace <file_name> with the actual file name. e.g. If the file name is "poky-swi-ext-sample-1.7.3.sh", the command would be "bash poky-swi-ext-sample-1.7.3.sh"):

```
$ cd ~/Downloads
```

```
$ bash <file_name>
```



```
mangoh@mangoh-ThinkPad-X230:~$ cd ~/Downloads/
mangoh@mangoh-ThinkPad-X230:~/Downloads$ bash poky-swi-ext-glibc-x86_64-meta
lchain-swi-ext-armv7a-vfp-neon-toolchain-swi-ext-1.7.3.sh
Enter target directory for SDK (default: /opt/swi/y17-ext):
The directory "/opt/swi/y17-ext" already contains a SDK for this architectur
If you continue, existing files will be overwritten! Proceed[y/N]?y
Extracting SDK...done
Setting it up...
done
SDK has been successfully set up and is ready to be used.
mangoh@mangoh-ThinkPad-X230:~/Downloads$ _
```

f. When prompted to enter a target directory for the SDK, press Enter to accept the default (/opt/swi/y17-ext).

g. When prompted to install or (possibly) replace the SDK, type ’Y’ and press Enter.

When finished, installing, the message "SDK has been successfully set up and is ready to be used." will appear.

h. Configure the toolchain to make it available for use in generating the mangOH Red platform and the kernel modules that it references:

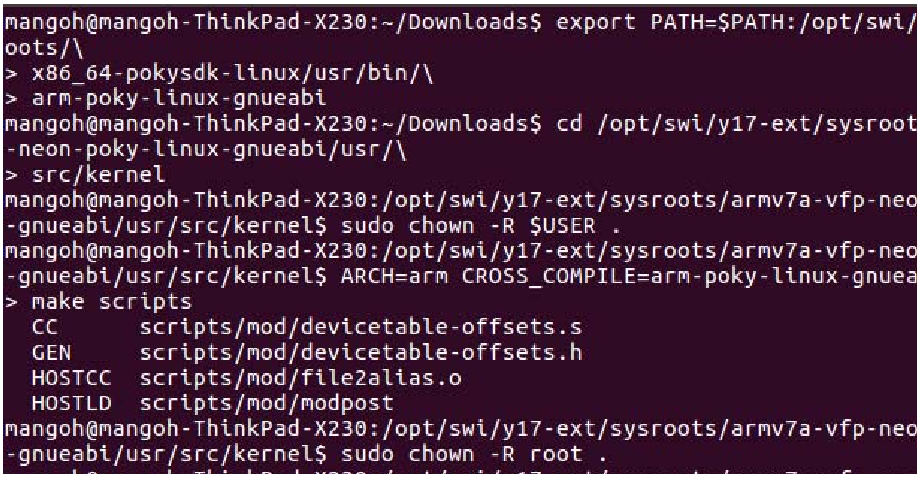
```
$ export PATH=$PATH:/opt/swi/y17-ext/sysroots/\
       x86_64-pokysdk-linux/usr/bin/\
       arm-poky-linux-gnueabi
```

```
$ cd /opt/swi/y17-ext/sysroots/\
       armv7a-vfp-neon-poky-linux-gnueabi/usr/\
       src/kernel
```

```
$ sudo chown -R $USER .
```

```
$ ARCH=arm CROSS_COMPILE=arm-poky-linux-gnueabi- \
       make scripts
```

```
$ sudo chown -R root .
```



```
mangoh@mangoh-ThinkPad-X230:~/Downloads$ export PATH=$PATH:/opt/swi/
oots/\
> x86_64-pokysdk-linux/usr/bin/\
> arm-poky-linux-gnueabi
mangoh@mangoh-ThinkPad-X230:~/Downloads$ cd /opt/swi/y17-ext/sysroot
-neon-poky-linux-gnueabi/usr/\
> src/kernel
mangoh@mangoh-ThinkPad-X230:/opt/swi/y17-ext/sysroots/armv7a-vfp-neo
-gnueabi/usr/src/kernel$ sudo chown -R $USER .
mangoh@mangoh-ThinkPad-X230:/opt/swi/y17-ext/sysroots/armv7a-vfp-neo
-gnueabi/usr/src/kernel$ ARCH=arm CROSS_COMPILE=arm-poky-linux-gnuea
> make scripts
  CC      scripts/mod/devicetable-offsets.s
  GEN     scripts/mod/devicetable-offsets.h
  HOSTCC  scripts/mod/file2alias.o
  HOSTLD  scripts/mod/modpost
mangoh@mangoh-ThinkPad-X230:/opt/swi/y17-ext/sysroots/armv7a-vfp-neo
-gnueabi/usr/src/kernel$ sudo chown -R root .
```

8. Install the repo application, which will be used to clone the Legato file repository:

```
$ sudo apt-get install repo
```

Note: This may take a few minutes to run.

9. If the install in Step 8 failed because phablet-tools was previously installed:

a. Enter the following command:

```
$ sudo apt-get remove --purge phablet-tools && \
        apt-get install repo
```

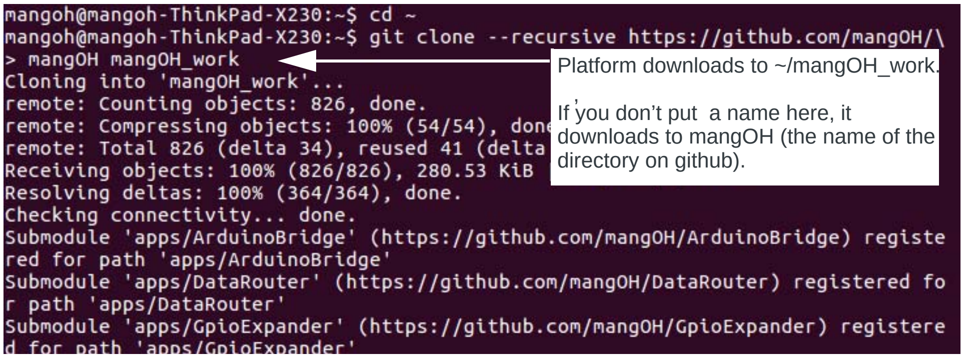
b. Go back to Step 8.

10. If you have not used git or git-repo to clone a project before, identify yourself as follows:

```
$ git config --global user.email "youremail@example.com"
$ git config --global user.name "your.name"
```

11. Download the mangOH platform files into a working directory—enter the following command and either replace <mangOH_work_directory> with a new directory name (e.g. "mangOH_work"), or remove it (to use the default directory name "mangOH").

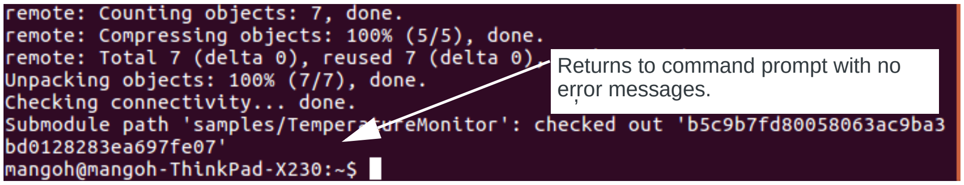
```
$ cd ~
$ git clone --recursive https://github.com/mangOH/\
       mangOH <mangOH_work_directory>
```



```
mangoh@mangoh-ThinkPad-X230:~$ cd ~
mangoh@mangoh-ThinkPad-X230:~$ git clone --recursive https://github.com/mangOH/\
> mangOH mangOH_work
Cloning into 'mangOH_work'...
remote: Counting objects: 826, done.
remote: Compressing objects: 100% (54/54), done
remote: Total 826 (delta 34), reused 41 (delta
Receiving objects: 100% (826/826), 280.53 KiB
Resolving deltas: 100% (364/364), done.
Checking connectivity... done.
Submodule 'apps/ArduinoBridge' (https://github.com/mangOH/ArduinoBridge) registe
red for path 'apps/ArduinoBridge'
Submodule 'apps/DataRouter' (https://github.com/mangOH/DataRouter) registered fo
r path 'apps/DataRouter'
Submodule 'apps/GpioExpander' (https://github.com/mangOH/GpioExpander) registere
d for path 'apps/GpioExpander'
```

Platform downloads to ~/mangOH_work.

If you don't put a name here, it downloads to mangOH (the name of the directory on github).



```
remote: Counting objects: 7, done.
remote: Compressing objects: 100% (5/5), done.
remote: Total 7 (delta 0), reused 7 (delta 0)
Unpacking objects: 100% (7/7), done.
Checking connectivity... done.
Submodule path 'samples/TemperatureMonitor': checked out 'b5c9b7fd80058063ac9ba3
bd0128283ea697fe07'
mangoh@mangoh-ThinkPad-X230:~$
```

Returns to command prompt with no error messages.

Note: <mangOH_work_directory> is optional—if not used, a working directory is created with the same name as the repository (in this case, "mangOH").

12. Add an environment variable (shortcut) for the mangoh work directory:
    - a. Edit your ~/.bashrc file (the startup script that runs when you open a terminal window) and add the following line at the end of the file:

```
export MANGOH_ROOT=~/mangOH_work
```

Note: . If you downloaded into a different directory name in Step 11, replace "mangOH_work" with that name in the above export statement:

    - b. Save and close the file.
    - c. Run the script to set the new environment variable for your current window:

```
$ . ~/.bashrc
```

Important: *Make sure you include the '.' (period) at the beginning of the command. This command runs the script in the open terminal window; you will not have to run it in new windows.*

Now that the Legato development environment is installed, you can Prepare Your mangOH Red For Development on page 23.

5: Prepare Your mangOH Red For Development

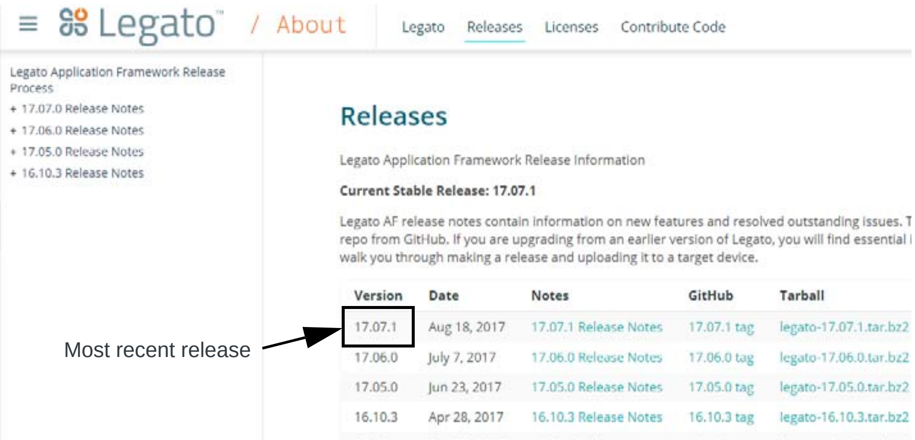
In this chapter, you will update the CF3 module on your mangOH Red with the basic mangOH Red platform (application suite).

5.1 Build and Install Legato Platform and mangOH Red Platform on Target

Now that your dev machine has its development environment set up, you can build and install the Legato Platform and mangOH Red Platform application suites onto your target (the CF3 module in your mangOH Red):

1. Get the Legato Application Framework (AF):

   a. Go to http://legato.io/legato-docs/latest/aboutReleaseInfo.html to get the version number of the most recent release.



Legato Application Framework Release Process
+ 17.07.0 Release Notes
+ 17.06.0 Release Notes
+ 17.05.0 Release Notes
+ 16.10.3 Release Notes

Releases

Legato Application Framework Release Information

Current Stable Release: 17.07.1

Legato AF release notes contain information on new features and resolved outstanding issues. T
repo from GitHub. If you are upgrading from an earlier version of Legato, you will find essential
walk you through making a release and uploading it to a target device.

Version	Date	Notes	GitHub	Tarball
17.07.1	Aug 18, 2017	17.07.1 Release Notes	17.07.1 tag	legato-17.07.1.tar.bz2
17.06.0	July 7, 2017	17.06.0 Release Notes	17.06.0 tag	legato-17.06.0.tar.bz2
17.05.0	Jun 23, 2017	17.05.0 Release Notes	17.05.0 tag	legato-17.05.0.tar.bz2
16.10.3	Apr 28, 2017	16.10.3 Release Notes	16.10.3 tag	legato-16.10.3.tar.bz2

Most recent release

   b. Download the framework files into a working directory (for example, "legato_framework")—Replace the release number in the ’repo’ command with the most recent release (this example downloads version 17.07.1):

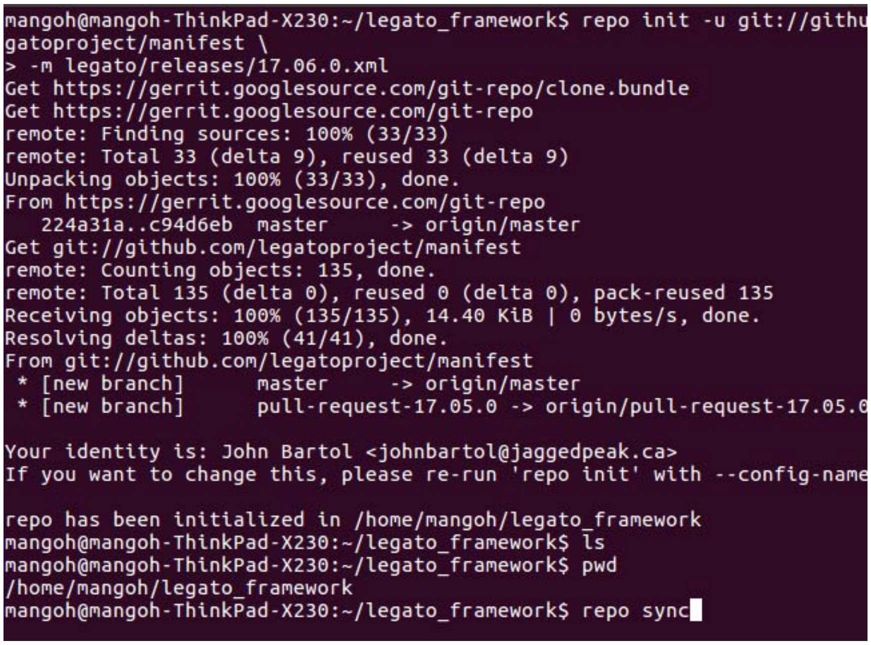
      i. Create a working directory below your home directory to hold the framework files (for example, "legato_framework"):

```
$ mkdir ~/legato_framework
```

Note: Through the rest of this guide, "legato_framework" is assumed to be the file you created. If you used a different name, make sure to use that name in any commands that refer to legato_framework.

      ii. Download the framework files into the work directory:

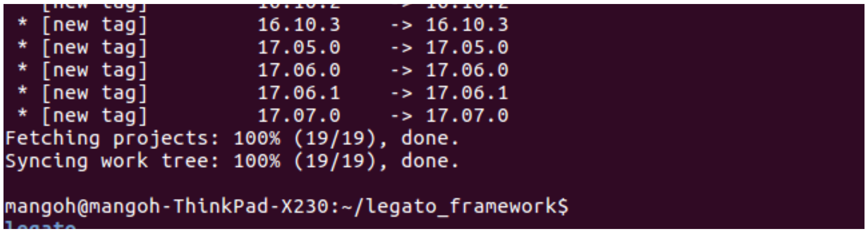
```
$ cd ~/legato_framework
$ repo init -u git://github.com/legatoproject/\
      manifest -m legato/releases/17.07.1.xml
$ repo sync
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ repo init -u git://githu
gatoproject/manifest \
> -m legato/releases/17.06.0.xml
Get https://gerrit.googlesource.com/git-repo/clone.bundle
Get https://gerrit.googlesource.com/git-repo
remote: Finding sources: 100% (33/33)
remote: Total 33 (delta 9), reused 33 (delta 9)
Unpacking objects: 100% (33/33), done.
From https://gerrit.googlesource.com/git-repo
   224a31a..c94d6eb  master     -> origin/master
Get git://github.com/legatoproject/manifest
remote: Counting objects: 135, done.
remote: Total 135 (delta 0), reused 0 (delta 0), pack-reused 135
Receiving objects: 100% (135/135), 14.40 KiB | 0 bytes/s, done.
Resolving deltas: 100% (41/41), done.
From git://github.com/legatoproject/manifest
 * [new branch]      master     -> origin/master
 * [new branch]      pull-request-17.05.0 -> origin/pull-request-17.05.0

Your identity is: John Bartol <johnbartol@jaggedpeak.ca>
If you want to change this, please re-run 'repo init' with --config-name

repo has been initialized in /home/mangoh/legato_framework
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ ls
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ pwd
/home/mangoh/legato_framework
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ repo sync
```



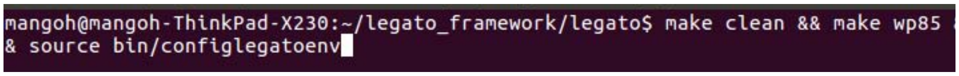
```
 * [new tag]         16.10.2    -> 16.10.2
 * [new tag]         16.10.3    -> 16.10.3
 * [new tag]         17.05.0    -> 17.05.0
 * [new tag]         17.06.0    -> 17.06.0
 * [new tag]         17.06.1    -> 17.06.1
 * [new tag]         17.07.0    -> 17.07.0
Fetching projects: 100% (19/19), done.
Syncing work tree: 100% (19/19), done.

mangoh@mangoh-ThinkPad-X230:~/legato_framework$
legato
```

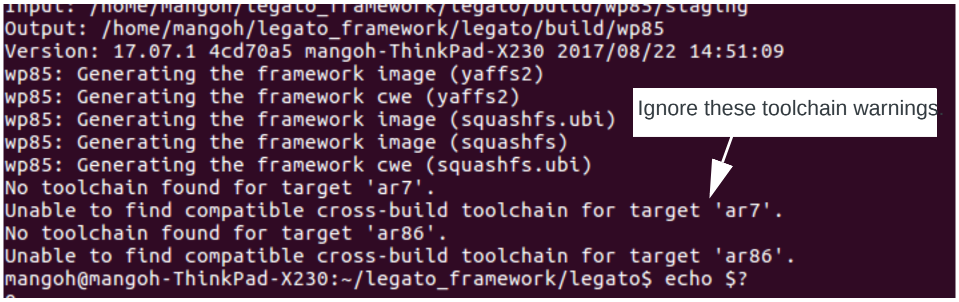
Note: This may take several minutes to run.

2. In a terminal window, build and install the Legato AF:

```
$ cd legato
$ make clean && make wp85 && source bin/configlegatoenv
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ make clean && make wp85 &
& source bin/configlegatoenv
```

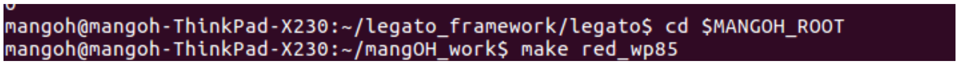


```
Input: /home/mangoh/legato_framework/legato/build/wp85/staging
Output: /home/mangoh/legato_framework/legato/build/wp85
Version: 17.07.1 4cd70a5 mangoh-ThinkPad-X230 2017/08/22 14:51:09
wp85: Generating the framework image (yaffs2)
wp85: Generating the framework cwe (yaffs2)
wp85: Generating the framework image (squashfs.ubi)
wp85: Generating the framework image (squashfs)
wp85: Generating the framework cwe (squashfs.ubi)
No toolchain found for target 'ar7'.
Unable to find compatible cross-build toolchain for target 'ar7'.
No toolchain found for target 'ar86'.
Unable to find compatible cross-build toolchain for target 'ar86'.
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ echo $?
0
```

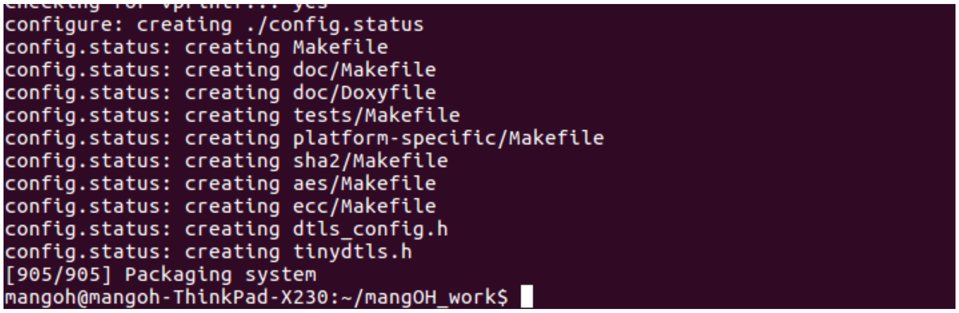
Ignore these toolchain warnings

3. Go to the mangoh work directory and build the platform:

```
$ cd $MANGOH_ROOT
$ make red_wp85
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ cd $MANGOH_ROOT
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ make red_wp85
```



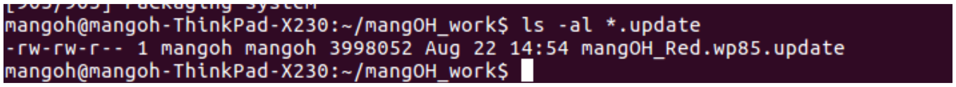
```
checking for vprintf... yes
configure: creating ./config.status
config.status: creating Makefile
config.status: creating doc/Makefile
config.status: creating doc/Doxyfile
config.status: creating tests/Makefile
config.status: creating platform-specific/Makefile
config.status: creating sha2/Makefile
config.status: creating aes/Makefile
config.status: creating ecc/Makefile
config.status: creating dtls_config.h
config.status: creating tinydtls.h
[905/905] Packaging system
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ 
```

Note: This may take several minutes to run.

Note: In the command "make wp85", 'wp85' indicates the target type on which the applications will run. If a different module type is used, the make command must be modified to indicate the correct type. For example, if the CF3 module is a WP7602, the target must be changed from "wp85" to "wp76". This applies to all make commands described in this guide.

4. Verify that the update file mangOH_Red.wp85.update was created:

```
$ ls -al *.update
```



```
[905/905] Packaging system
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ ls -al *.update
-rw-rw-r-- 1 mangoh mangoh 3998052 Aug 22 14:54 mangOH_Red.wp85.update
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ 
```

5. Make sure the mangOH board is powered on and is connected to your dev machine—the board is connected if you receive ping responses:

```
$ ping 192.168.2.2
```

Press Ctrl+C to return to the command prompt.

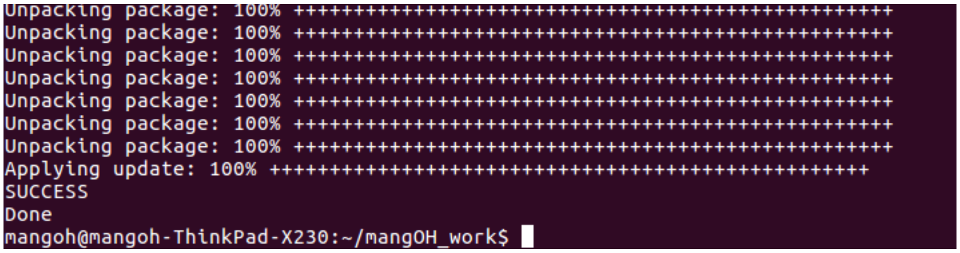
6. Follow the steps in How to Update Module Firmware on page 26 to make sure you have the latest firmware on the CF3 module.

7. Install the mangOH_Red platform on your mangOH board:

```
$ instsys mangOH_Red.wp85.update 192.168.2.2
```

Important: *Before you can install the platform you just built (using the most recent Legato framework) onto your mangOH Red, you must make sure you also have the latest firmware—the platform is built to work on the matching firmware.*

If the applications install successfully, the last message shown will be "SUCCESS   Done".



```
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Applying update: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
SUCCESS
Done
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$
```

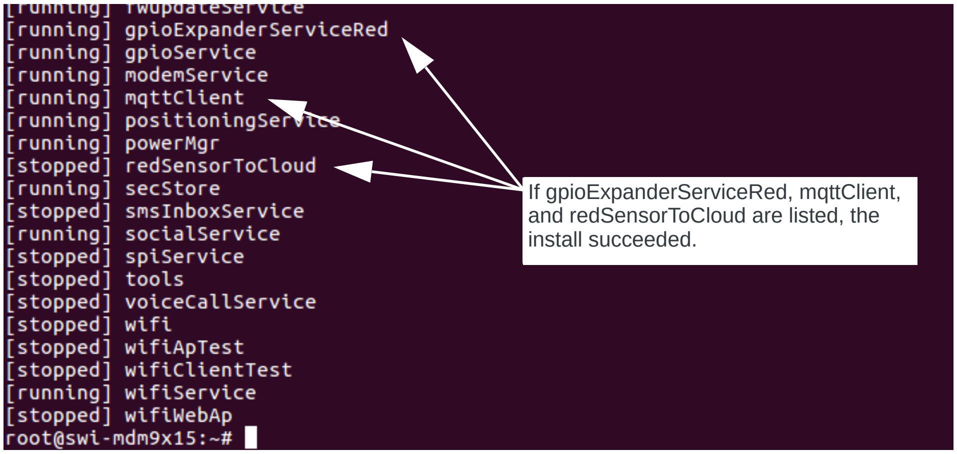
8. Verify the mangOH platform apps installed correctly:
   - **a.** Connect to the mangOH Red:

     ```
     $ ssh root@192.168.2.2
     ```

   - **b.** Show the list of installed apps to confirm the build and install succeeded:

     ```
     # app status
     ```

     If the following apps appear in the list, the build and install succeeded:



```
[running] fwupdateService
[running] gpioExpanderServiceRed
[running] gpioService
[running] modemService
[running] mqttClient
[running] positioningService
[running] powerMgr
[stopped] redSensorToCloud
[running] secStore
[stopped] smsInboxService
[running] socialService
[stopped] spiService
[stopped] tools
[stopped] voiceCallService
[stopped] wifi
[stopped] wifiApTest
[stopped] wifiClientTest
[running] wifiService
[stopped] wifiWebAp
root@swi-mdm9x15:~#
```

If gpioExpanderServiceRed, mqttClient, and redSensorToCloud are listed, the install succeeded.

Now that the mangOH Red platform is installed, you will learn how to Connect To Mobile Networks on page 29.

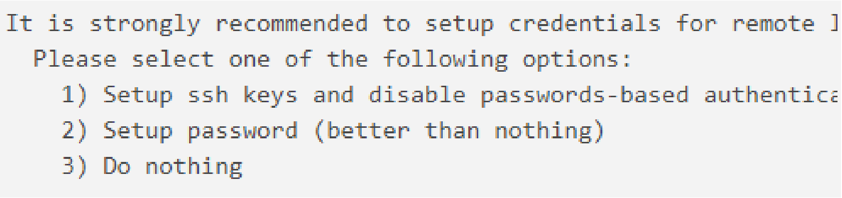
5.2 How to Update Module Firmware

Use the following procedure to update your module firmware, and you can use it again when new firmware versions are released:

1. Check the firmware version on your module:
   - **a.** Open a terminal window.
   - **b.** Connect to the mangOH Red:

     ```
     $ ssh root@192.168.2.2
     ```

   - **c.** The following message appears if you are using your CF3 module for the first time (modules are shipped without a password).



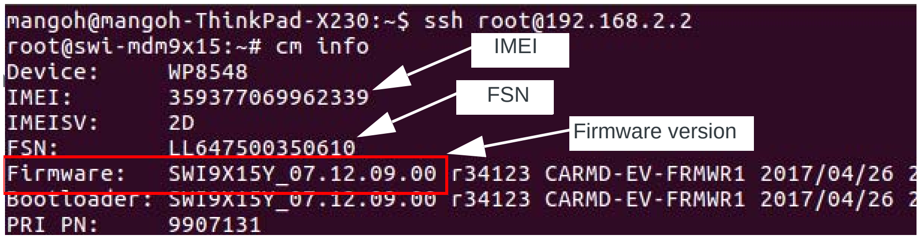
```
It is strongly recommended to setup credentials for remote l
  Please select one of the following options:
    1) Setup ssh keys and disable passwords-based authentica
    2) Setup password (better than nothing)
    3) Do nothing
```

For now, type 3 and press Enter, then type Y and press Enter to be reminded the next time you connect.

Note: After completing this tutorial, you should select an appropriate login authentication method (ssh keys or password) from this menu—see legato.io/legato-docs/latest/basicTarget.html for details.

d. Display information about the CF3 module:

```
# cm info
```



```
mangoh@mangoh-ThinkPad-X230:~$ ssh root@192.168.2.2
root@swi-mdm9x15:~# cm info
Device:     WP8548
IMEI:       359377069962339
IMEISV:     2D
FSN:        LL647500350610
Firmware:   SWI9X15Y_07.12.09.00 r34123 CARMD-EV-FRMWR1 2017/04/26 2
Bootloader: SWI9X15Y_07.12.09.00 r34123 CARMD-EV-FRMWR1 2017/04/26 2
PRI PN:     9907131
```

e. Make note of your Firmware version, IMEI, and FSN. You will use all of these in this guide.

f. Disconnect from the mangOH Red:

```
# exit
```

2. Go to https://source.sierrawireless.com and do the following:

   a. In the Devices section, click AirPrime.

   b. Click WP series.

   c. Click your module type.

   d. In the Software download section, click Firmware to display the list of available firmware packages.

   e. In the Combined Images table, compare the Firmware version for the Generic carrier with your module's firmware version:

      - If your version is the same as the Generic version—The firmware does not need to be updated. Continue to the next section (Build and Install Legato Platform and mangOH Red Platform on Target).
      - If your version is lower than the Generic version—Continue to Step f to update your firmware.

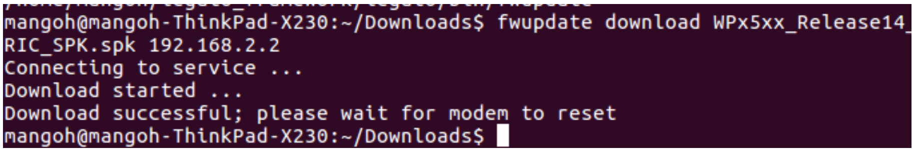
   f. In the Binaries column for the Generic carrier, click Download.

   g. Make sure the mangOH Red is connected to the dev machine with a mini-USB cable.

h. In the terminal window, go to the Downloads folder and install the new firmware (replace <file> with the name of the file that you downloaded):

```
$ cd ~/Downloads
$ fwupdate download <file> 192.168.2.2
```

Note: This will take several minutes to run.



```
/home/mangoh/legato_framework/legato/bin/fwupdate
mangoh@mangoh-ThinkPad-X230:~/Downloads$ fwupdate download WPx5xx_Release14_
RIC_SPK.spk 192.168.2.2
Connecting to service ...
Download started ...
Download successful; please wait for modem to reset
mangoh@mangoh-ThinkPad-X230:~/Downloads$
```

3. As indicated in the response on the previous step, wait (1–2 minutes) while the module reboots with the new firmware. (If you still have your console terminal window open, you will see when the device has finished rebooting.)

4. Verify that the firmware updated:

a. Connect to the mangOH Red:

```
$ ssh root@192.168.2.2
```

b. Display information about the CF3 module and confirm the new Firmware version is listed:

```
# cm info
```

c. Disconnect from the mangOH Red:

```
# exit
```

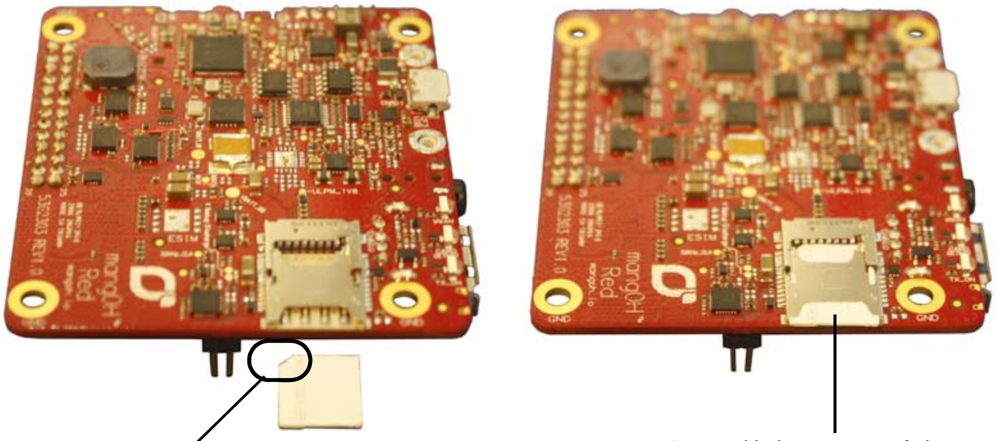
5. If you did this firmware update as part of the instructions in Build and Install Legato Platform and mangOH Red Platform on Target on page 23, go to Step 7 on page 25.

6: Connect To Mobile Networks

In this chapter, you will learn how to connect the mangOH Red to a mobile network. When the mangOH_Red has a data connection, you can transmit data, including on-board sensor readings, to the IoT cloud.

6.1 Connect To a Mobile Network

To connect to a mobile network, you must have an activated micro-SIM in the mangOH Red.



Note the location of the notched corner.

Inserted in bottom part of slot

1. If you do not have a micro-SIM in the mangOH Red, insert one before continuing:
   - **a.** Disconnect the power from the mangOH Red (remove the jumper from the power header, or unplug the micro-USB cable that is providing power).
   - **b.** Insert a micro-SIM in the slot on the bottom side of the mangOH Red. You can use the Sierra Wireless micro-SIM that is included in the kit, or another micro-SIM that has been activated by a mobile network provider.
   - **c.** Reconnect the power (plug in the micro-USB cable or insert the jumper on the power header on the same pins it was removed from in step a. The Power LED will light immediately.

Note: You must disconnect the power before switching SIMs so the mangOH_Red can detect the SIM while powering on.

2. Connect to the target's console:
   - **a.** On the dev machine, open a terminal window.
   - **b.** Connect to the target:

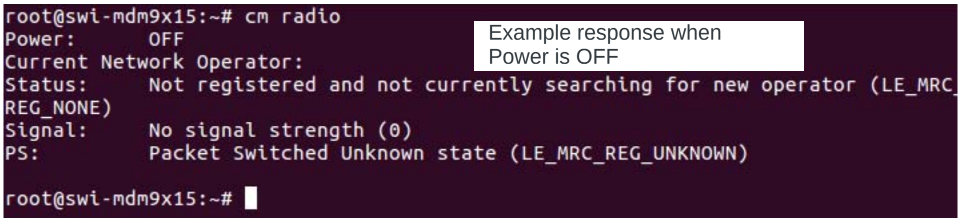
```
$ ssh root@192.168.2.2
```

3. Turn on the target's radio (modem);

   ```
   # cm radio on
   ```

4. Display the status of the target's radio:

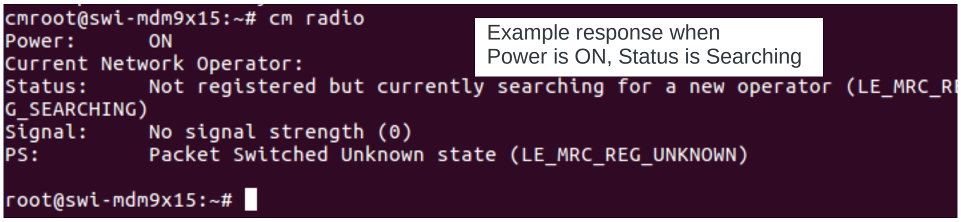
   ```
   # cm radio
   ```



```
root@swi-mdm9x15:~# cm radio
Power:      OFF
Current Network Operator:
Status:     Not registered and not currently searching for new operator (LE_MRC_
REG_NONE)
Signal:     No signal strength (0)
PS:         Packet Switched Unknown state (LE_MRC_REG_UNKNOWN)

root@swi-mdm9x15:~# █
```

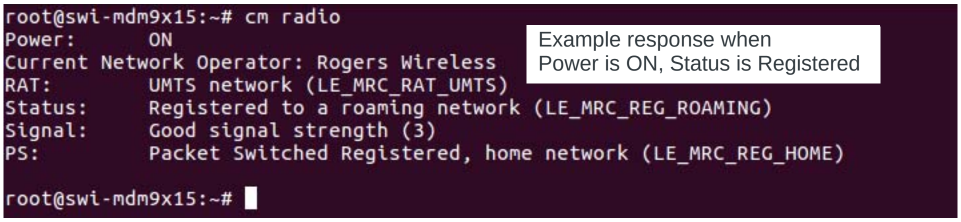
Example response when Power is OFF



```
cmroot@swi-mdm9x15:~# cm radio
Power:      ON
Current Network Operator:
Status:     Not registered but currently searching for a new operator (LE_MRC_R
G_SEARCHING)
Signal:     No signal strength (0)
PS:         Packet Switched Unknown state (LE_MRC_REG_UNKNOWN)

root@swi-mdm9x15:~# █
```

Example response when Power is ON, Status is Searching



```
root@swi-mdm9x15:~# cm radio
Power:      ON
Current Network Operator: Rogers Wireless
RAT:        UMTS network (LE_MRC_RAT_UMTS)
Status:     Registered to a roaming network (LE_MRC_REG_ROAMING)
Signal:     Good signal strength (3)
PS:         Packet Switched Registered, home network (LE_MRC_REG_HOME)

root@swi-mdm9x15:~# █
```

Example response when Power is ON, Status is Registered

5. If the:

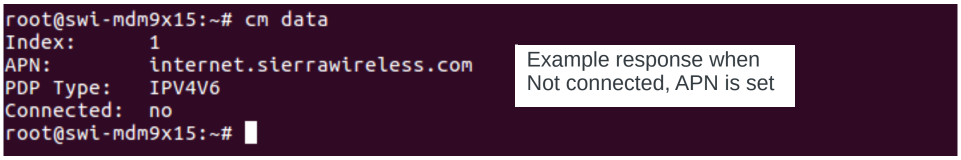
   - Power is OFF—Turn on the radio and then repeat Step 4:

     ```
     # cm radio on
     ```

   - Power is ON and Status is 'searching'—Wait 10–15 seconds while the radio searches for a network to register on, then repeat Step 4.
   - Power is ON and Status is Registered—Continue to Step 6.

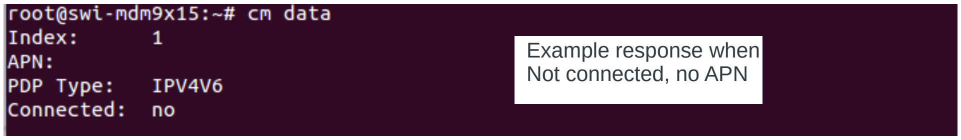
6. Check the connection status:

```
# cm data
```



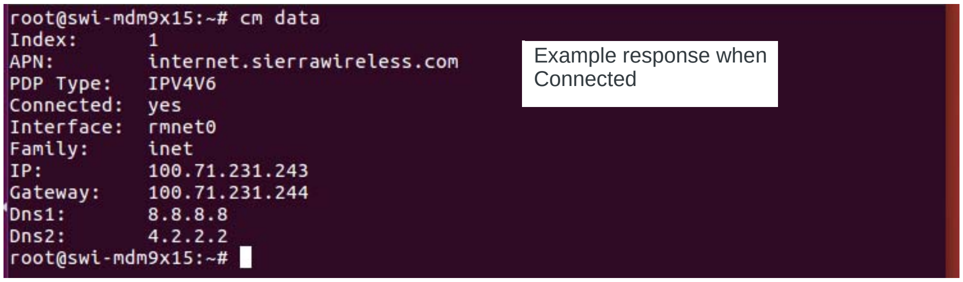
```
root@swi-mdm9x15:~# cm data
Index:      1
APN:        internet.sierrawireless.com
PDP Type:   IPV4V6
Connected:  no
root@swi-mdm9x15:~# █
```

Example response when Not connected, APN is set



```
root@swi-mdm9x15:~# cm data
Index:      1
APN:
PDP Type:   IPV4V6
Connected:  no
```

Example response when Not connected, no APN



```
root@swi-mdm9x15:~# cm data
Index:      1
APN:        internet.sierrawireless.com
PDP Type:   IPV4V6
Connected:  yes
Interface:  rmnet0
Family:     inet
IP:         100.71.231.243
Gateway:    100.71.231.244
Dns1:       8.8.8.8
Dns2:       4.2.2.2
root@swi-mdm9x15:~# █
```

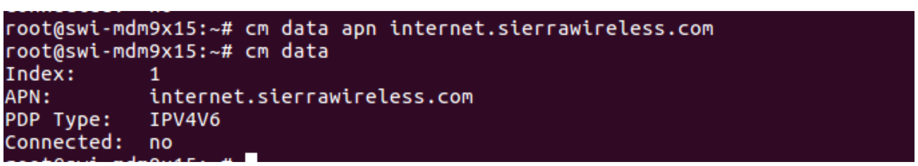
Example response when Connected

a. If "Connected" is:

- "no", and APN has a value—The mangOH Red is ready to connect to the network. Go to Step 7.
- "no", and APN is blank—You must set the APN. Continue to the next step (step b).
- "yes"—The mangOH Red is connected to the network. Go to Step 8.

b. If you need to set the APN, replace "<your apn>" with the actual APN in the following command:

```
# cm data apn <your_apn>
```



```
root@swi-mdm9x15:~# cm data apn internet.sierrawireless.com
root@swi-mdm9x15:~# cm data
Index:      1
APN:        internet.sierrawireless.com
PDP Type:   IPV4V6
Connected:  no
```

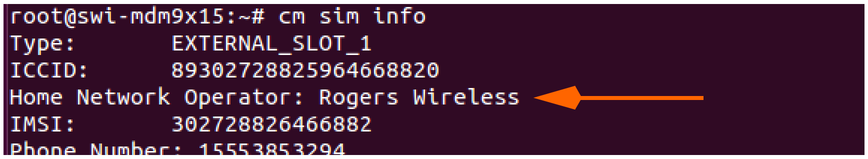
Note: The APN for the Sierra Wireless SIM is internet.sierrawireless.com.

Note: If your mobile network operator uses different APNs for 3G and LTE, make sure to use the APN for the correct network based on your CF3 module type. For example, the WP8548 is a 3G-only module that does not support LTE—the APN for the network operator's 3G network should be used.

If you do not know the APN for your SIM:

i. Get your Home Network Operator name:

```
# cm sim info
```



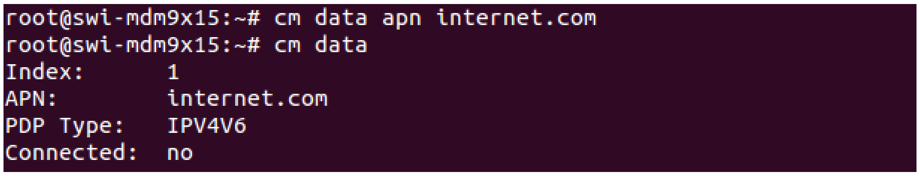
```
root@swi-mdm9x15:~# cm sim info
Type:        EXTERNAL_SLOT_1
ICCID:       89302728825964668820
Home Network Operator: Rogers Wireless
IMSI:        302728826466882
Phone Number: 15553853294
```

ii. Search the Internet for the APN for your Home Network Operator (for example, search for "I TIM APN").

iii. Set the APN as described above.

c. Check the connection status again to make sure you set the APN correctly:

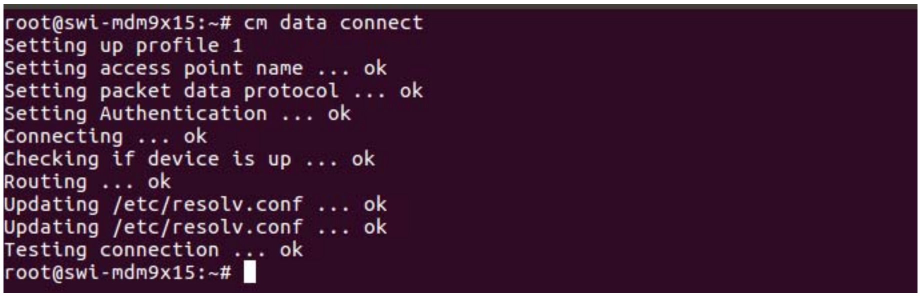
```
# cm data
```



```
root@swi-mdm9x15:~# cm data apn internet.com
root@swi-mdm9x15:~# cm data
Index:       1
APN:         internet.com
PDP Type:    IPV4V6
Connected:   no
```

7. Set up a data connection to the mobile network:

```
# cm data connect
```



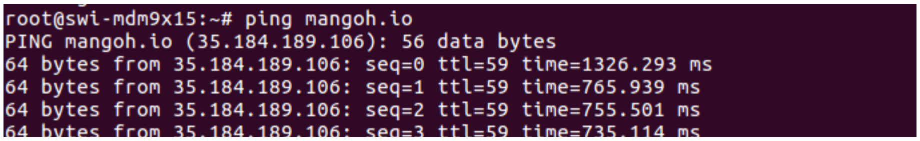
```
root@swi-mdm9x15:~# cm data connect
Setting up profile 1
Setting access point name ... ok
Setting packet data protocol ... ok
Setting Authentication ... ok
Connecting ... ok
Checking if device is up ... ok
Routing ... ok
Updating /etc/resolv.conf ... ok
Updating /etc/resolv.conf ... ok
Testing connection ... ok
root@swi-mdm9x15:~# 
```

Several status messages will appear—if the connection succeeds, all the messages indicate "ok".

8. Test the data connection:

a. When the command prompt reappears, verify that the connection is working—'ping' a URL that you know is working (e.g. mangoh.io, google.com, etc.).

```
# ping mangoh.io
```



```
root@swi-mdm9x15:~# ping mangoh.io
PING mangoh.io (35.184.189.106): 56 data bytes
64 bytes from 35.184.189.106: seq=0 ttl=59 time=1326.293 ms
64 bytes from 35.184.189.106: seq=1 ttl=59 time=765.939 ms
64 bytes from 35.184.189.106: seq=2 ttl=59 time=755.501 ms
64 bytes from 35.184.189.106: seq=3 ttl=59 time=735.114 ms
```

When ping responses (e.g. "64 bytes from 35.164...") appear, the connection is working. (Responses may take 10–15 seconds to being appearing.)

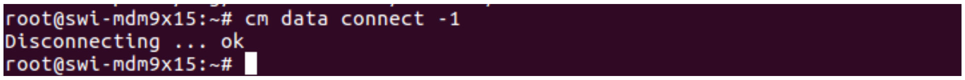
b. Stop the ping command when responses begin to appear—Press Ctrl+C to return to the command prompt.

Note: If no responses appear within 30 seconds, press Ctrl+C, make sure the antenna is connected, and go back to Step 4 and try again. If you still cannot get a response, power cycle the mangOH_Red and start the procedure again.

9. Now that you know how to start a data connection, you will be able to transmit data to the IoT cloud. (In the next section, you will set up your free account on the Sierra Wireless AirVantage IoT Acceleration Platform.)

For now, enter the disconnect command to close the data connection while you set up your AirVantage account:

```
# cm data connect -1
```



```
root@swi-mdm9x15:~# cm data connect -1
Disconnecting ... ok
root@swi-mdm9x15:~#
```

Now that you know how to start (open) and stop (close) a data connection, you are ready to Connect to the IoT Cloud on page 34 and begin sending data to the ’cloud’.

7: Connect to the IoT Cloud

In this section, you will register your device with Sierra Wireless' AirVantage IoT Acceleration platform (a cloud-based service to collect data from your device), and begin submitting your mangOH Red's on-board sensor data.

7.1 Register and connect to AirVantage

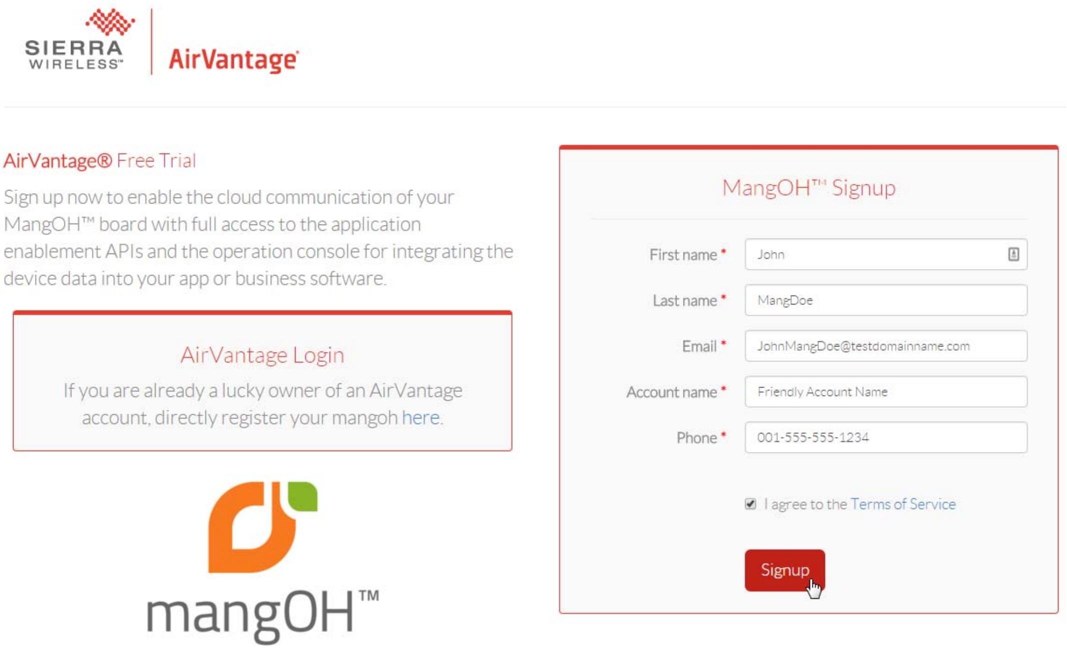
Your mangOH Red kit includes a free account on the AirVantage IoT Acceleration Platform for your CF3 module. This platform provides Sierra Wireless' cloud-based services for over-the-air (OTA) device management and application enablement. These services provide the infrastructure for you to build, connect, and operate your IoT applications in a single platform.

Note: You can register up to five devices (CF3 modules and other supported devices) on your free account.

To use AirVantage, you must register your device and then connect your mangOH Red to the AirVantage server.

7.1.1 Register with AirVantage

1. In a browser, go to https://eu.airvantage.net/accounts/signup?type=Mangoh.



AirVantage® Free Trial

Sign up now to enable the cloud communication of your MangOH™ board with full access to the application enablement APIs and the operation console for integrating the device data into your app or business software.

AirVantage Login

If you are already a lucky owner of an AirVantage account, directly register your mangoh here.

MangOH™ Signup

First name *	John
Last name *	MangDoe
Email *	JohnMangDoe@testdomainname.com
Account name *	Friendly Account Name
Phone *	001-555-555-1234

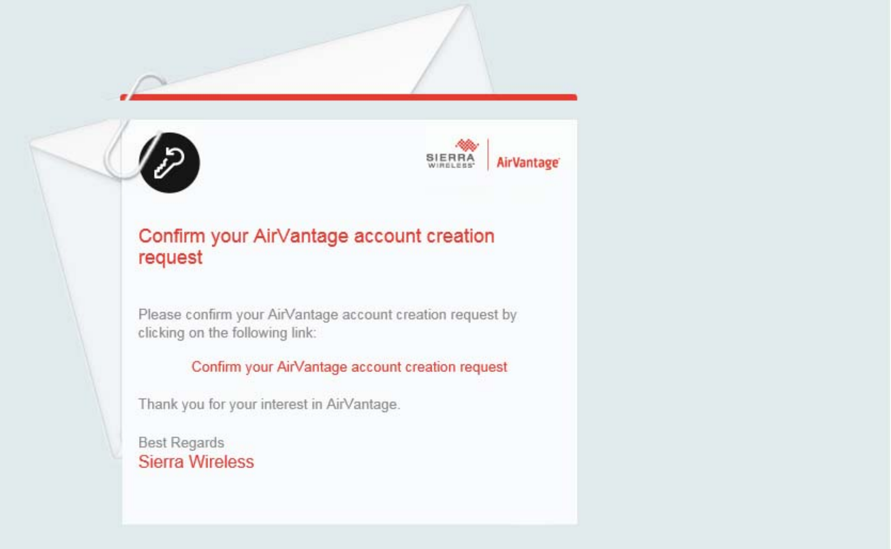
☑ I agree to the Terms of Service

2. In the MangOH Signup area, enter your:
   - First and last names
   - Email address—Address to use as your AirVantage username.

     Important: *Use a valid address—This is your username for accessing AirVantage, and is needed to complete the registration process.*

   - Account name—A descriptive name to identify this AirVantage account. Use a unique name such as a combination of your company name, the project name, your name, etc.
   - Phone number—Use international format (for example, for North American phone numbers, use "001" plus the 10-digit area code and phone number).
3. Review the Terms of Service and select "I agree to the Terms of Service".
4. Click Signup.

   An email is sent automatically to your email address with a confirmation link.
5. Open the email and click the link to confirm your signup request.



Confirm your AirVantage account creation request

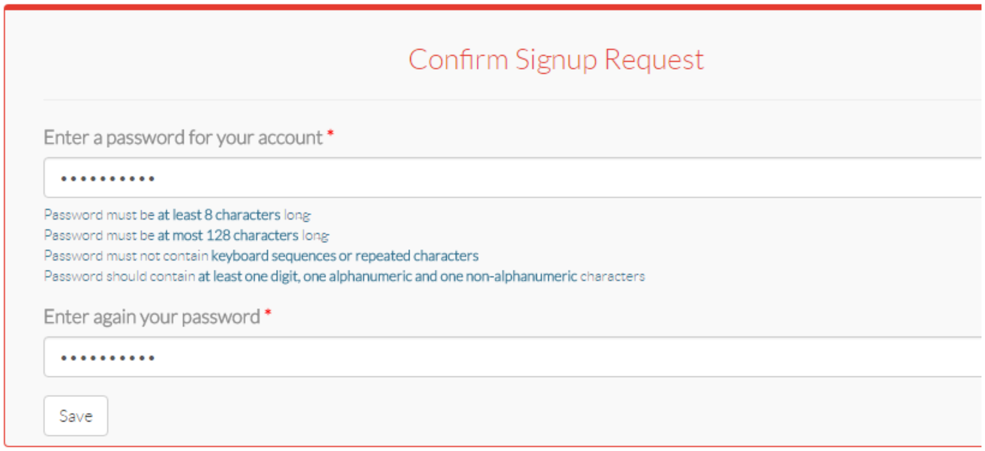
Please confirm your AirVantage account creation request by clicking on the following link:

Confirm your AirVantage account creation request

Thank you for your interest in AirVantage.

Best Regards
Sierra Wireless

6. When your browser opens to confirm the signup request, enter a password that satisfies the requirements shown on-screen, and re-enter it to confirm.



Confirm Signup Request

Enter a password for your account *

••••••••••

Password must be at least 8 characters long
Password must be at most 128 characters long
Password must not contain keyboard sequences or repeated characters
Password should contain at least one digit, one alphanumeric and one non-alphanumeric characters

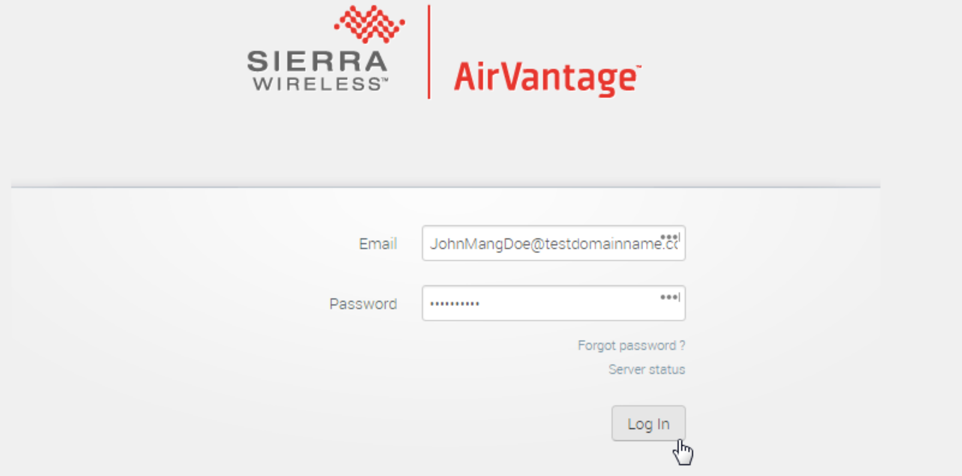
Enter again your password *

••••••••••

7. Click Save.

   If your password is acceptable, the AirVantage Login screen appears.

8. Enter your account's email address and password, and click Log In.



Email JohnMangDoe@testdomainname.cc

Password ••••••••••

9. If you did not record your device's FSN and IMEI earlier (in Build and Install Legato Platform and mangOH Red Platform on Target on page 23):

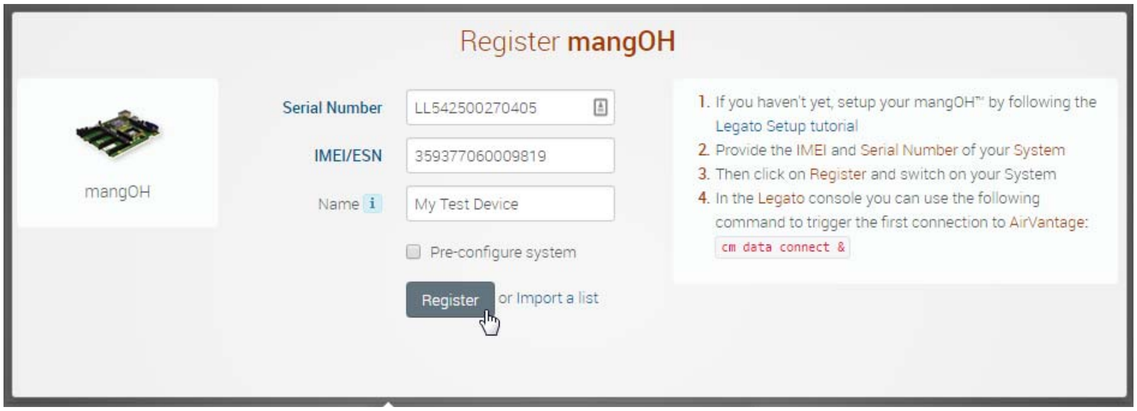
   a. Open a terminal window and connect to the device:

   ```
   $ ssh root@192.168.2.2
   ```

   b. Display the device information (including the FSN and IMEI):

   ```
   # cm info
   ```

10. In the Register mangOH window in your browser, enter your device’s information:



Register **mangOH**

mangOH

Serial Number: LL542500270405

IMEI/ESN: 359377060009819

Name: My Test Device

□ Pre-configure system

Register or Import a list

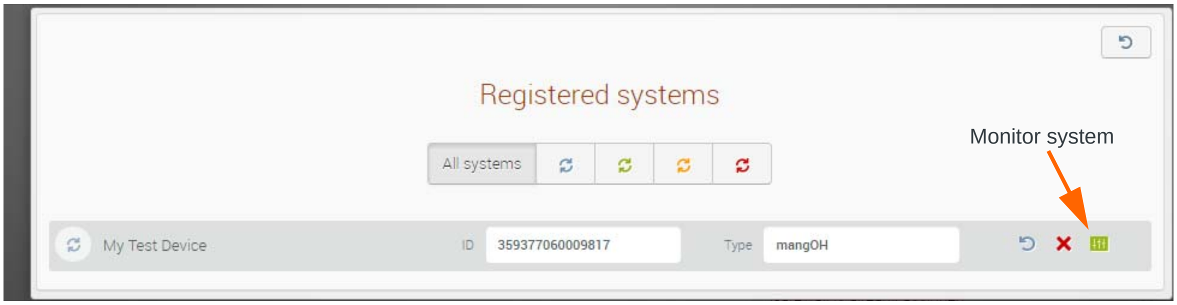
1. If you haven't yet, setup your mangOH™ by following the Legato Setup tutorial
2. Provide the IMEI and Serial Number of your System
3. Then click on Register and switch on your System
4. In the Legato console you can use the following command to trigger the first connection to AirVantage: `cm data connect &`

- Serial Number—Enter the module’s FSN.
- IMEI/ESN—Enter the module’s IMEI.
- Name—(Optional) Enter a descriptive name for the device (e.g. "Test Device 1", "Parking Meter", etc.)
- Pre-configure system—Do not select this option.

11. Click Register.

The device appears in the ’Registered systems’ section at the bottom of the screen.

Note: The displayed Type may say ’mangOH Green’—this does not affect the module registration.



Registered systems

All systems

Monitor system

My Test Device | ID: 359377060009817 | Type: mangOH

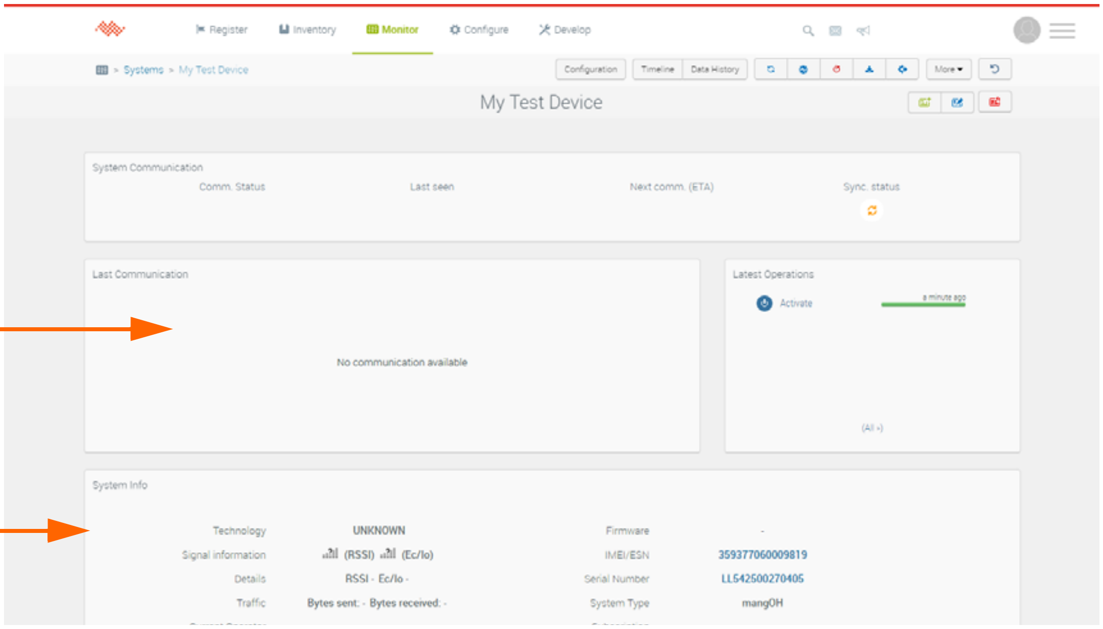
12. Now that your device is registered, click the monitor icon at the right side of your device entry (▦) to go to the System Details screen (see next step).

13. The System Details screen displays widgets reporting information about your device, communications received from it, running applications, etc.

The areas shown below (Last Communication and System Info) are both blank because you have not connected your mangOH Red to AirVantage yet. Leave this browser window open and continue to Connect to AirVantage on page 38.

Last Communication
(When you have your device registered, your most recent communication will appear here.

System Info
(Details about the CF3 module in your mangOH will appear here.)



No communication available

Technology	UNKNOWN	Firmware	-
Signal information	(RSSI) (Ec/Io)	IMEI/ESN	359377060009819
Details	RSSI - Ec/Io -	Serial Number	LL542500270405
Traffic	Bytes sent: - Bytes received: -	System Type	mangOH

7.1.2 Connect to AirVantage

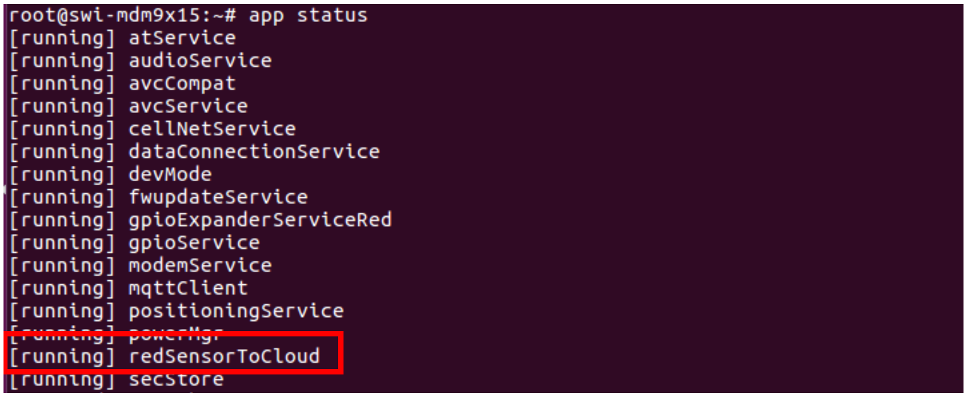
Now that you are registered on AirVantage, connect your mangOH Red to the AirVantage server and begin transmitting data:

1. On the dev machine, open a terminal window.
2. Connect to the mangOH Red:

```
$ ssh root@192.168.2.2
```

3. The mangOH Red platform that you installed earlier includes an application that reports sensor data from your mangOH Red to the IoT cloud. Start the application to send data to AirVantage, and confirm that it started running:

```
# app start redSensorToCloud
# app status
```



```
root@swi-mdm9x15:~# app status
[running] atService
[running] audioService
[running] avcCompat
[running] avcService
[running] cellNetService
[running] dataConnectionService
[running] devMode
[running] fwupdateService
[running] gpioExpanderServiceRed
[running] gpioService
[running] modemService
[running] mqttClient
[running] positioningService
[running] powerMgr
[running] redSensorToCloud
[running] secStore
```

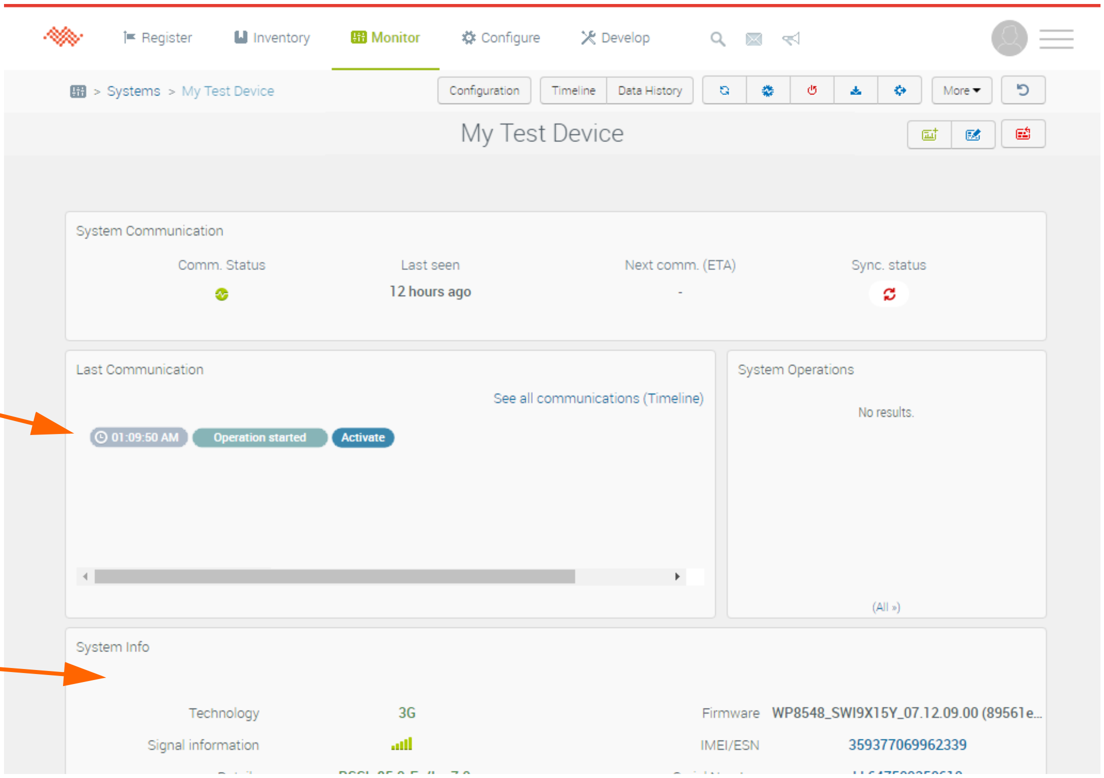
Note: redSensorToCloud automatically opens a data connection, so you do not need to use "cm data connect".

4. In your browser, refresh the AirVantage System Details screen.

   The System Info section now shows details about your module, and the Last Communication section shows your Registration connection or sensor data, whichever was most recently received.

Last Communication
(Shows when your board last communicated with AirVantage, and the type of communication.
For example, this CF3 communicated its Registration.

System Info
(Information about the CF3 module in your mangOH board)



My Test Device

System Communication

Comm. Status	Last seen	Next comm. (ETA)	Sync. status
●	12 hours ago	-	

Last Communication

See all communications (Timeline)

01:09:50 AM | Operation started | Activate

System Operations

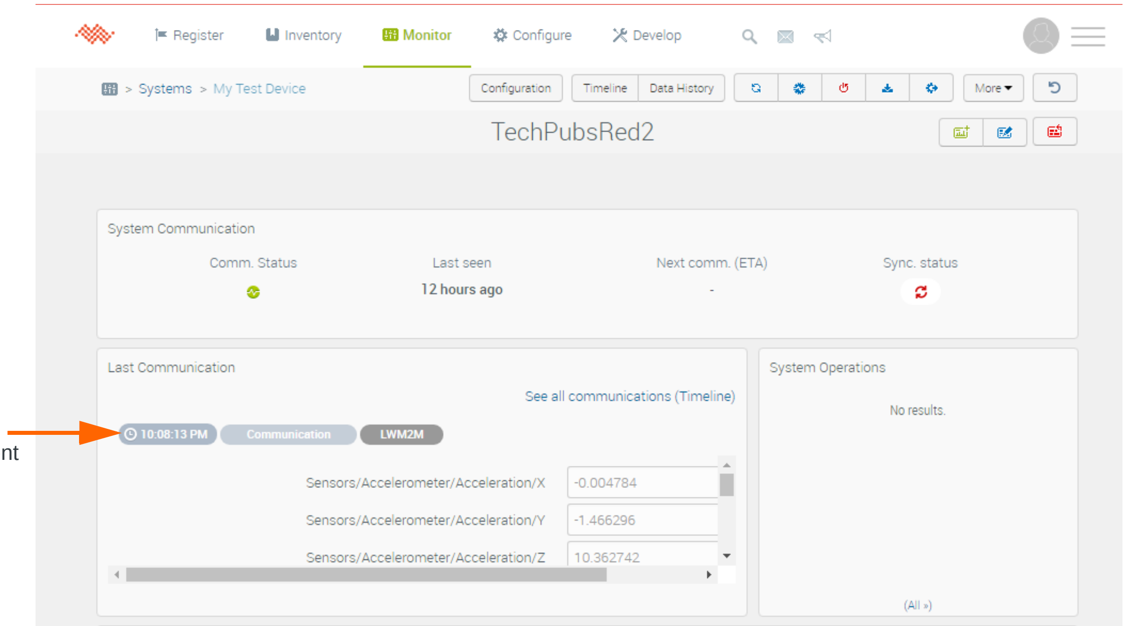
No results.

(All »)

System Info

Technology	3G	Firmware	WP8548_SWI9X15Y_07.12.09.00 (89561e...
Signal information		IMEI/ESN	359377069962339

Last Communication
Shows your most recent sensor data.



TechPubsRed2

System Communication

Comm. Status	Last seen	Next comm. (ETA)	Sync. status
●	12 hours ago	-	

Last Communication

See all communications (Timeline)

10:08:13 PM | Communication | LWM2M

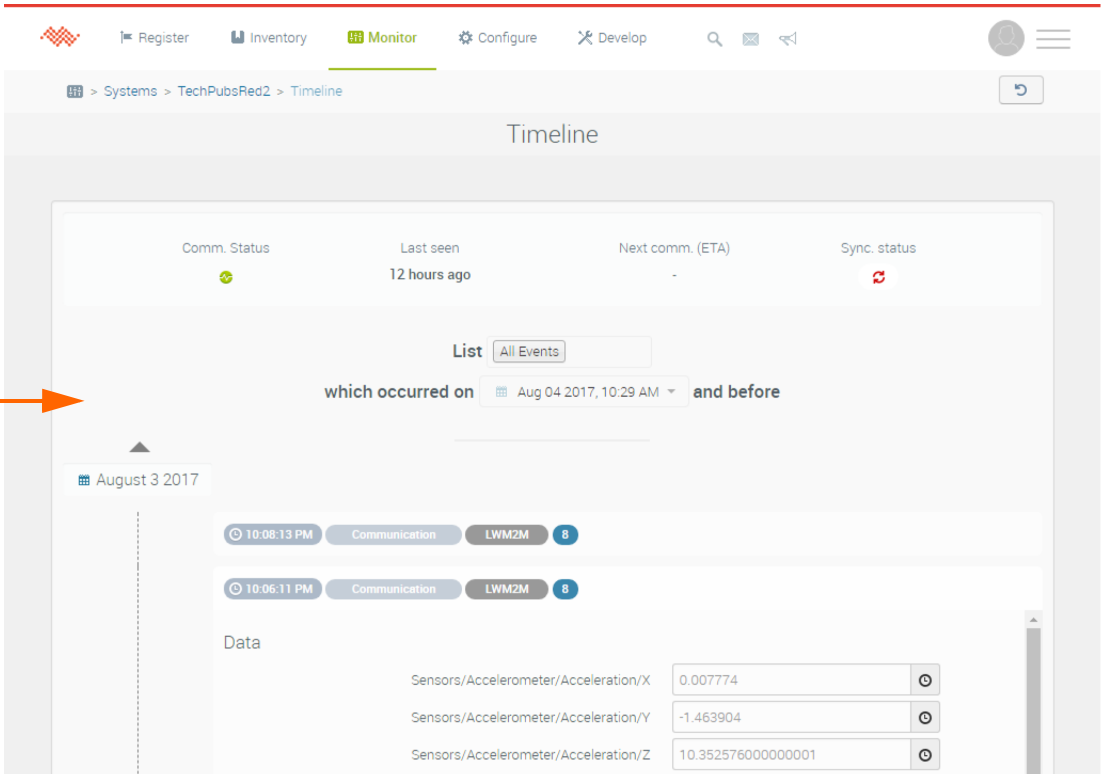
Sensors/Accelerometer/Acceleration/X	-0.004784
Sensors/Accelerometer/Acceleration/Y	-1.466296
Sensors/Accelerometer/Acceleration/Z	10.362742

System Operations

No results.

(All »)

5. To see details on all transmissions received, click Timeline.



Comm. Status	Last seen	Next comm. (ETA)	Sync. status
●	12 hours ago	-	↻

List All Events

which occurred on Aug 04 2017, 10:29 AM and before

August 3 2017

10:08:13 PM Communication LWM2M 8

10:06:11 PM Communication LWM2M 8

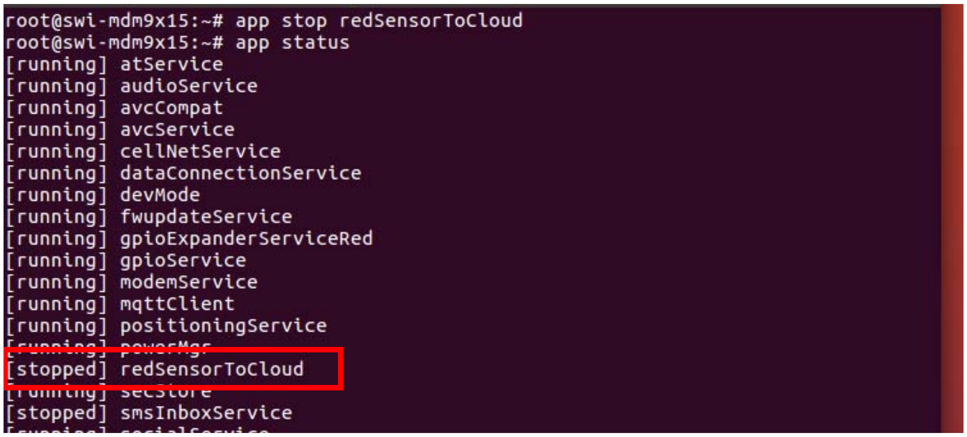
Data

Sensors/Accelerometer/Acceleration/X	0.007774
Sensors/Accelerometer/Acceleration/Y	-1.463904
Sensors/Accelerometer/Acceleration/Z	10.352576000000001

Timeline has sorting options to choose the data to display.
This example shows the two most recent sets of sensor data. The second set is expanded to show each sensor reading.

6. To stop sending data, and to confirm the app has stopped:

```
# app stop redSensorToCloud
# app status
```



```
root@swi-mdm9x15:~# app stop redSensorToCloud
root@swi-mdm9x15:~# app status
[running] atService
[running] audioService
[running] avcCompat
[running] avcService
[running] cellNetService
[running] dataConnectionService
[running] devMode
[running] fwupdateService
[running] gpioExpanderServiceRed
[running] gpioService
[running] modemService
[running] mqttClient
[running] positioningService
[running] powerMgr
[stopped] redSensorToCloud
[running] secStore
[stopped] smsInboxService
[running] socialService
```

Note: redSensorToCloud automatically closes the data connection, so you do not need to use "cm data connect -1".

You have now registered and connected your device to AirVantage, and completed the mangOH Red Fundamentals tutorial. For more information on the mangOH platform, visit mangoh.io.

To begin developing simple applications or modifying existing applications, work through the examples in Develop and Test applications on page 42.

A: Develop and Test applications

In this section, you will learn how to develop applications in the Legato development environment, install them onto your mangOH Red, and test that they run.

Legato provides two interfaces for developing applications:

- CLI—Command Line Interpreter in a terminal window.
- Developer Studio—A GUI (Graphical User Interface) development environment.

This section describes development using CLI.

Note: You will be updating application source code in this section. Use whichever editor you prefer—these instructions do not refer to a specific editor.

Tip: *This tutorial touches on the basics of using the Legato development environment. After completing the examples in this chapter, see http://legato.io/legato-docs/latest/mangOH_developers.html for detailed references, forums, etc.*

A.1 Develop using the CLI—Command Line Interpreter

A.1.1 Configure the Dev Machine's Terminal Windows for Development

Note: If you installed Legato to a subdirectory of your home directory using a different name than 'legato', replace "~/legato" with "~/<yourDirectory>" in the commands in this section.

To use the CLI in a terminal window to compile and build applications, you must configure the window to work with Legato tools.

The easiest way to do this is to define a short 'alias' in your ~/.bashrc file (the startup script that runs each time you open a new terminal window) that you can use to run the required commands (instead of entering the commands manually every time):

To modify your .bashrc (you only need to do this once on your dev machine):

1. Open a terminal window.
2. Edit your ~/.bashrc file and add the following lines at the end of the file:

```
alias cfglegato=\
"pushd . && cd ~/legato_framework/legato && source ./bin/configlegatoenv ; popd"
```

3. Save and close the file.
4. Run the script to set the new environment variable for your current window:

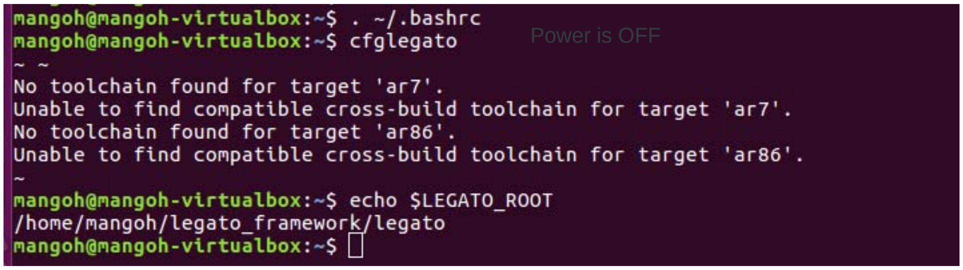
```
$ . ~/.bashrc
```

Important: *Make sure you include the '.' (period) at the beginning of the command. This command runs the script in the open terminal window; you will not have to run it in new windows.*

Now each time you open a new terminal window, you can:

1. Enter the alias (cfglegato) to configure the window:

   ```
   $ cfglegato
   ```



```
mangoh@mangoh-virtualbox:~$ . ~/.bashrc
mangoh@mangoh-virtualbox:~$ cfglegato
~ ~
No toolchain found for target 'ar7'.
Unable to find compatible cross-build toolchain for target 'ar7'.
No toolchain found for target 'ar86'.
Unable to find compatible cross-build toolchain for target 'ar86'.
~
mangoh@mangoh-virtualbox:~$ echo $LEGATO_ROOT
/home/mangoh/legato_framework/legato
mangoh@mangoh-virtualbox:~$ 
```

Note: One of the things the command does is check to see which toolchains you have on your development machine and warns you about any that are missing. Since you have loaded only the wp85 toolchain, warnings appear about the others. You can ignore these messages.

2. Confirm that the environment was set correctly:

   ```
   $ echo $LEGATO_ROOT
   ```

   If a directory path appears, the command worked. If no value was returned, there was a problem with the command—make sure that you entered the alias correctly, using the actual directory name that you used to install Legato.

Note: You can also use the command "~/legato_framework/legato/bin/legs" to configure the terminal, but this starts a new shell session—your command history and any environment variables you have set will be lost.

A.1.2 Update an Installed Application

As you saw when you set up your AirVantage account, one of the mangOH platform applications loaded on your device in Build and Install Legato Platform and mangOH Red Platform on Target on page 23 was redSensorToCloud. This application reports sensor readings to the cloud (e.g. AirVantage) every two minutes.

In this section you will increase the reporting frequency of the redSensorToCloud application and install the new version on the mangOH Red.

To update redSensorToCloud:

1. On the dev machine, open a new terminal window.

2. Configure the window for development—enter the following command (that you previously set up in Configure the Dev Machine’s Terminal Windows for Development on page 42):

   ```
   $ cfglegato
   ```

3. Go to the folder containing the application’s source code:

   ```
   $ cd $MANGOH_ROOT/apps/RedSensorToCloud
   ```

4. The source code components for this application are in two sub-folders— avPublisherComponent and sensorsComponent. The code that controls the publishing frequency is in avPublisherComponent—go to that folder:

   ```
   $ cd avPublisherComponent
   ```

5. Open and edit the source code (avPublisher.c) with your preferred editor—two values must be updated to adjust the reporting frequency:

   a. Search for the variable declaration for MaxIntervalBetweenPublish.

      static const int MaxIntervalBetweenPublish (120)

   b. Change the interval value to 30—This increases the reporting frequency to at least once every 30 seconds from once every 120 seconds.

   c. Search for the variable declaration for TimeToStale.

      static const int TimeToStale (60)

   d. Change the stale value to 30—This decreases the length of time a sensor reading is considered to be ’current’ before a new sensor reading must be taken.

   e. Save your changes and exit the editor.

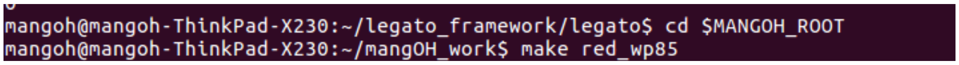
At this point, you have modified the redSensorToCloud application’s source code. Now you have to build (compile) it.

This application was created as part of the mangOH Red platform; to rebuild the application, you will rebuild the whole system (Legato Platform and mangOH Red platform). This method is suggested when applications may interact with each other. If only one application is rebuilt, it may not work properly with other applications that it depends on (or that depend on it).

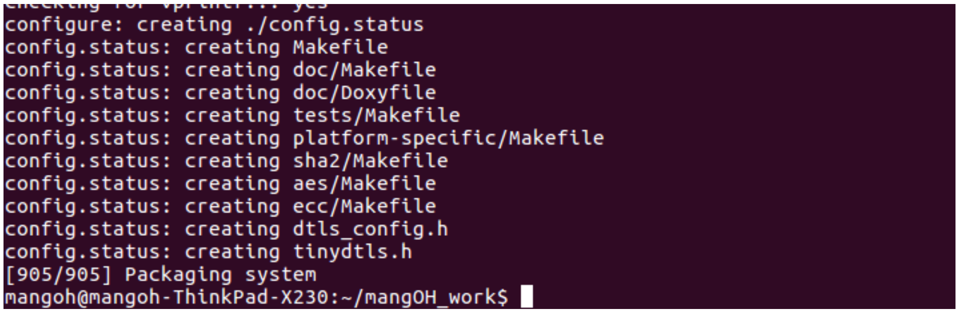
To rebuild the Legato Platform and mangOH Red platform, including redSensorToCloud with your changes, and install it onto your mangOH Red:

6. Build and install the mangOH Red platform:

   ```
   $ cd $MANGOH_ROOT
   $ make red_wp85
   ```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ cd $MANGOH_ROOT
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ make red_wp85
```



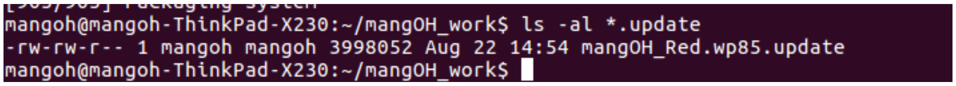
```
checking for vprintf... yes
configure: creating ./config.status
config.status: creating Makefile
config.status: creating doc/Makefile
config.status: creating doc/Doxyfile
config.status: creating tests/Makefile
config.status: creating platform-specific/Makefile
config.status: creating sha2/Makefile
config.status: creating aes/Makefile
config.status: creating ecc/Makefile
config.status: creating dtls_config.h
config.status: creating tinydtls.h
[905/905] Packaging system
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ █
```

Note: This may take several minutes to run.

Note: This ’make’ command uses the Makefile in $LEGATO_ROOT to build the entire system.

7. Verify that the update file mangOH_Red.wp85.update was created:

```
$ ls -al *.update
```



```
[905/905] Packaging system
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ ls -al *.update
-rw-rw-r-- 1 mangoh mangoh 3998052 Aug 22 14:54 mangOH_Red.wp85.update
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ █
```

8. Make sure the mangOH board is powered on and is connected to your dev machine—the board is connected if you receive ping responses:

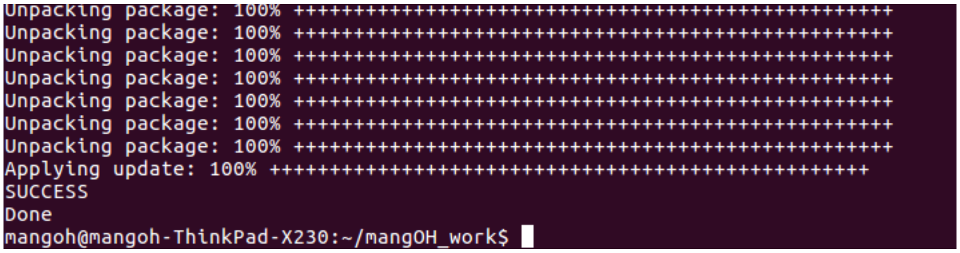
```
$ ping 192.168.2.2
```

Press Ctrl+C to return to the command prompt.

9. Install the Project mangOH applications on your mangOH board:

```
$ instsys mangOH_Red.wp85.update 192.168.2.2
```

If the applications install successfully, the last message shown will be "SUCCESS   Done".



```
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
Applying update: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++
SUCCESS
Done
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ █
```

10. After the installation is done, open a terminal window and connect to the mangOH Red:

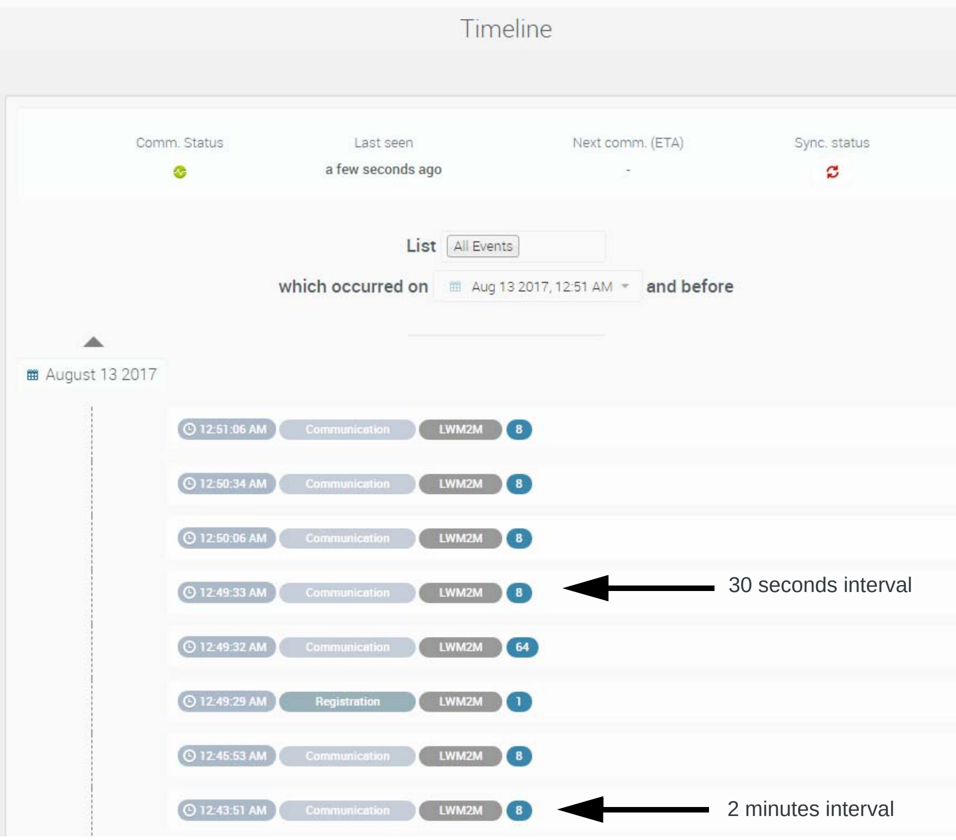
```
$ ssh root@192.168.2.2
```

11. By default, redSensorToCloud is installed but not started. Start the application to send data to AirVantage:

```
# app start redSensorToCloud
```

Note: redSensorToCloud automatically opens a data connection, so you do not need to use "cm data connect".

In your AirVantage account, you will start to see sensor reports appearing on your new schedule—on the Timeline screen you can compare the timestamp intervals for new reports compared to reports received before you made your changes.



Timeline

Comm. Status	Last seen	Next comm. (ETA)	Sync. status
●	a few seconds ago	-	↻

List All Events

which occurred on Aug 13 2017, 12:51 AM and before

August 13 2017

12:51:06 AM	Communication	LWM2M	8
12:50:34 AM	Communication	LWM2M	8
12:50:06 AM	Communication	LWM2M	8
12:49:33 AM	Communication	LWM2M	8
12:49:32 AM	Communication	LWM2M	64
12:49:29 AM	Registration	LWM2M	1
12:45:53 AM	Communication	LWM2M	8
12:43:51 AM	Communication	LWM2M	8

30 seconds interval

2 minutes interval

12. When you're ready to stop sending data:

```
# app stop redSensorToCloud
```

Note: redSensorToCloud automatically closes the data connection, so you do not need to use "cm data connect -1".

A.1.3 Update and Install a New Application

When you installed Legato, sample application files were also stored. In this section, you will build and then install the "hello world" application on the target.

Build (compile) an application on the dev machine and install it on the target:

1. On the dev machine, open a new terminal window.
2. Set up the window for CLI development as described in Configure the Dev Machine’s Terminal Windows for Development on page 42.
3. Go to the sample application directory for Hello World:

   ```
   $ cd $LEGATO_ROOT/apps/sample/helloWorld
   ```

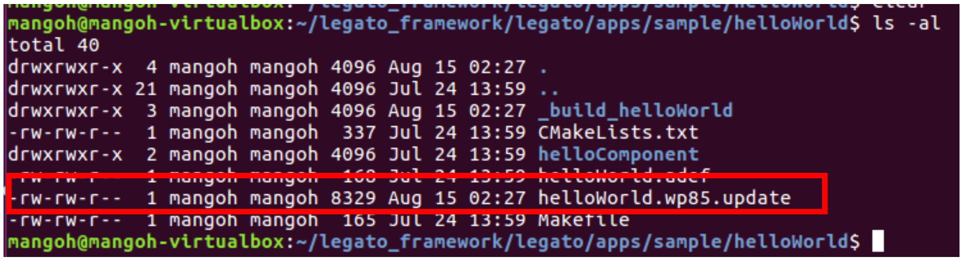
4. Compile the application.

   ```
   $ make wp85
   ```

   Note: This ’make’ command uses the Makefile in the current directory to build only the sample application. It does not build the entire system like the ’make’ command in Update an Installed Application on page 43.

5. Verify that the update file helloWorld.wp85.update was created:

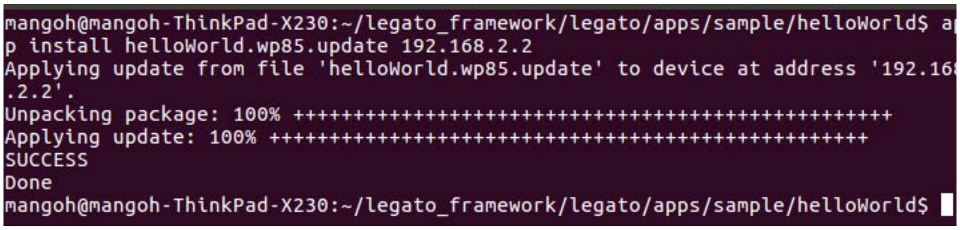
   ```
   $ ls -al
   ```



```
mangoh@mangoh-virtualbox:~/legato_framework/legato/apps/sample/helloWorld$ clear
mangoh@mangoh-virtualbox:~/legato_framework/legato/apps/sample/helloWorld$ ls -al
total 40
drwxrwxr-x  4 mangoh mangoh 4096 Aug 15 02:27 .
drwxrwxr-x 21 mangoh mangoh 4096 Jul 24 13:59 ..
drwxrwxr-x  3 mangoh mangoh 4096 Aug 15 02:27 _build_helloWorld
-rw-rw-r--  1 mangoh mangoh  337 Jul 24 13:59 CMakeLists.txt
drwxrwxr-x  2 mangoh mangoh 4096 Jul 24 13:59 helloComponent
-rw-rw-r--  1 mangoh mangoh  168 Jul 24 13:59 helloWorld.adef
-rw-rw-r--  1 mangoh mangoh 8329 Aug 15 02:27 helloWorld.wp85.update
-rw-rw-r--  1 mangoh mangoh  165 Jul 24 13:59 Makefile
mangoh@mangoh-virtualbox:~/legato_framework/legato/apps/sample/helloWorld$
```

6. Install the application on the target:

   ```
   $ app install helloWorld.wp85.update 192.168.2.2
   ```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato/apps/sample/helloWorld$ ap
p install helloWorld.wp85.update 192.168.2.2
Applying update from file 'helloWorld.wp85.update' to device at address '192.168
.2.2'.
Unpacking package: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++++
Applying update: 100% ++++++++++++++++++++++++++++++++++++++++++++++++++++
SUCCESS
Done
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato/apps/sample/helloWorld$
```

Note: This application will remain on the target until you either specifically remove it, or until the next time you reinstall the system on the target.

Log in to the target and run the application:

1. Set up a window to show the application’s output (the "Hello World" application writes to a log file) as follows:
   a. Open a new terminal window (referred to as LOG_TERM in this procedure).

b. Connect to the target:

```
$ ssh root@192.168.2.2
```

c. Watch the log file and show when a message from "hello world" appears:

```
# logread -f | grep "Hello"
```

Note: Nothing will appear to happen until you run the Hello World application in the next step. Leave this command running until after you see the Hello World output, then you can press Ctrl+C to cancel it and return to the command prompt.

2. Run the application:

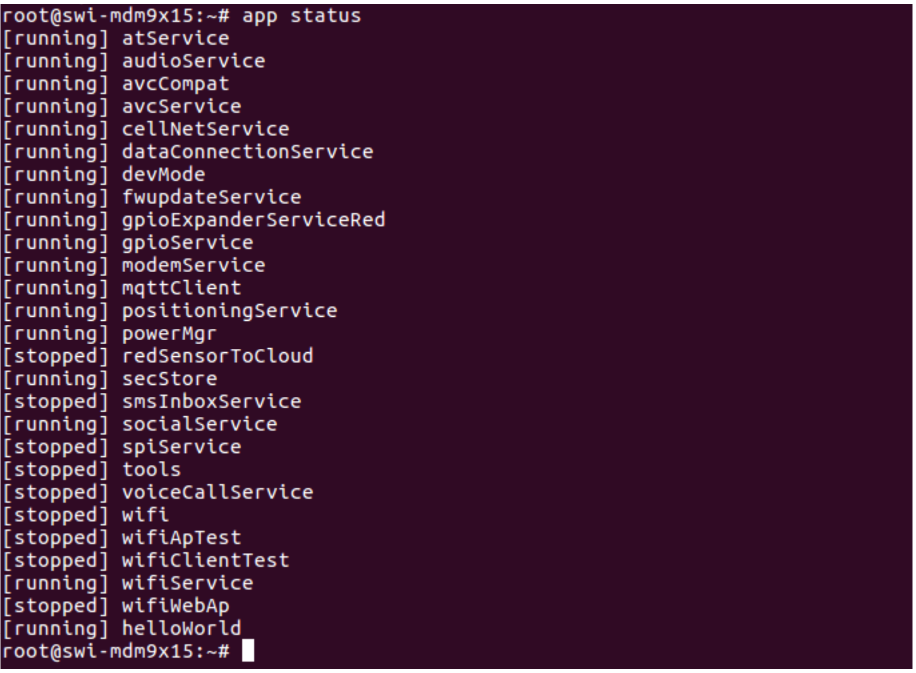
a. Open a terminal window to run the application (referred to as APP_TERM in this procedure).

b. Connect to the target:

```
$ ssh root@192.168.2.2
```

c. Check that the application is installed:

```
# app status
```



Hello World application

```
root@swi-mdm9x15:~# app status
[running] atService
[running] audioService
[running] avcCompat
[running] avcService
[running] cellNetService
[running] dataConnectionService
[running] devMode
[running] fwupdateService
[running] gpioExpanderServiceRed
[running] gpioService
[running] modemService
[running] mqttClient
[running] positioningService
[running] powerMgr
[stopped] redSensorToCloud
[running] secStore
[stopped] smsInboxService
[running] socialService
[stopped] spiService
[stopped] tools
[stopped] voiceCallService
[stopped] wifi
[stopped] wifiApTest
[stopped] wifiClientTest
[running] wifiService
[stopped] wifiWebAp
[running] helloWorld
root@swi-mdm9x15:~#
```

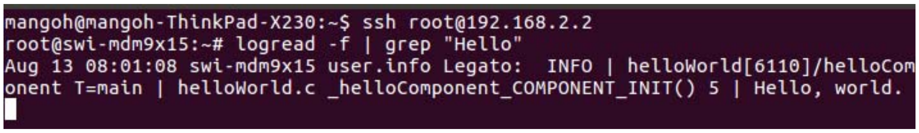
The "hello world" application should appear in the list with a status of ’Running’. The application was built to run automatically; when you write your own applications, you can make them install without running, if you prefer.

d. Stop the application (so you can restart it and see the output):

```
# app stop helloWorld
```

e. Run the application and see that it outputs a "Hello, world." message to the LOG_TERM terminal window:

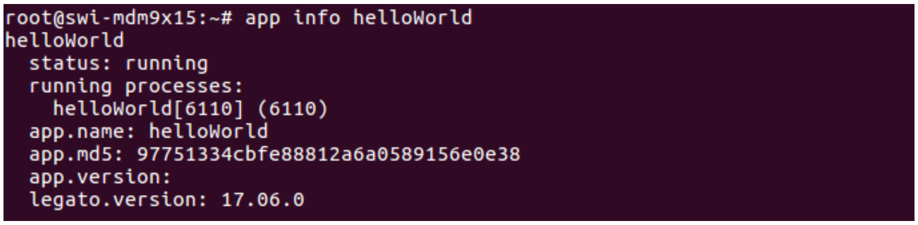
```
# app start helloWorld
```



```
mangoh@mangoh-ThinkPad-X230:~$ ssh root@192.168.2.2
root@swi-mdm9x15:~# logread -f | grep "Hello"
Aug 13 08:01:08 swi-mdm9x15 user.info Legato:  INFO | helloWorld[6110]/helloCom
onent T=main | helloWorld.c _helloComponent_COMPONENT_INIT() 5 | Hello, world.
```

f. (Optional) If you want to see information about the application, enter the following command:

```
# app info helloWorld
```



```
root@swi-mdm9x15:~# app info helloWorld
helloWorld
  status: running
  running processes:
    helloWorld[6110] (6110)
  app.name: helloWorld
  app.md5: 97751334cbfe88812a6a0589156e0e38
  app.version:
  legato.version: 17.06.0
```

g. In the LOG_TERM terminal window, press Ctrl+C to return to the command prompt.

You have now successfully compiled a working application, and installed, stopped, and run it on the module.

Note: To learn more about the Legato development environment, visit http://legato.io/legato-docs/latest/.

B: Update Legato Application Framework

As part of the Build and Install Legato Platform and mangOH Red Platform on Target on page 23 process, you downloaded and installed the latest version of the Legato Application Framework (AF).

When new versions of the framework are released, you can install them on your dev machine using the procedure below.

B.1 Update the Legato AF on Your Dev Machine

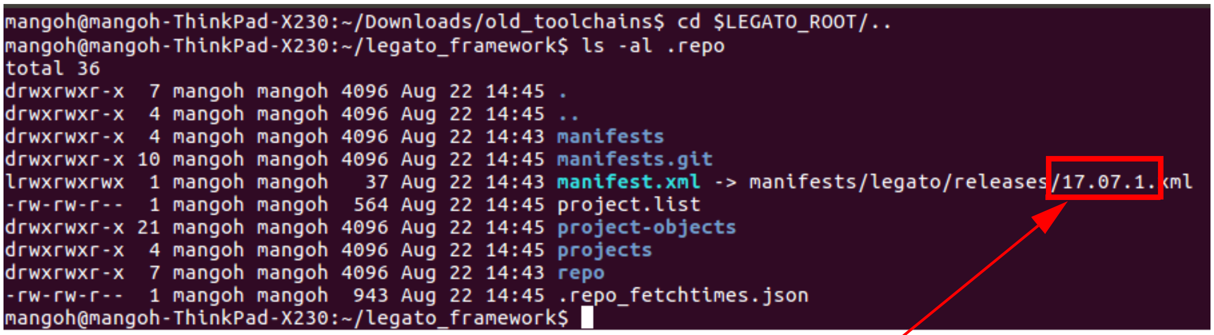
To update the Legato AF on your dev machine:

1. Open a terminal window.
2. Configure your environment for development:

```
$ cfglegato
```

3. Check the version of the Legato AF that is currently installed:

```
$ cd $LEGATO_ROOT/..
$ ls -al .repo
```

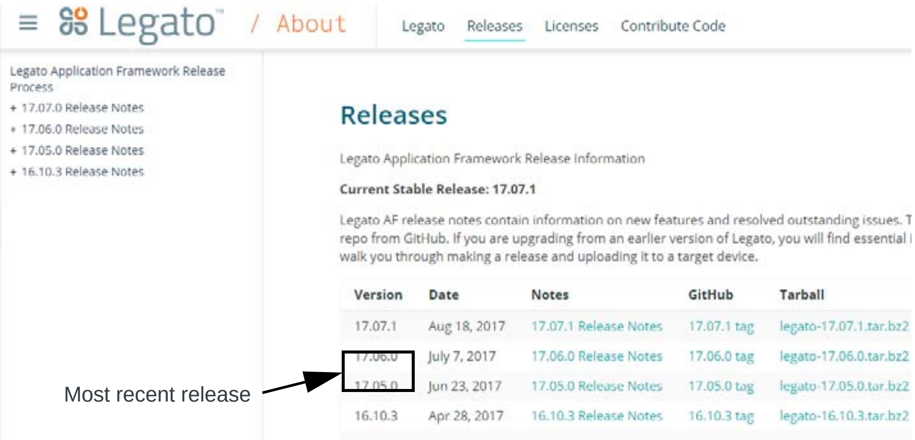


```
mangoh@mangoh-ThinkPad-X230:~/Downloads/old_toolchains$ cd $LEGATO_ROOT/..
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ ls -al .repo
total 36
drwxrwxr-x  7 mangoh mangoh 4096 Aug 22 14:45 .
drwxrwxr-x  4 mangoh mangoh 4096 Aug 22 14:45 ..
drwxrwxr-x  4 mangoh mangoh 4096 Aug 22 14:43 manifests
drwxrwxr-x 10 mangoh mangoh 4096 Aug 22 14:45 manifests.git
lrwxrwxrwx  1 mangoh mangoh   37 Aug 22 14:43 manifest.xml -> manifests/legato/releases/17.07.1.xml
-rw-rw-r--  1 mangoh mangoh  564 Aug 22 14:45 project.list
drwxrwxr-x 21 mangoh mangoh 4096 Aug 22 14:45 project-objects
drwxrwxr-x  4 mangoh mangoh 4096 Aug 22 14:45 projects
drwxrwxr-x  7 mangoh mangoh 4096 Aug 22 14:43 repo
-rw-rw-r--  1 mangoh mangoh  943 Aug 22 14:45 .repo_fetchtimes.json
mangoh@mangoh-ThinkPad-X230:~/legato_framework$
```

Currently installed Legato AF version

The installed version is indicated in the manifest.xml link.

4. Go to http://legato.io/legato-docs/latest/aboutReleaseInfo.html to get the version number of the most recent release.



Releases

Legato Application Framework Release Information

Current Stable Release: 17.07.1

Legato AF release notes contain information on new features and resolved outstanding issues. T
repo from GitHub. If you are upgrading from an earlier version of Legato, you will find essential I
walk you through making a release and uploading it to a target device.

Version	Date	Notes	GitHub	Tarball
17.07.1	Aug 18, 2017	17.07.1 Release Notes	17.07.1 tag	legato-17.07.1.tar.bz2
17.06.0	July 7, 2017	17.06.0 Release Notes	17.06.0 tag	legato-17.06.0.tar.bz2
17.05.0	Jun 23, 2017	17.05.0 Release Notes	17.05.0 tag	legato-17.05.0.tar.bz2
16.10.3	Apr 28, 2017	16.10.3 Release Notes	16.10.3 tag	legato-16.10.3.tar.bz2

5. If your release is older (lower version number) than the most recent release:

a. Download the framework files into your working directory (for example, "legato_framework")—Replace the release number in the ’repo’ command with the most recent release (this example downloads version 17.07.1):

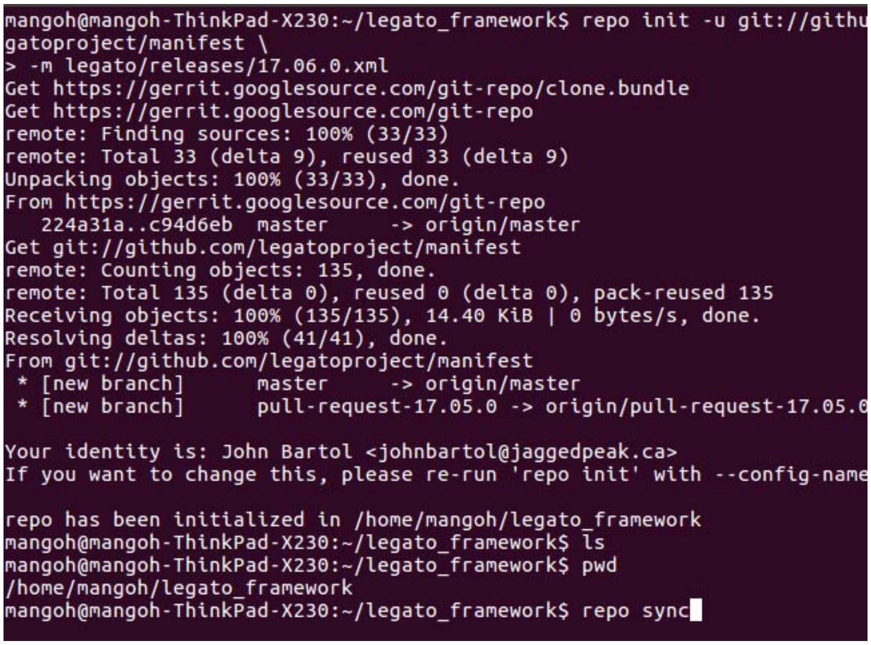
Note: Through the rest of this guide, "legato_framework" is assumed to be the file you created. If you used a different name, make sure to use that name in any commands that refer to legato_framework.

i. Optionally, rename your existing legato folder so that you can restore the current framework if necessary at a later point (replace <version> with your current Legato AF version in the following command):

```
$ mv legato legato_<version>
```

ii. Download the framework files into the work directory:

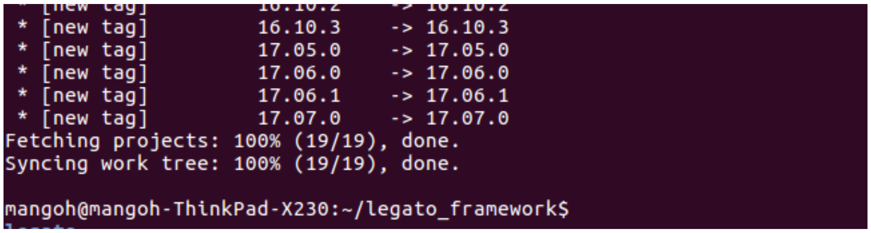
```
$ repo init -u git://github.com/legatoproject/\
      manifest -m legato/releases/17.07.1.xml
$ repo sync
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ repo init -u git://githu
gatoproject/manifest \
> -m legato/releases/17.06.0.xml
Get https://gerrit.googlesource.com/git-repo/clone.bundle
Get https://gerrit.googlesource.com/git-repo
remote: Finding sources: 100% (33/33)
remote: Total 33 (delta 9), reused 33 (delta 9)
Unpacking objects: 100% (33/33), done.
From https://gerrit.googlesource.com/git-repo
   224a31a..c94d6eb  master     -> origin/master
Get git://github.com/legatoproject/manifest
remote: Counting objects: 135, done.
remote: Total 135 (delta 0), reused 0 (delta 0), pack-reused 135
Receiving objects: 100% (135/135), 14.40 KiB | 0 bytes/s, done.
Resolving deltas: 100% (41/41), done.
From git://github.com/legatoproject/manifest
 * [new branch]      master     -> origin/master
 * [new branch]      pull-request-17.05.0 -> origin/pull-request-17.05.0

Your identity is: John Bartol <johnbartol@jaggedpeak.ca>
If you want to change this, please re-run 'repo init' with --config-name

repo has been initialized in /home/mangoh/legato_framework
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ ls
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ pwd
/home/mangoh/legato_framework
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ repo sync
```



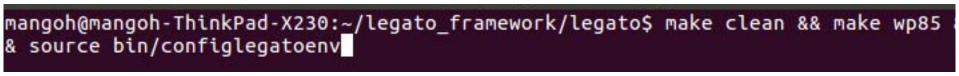
```
 * [new tag]         16.10.2    -> 16.10.2
 * [new tag]         16.10.3    -> 16.10.3
 * [new tag]         17.05.0    -> 17.05.0
 * [new tag]         17.06.0    -> 17.06.0
 * [new tag]         17.06.1    -> 17.06.1
 * [new tag]         17.07.0    -> 17.07.0
Fetching projects: 100% (19/19), done.
Syncing work tree: 100% (19/19), done.

mangoh@mangoh-ThinkPad-X230:~/legato_framework$
```

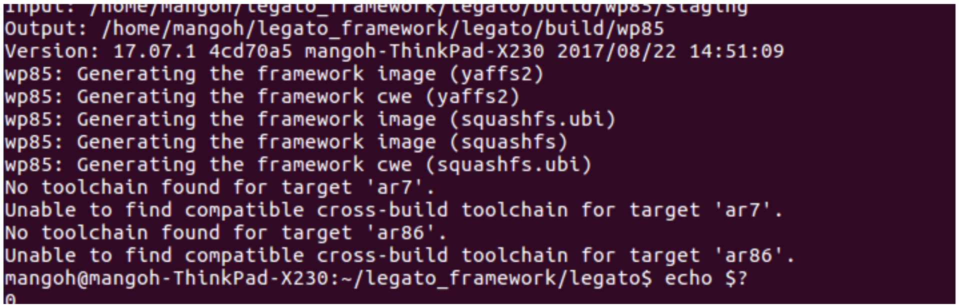
Note: This may take several minutes to run.

6. Build and install the Legato AF:

```
$ cd legato
$ make clean && make wp85 && source bin/configlegatoenv
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ make clean && make wp85 &
& source bin/configlegatoenv
```



```
Input: /home/mangoh/legato_framework/legato/build/wp85/staging
Output: /home/mangoh/legato_framework/legato/build/wp85
Version: 17.07.1 4cd70a5 mangoh-ThinkPad-X230 2017/08/22 14:51:09
wp85: Generating the framework image (yaffs2)
wp85: Generating the framework cwe (yaffs2)
wp85: Generating the framework image (squashfs.ubi)
wp85: Generating the framework image (squashfs)
wp85: Generating the framework cwe (squashfs.ubi)
No toolchain found for target 'ar7'.
Unable to find compatible cross-build toolchain for target 'ar7'.
No toolchain found for target 'ar86'.
Unable to find compatible cross-build toolchain for target 'ar86'.
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ echo $?
0
```

C: Tips

C.1 Finding your SIM’s APN

Your SIM provider should give you the APN that you use to connect to their network. If you don’t have the APN, you should be able to find it online.

Common APNs:

- Rogers Wireless—"internet.com"
- Others—Search the Internet for "<provider> APN". For example, "Rogers Wireless APN"

C.2 Using the Linux Terminal program

Ubuntu includes a terminal emulator, which is labeled as "Terminal" in the desktop environment. The emulator allows you to execute command-line programs that interact with the Legato framework tools on your dev machine and the CF3 module in the mangOH Red.

For this tutorial, here are some useful tips:

- Open a terminal window. For example, in the Unity desktop shell used by default on Ubuntu Linux, do this using either of these methods:
  - Click the Search icon and type "terminal", then run the application that is listed.
  - Press Ctrl+Alt+T
- Open a new tab in a window—Press Ctrl+Shift+T
- Change a tab name in a window—Right-click in the tab and select Set Title.
- Copy text from a window—Highlight the text and press Ctrl+Insert.
- Paste text into a window—Press Shift+Insert.
- For in-depth detail, refer to https://help.ubuntu.com/community/UsingTheTerminal.

C.3 Useful commands for this tutorial (and more)

The following table describes the Legato and Linux commands used in this tutorial, plus other useful commands.

Table C-1: Legato commands

Command types	Command	Description
Versioning	cm info	Display the modules model, IMEI, FSN (serial number), and firmware and bootloader versions.
	legato version	Display the Legato framework version.
Radio	cm radio	Display the radio status.
	cm radio on cm radio off	Enable or disable the radio.
	Refer to cm radio (http://legato.io/legato-docs/latest/toolsTarget_cm.html#toolsTarget_cm_radio) for more details and command options.	
Data connections	cm data cm data info	Display information about the current profile in use.
	cm data apn <yourAPN>	Set the APN for your profile to the APN from your SIM provider.
	cm data connect	Start a data connection.
	cm data connect <timeout>	Start a data connection (keep trying for up to <timeout> seconds).
	Refer to cm data (http://legato.io/legato-docs/latest/toolsTarget_cm.html#toolsTarget_cm_data) for more details and command options.	
SIM	cm sim info	Display information about the SIM.
	cm sim status	Display the SIM status
	cm sim enterpin	Enter a SIM PIN code to be able to use the SIM.
	Refer to cm sim (http://legato.io/legato-docs/latest/toolsTarget_cm.html#toolsTarget_cm_sim) for more details and command options.	
Applications	app status	Display the status of installed applications (running, stopped).
	app start <appName> app stop <appName> app remove <appName>	Start, stop, or remove an application.
	Refer to app (http://legato.io/legato-docs/latest/toolsTarget_app.html) for more details and command options.	

Table C-2: Linux commands

Command types	Command	Description
Packages	add-apt-repository	Add a package repository to your list of locations where the apt-get package management tool searches for the packages you request.
	apt-get update	Update the list of repositories to include those you added with add-apt-repository.
	apt-get install	Search the repositories for a package, and install it.
	update-alternatives	TBD

C.4 Definitions

Table C-3: Definitions

Term	Definition
sudo	Allows you to run commands that require another user's security privileges. In this tutorial, the sudo command is used to run commands that require root/admin privileges.
Legato Application Framework (AF)	Collection of daemons (Supervisor, Config tree, service directory, etc.), liblegato, and tools that provide a framework for developing and installing apps on modules (e.g. WP8548)
Legato Platform	Legato Application Framework, Platform services, and a toolchain (applications) running on top of a supported operating system (e.g. Linux or RTOS).
Platform Services	Collection of apps installed with the Legato Application Framework to provide connectivity to module hardware. Platform Services exposes APIs for developers to connect apps running on the hardware to the Cloud.
wget	Gets files from a web server
IDE perspective	A defined layout of the IDE. Each perspective will show different view (panel) combinations.
IDE view	A panel of information. For example, a directory structure, a panel for entering Terminal commands, etc.