mangOH™ Red

Getting Started—WPx5xx + Windows VM + CLI

41110479
Rev 3
Contents subject to change

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Revision History

Revision number	Release date	Changes
1	August 2017	Document created

Contents

1: Introduction

Now that you have your mangOH™ Red, it's time to start using it!

Important: *Use this guide only if you are using a Windows computer (dev(elopment) machine). This guide includes instructions for Windows® dev machines using CLI (Command Line Interpreter).*

Windows

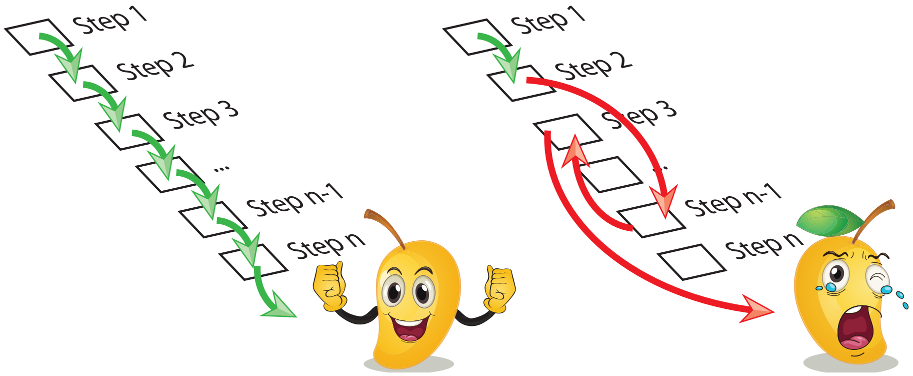
Use this guide to:

- Assemble your mangOH Red
- Set up your dev machine for mangOH development
- Install and run applications, and send data to the IoT Cloud via AirVantage, Sierra Wireless' cloud-based service platform for over-the-air (OTA) device management.

To get started with a native Linux dev machine, or for other mangOH Red resources (guides, tutorials, etc.), visit mangoh.io/mangoh-red-resources.

1.1 Get Started!

Important: *Follow all steps as described. If you skip, change, or 'jump around' steps, your device or development environment may not work properly.*



Before you begin, make sure your dev machine meets the minimum suggested requirements in Table 1-1 on page 7 for mangOH Red application development.

Note: *The instructions in this guide have been tested using the Legato Virtual Machine with a 64-bit Ubuntu 16.04 guest OS, available at mangoh.io/mangoh-red-resources-getting-started. If you use a different configuration and need assistance, please check out the forum at forum.mangoh.io.*

Note: *As you work through this guide, you can refer to Table G-1 on page 58 for descriptions of the commands you have to use.*

When you are ready to begin, work straight through the rest of this guide:

- STEP 1: Check Out Some Helpful Tips on page 8
- STEP 2: Set Up Your mangOH Red Hardware on page 9
- STEP 3: Prepare Your Windows Dev Machine For Legato Development on page 15
- STEP 4: Prepare Your mangOH Red For Development on page 20
- STEP 5: Connect To Mobile Networks on page 25
- STEP 6: Connect to the IoT Cloud on page 29

Things to check out after you finish the steps above:

- Develop and Test applications on page 37
- Update Legato Application Framework on page 45
- Tips on page 48
- Hardware Tips on page 53
- Console Access on page 54
- Quick Reference—Commands in this Guide on page 58

Table 1-1: Minimum System Requirements

	Windows
O/S	Windows 7 and higher (64-bit)
CPU	Dual core @ 2.6 GHz
RAM	4 GB
HDD	10 GB free space
USB Ports	• Preferred—2 (for full functionality) • Minimum—1

2: Check Out Some Helpful Tips

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 Legato VM with Ubuntu 16.04 guest OS.
  - "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 '#').*

    - '>'—Command is entered on the Windows computer
  - '~', "$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. Copy the command only, do not include the command prompt. (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>
- VM password—mangoh. You will need to use this to unlock the VM if you manually lock it.
- 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

3: Set Up Your mangOH Red Hardware

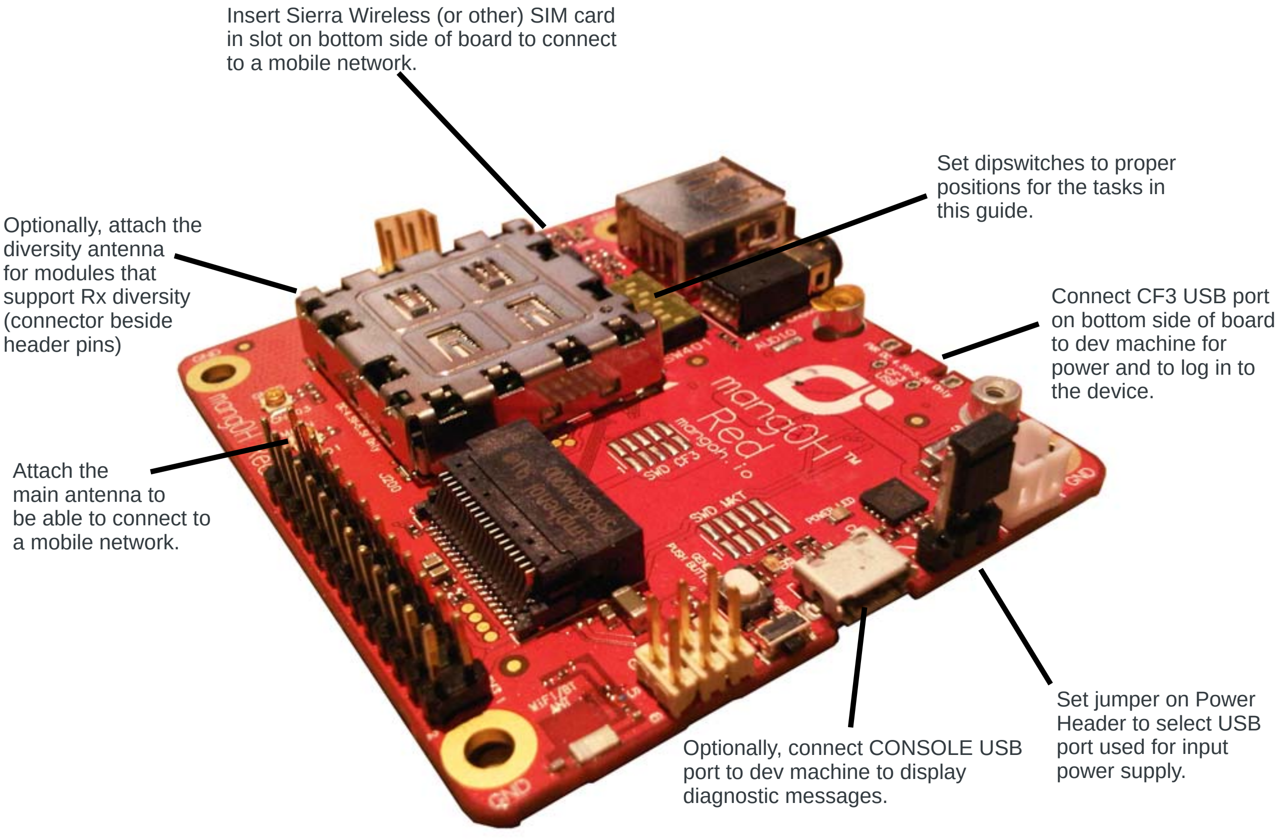
In this chapter, you will set up your mangOH Red to begin developing applications.

A typical mangOH Red kit includes:

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

The following image summarizes the parts of the mangOH Red that you will set up when you follow the instructions in Hardware Setup on page 10.

Important: *Do not start connecting components until told to in the instructions, otherwise you may encounter problems later in the guide.*



Insert Sierra Wireless (or other) SIM card in slot on bottom side of board to connect to a mobile network.

Set dipswitches to proper positions for the tasks in this guide.

Optionally, attach the diversity antenna for modules that support Rx diversity (connector beside header pins)

Connect CF3 USB port on bottom side of board to dev machine for power and to log in to the device.

Attach the main antenna to be able to connect to a mobile network.

Set jumper on Power Header to select USB port used for input power supply.

Optionally, connect CONSOLE USB port to dev machine to display diagnostic messages.

3.1 Install Drivers

Your Windows computer requires drivers for your mangOH Red's CF3 module. To download and install the drivers:

1. Go to http://mangoh.io/mangoh-red-resources-getting-started.
2. In the Getting Started with mangOH section, find and click Drivers for mangOH-compatible CF3 Modules. This takes you to the drivers page on the Source.
3. Click Download.

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

4. Open the downloads folder.
5. Run (double-click) GenericDriverSetup.exe and follow the prompts to install the drivers.

3.1.1 Install PuTTY terminal emulator

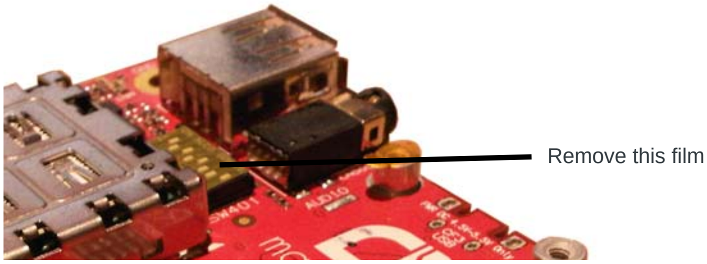
You need a terminal emulator to establish SSH connections to the mangOH Red:

1. If you do not have a terminal emulator on your computer that supports SSH, go to https://www.chiark.greenend.org.uk/~sgtatham/putty/latest to download and install the PuTTY SSH client.

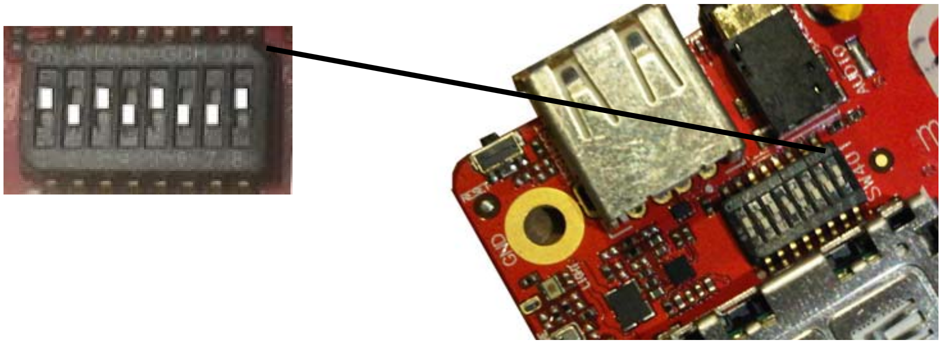
3.2 Hardware Setup

To set up the mangOH Red board:

1. Remove the protective film from the dipswitches:



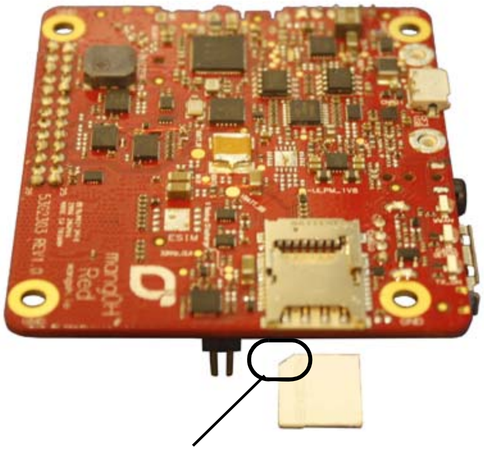
2. Make sure the dipswitches are set as follows:
   - ON—1,3,5,8
   - OFF—2,4,6,7



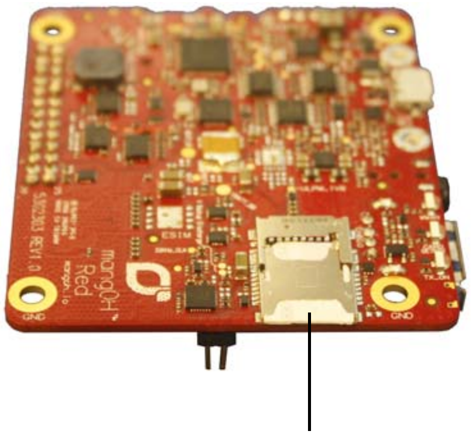
For switch details (not needed for this tutorial), see Dipswitch Settings on page 53.

3. 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 25 and Connect to the IoT Cloud on page 29.*



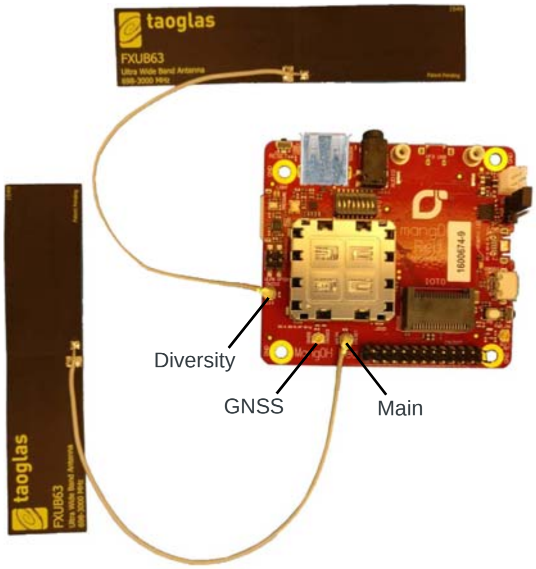
Note the location of the notched corner.



Inserted in bottom part of slot

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

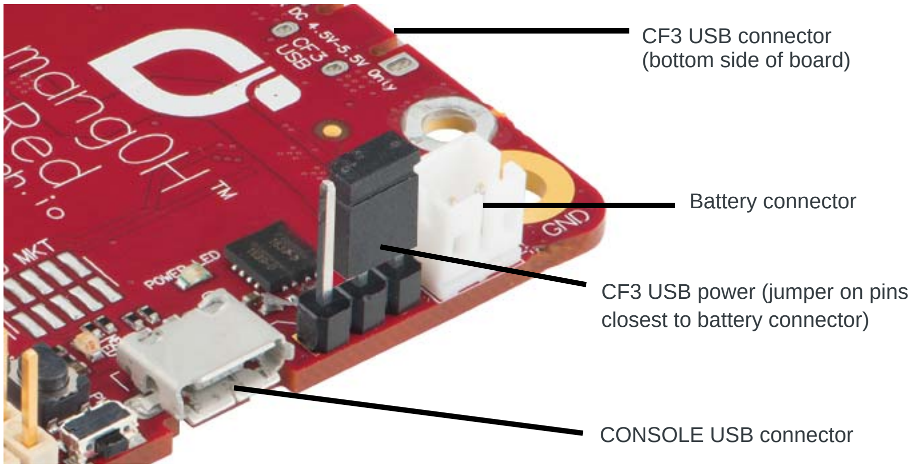
> **Note:** *The main antenna is required if you want to connect the mangOH Red to a mobile network in Connect To Mobile Networks on page 25.*



> **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.*
> - *CONSOLE_USB is a serial connection used to access the module's console for diagnostic purposes.*

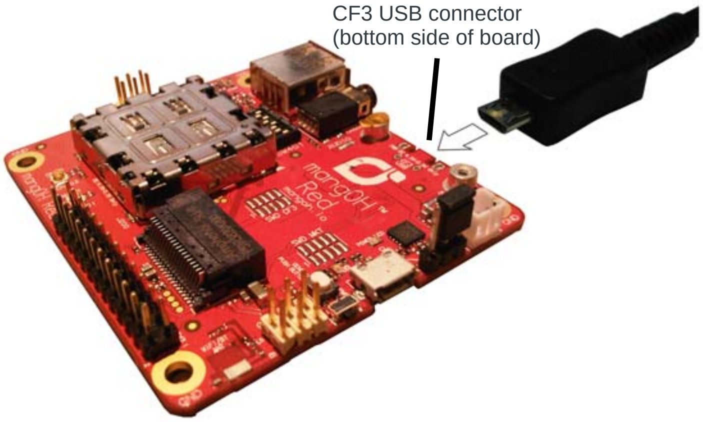
5. Move the power select jumper onto the pins closest to the battery connector to select the CF3 USB connector. (In this guide, power is supplied from the dev machine's USB port to this connector when you connect it in a later step.)



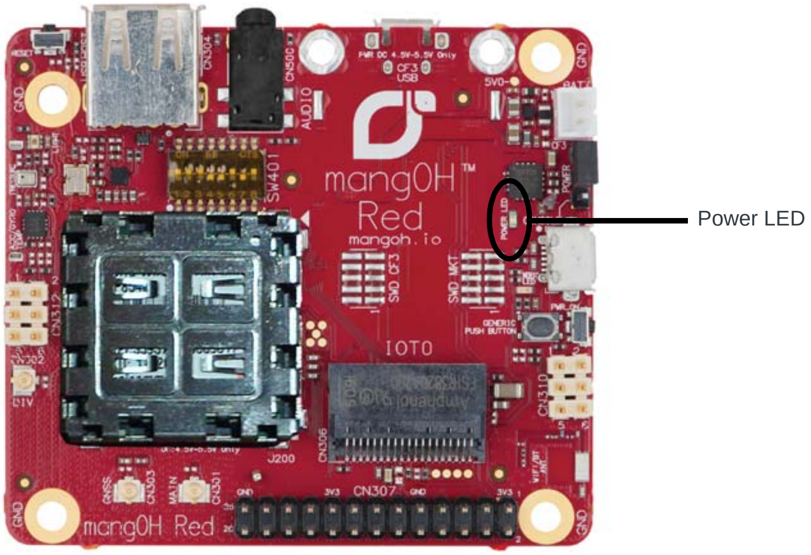
Note: *OPTIONALLY, if you want to be able to display the target’s console messages (diagnostic messages) and have two available USB ports on your dev machine, follow the instructions in Console Access on page 54. This is NOT a required step for this tutorial.*

6. 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.

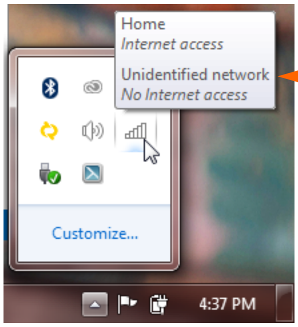


When the mangOH Red is powered, the Power LED turns solid green.



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.

b. Wait until the device enumerates (1 to 4 minutes)—Hover your cursor over the network status icon. When the device enumerates, this shows that you are connected to an “Unidentified Network” (your CF3 module) with “No Internet access” (because the module is not connected to a mobile network).



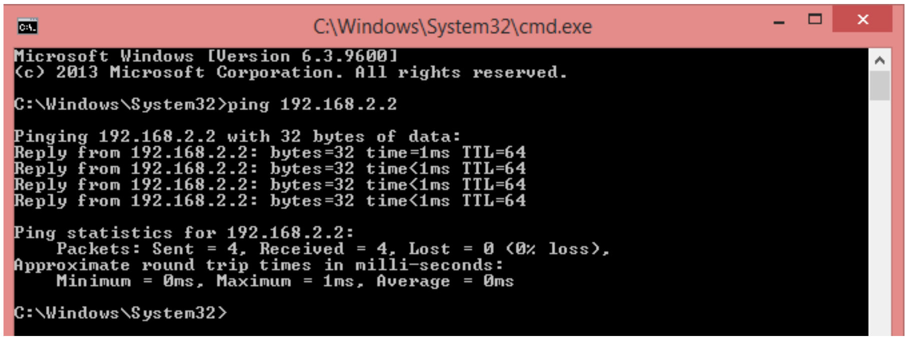
Connected to target device

c. Open a Windows terminal window—press Win+R (or Start > Run), then enter “`cmd`“ and press Enter.

d. Test the connection by ‘pinging’ the CF3 module (which has a default IP address of 192.168.2.2):

```
> ping 192.168.2.2
```

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



```
Microsoft Windows [Version 6.3.9600]
(c) 2013 Microsoft Corporation. All rights reserved.

C:\Windows\System32>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:
Reply from 192.168.2.2: bytes=32 time=1ms TTL=64
Reply from 192.168.2.2: bytes=32 time<1ms TTL=64
Reply from 192.168.2.2: bytes=32 time<1ms TTL=64
Reply from 192.168.2.2: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\Windows\System32>
```

Now you are ready to Prepare Your Windows Dev Machine For Legato Development.

4: Prepare Your Windows Dev Machine For Legato Development

In this chapter, you will prepare your dev machine for Legato application development by installing Oracle VirtualBox (a ’hypervisor’ (virtual machine monitor)) and a custom pre-configured virtual machine (VM) image.

Important: *To install and use the development environment, your dev machine must meet the requirements in Table 1-1 on page 7.*

Note: *The Legato development environment runs in a Legato Virtual Machine on your Windows computer. Compared to running natively on a Linux computer, its performance is decreased (typically) due to the overhead of running the virtual machine, but functionality is the same on both computer types.*

4.1 Prepare Your Computer

After preparing your mangOH Red in Set Up Your mangOH Red Hardware on page 9, including installing drivers on your computer and connecting the mangOH Red, you can prepare your computer for Legato development.

Your computer requires a virtual machine image configured with the Legato development environment. The following sections describe how to get and install the virtual machine.

4.1.1 Install Oracle VirtualBox

The VM image provided for mangOH Red is built for use with Oracle VirtualBox. If you do not have Oracle VirtualBox installed on your computer yet:

1. Go to https://www.virtualbox.org to download the VirtualBox binary for Windows hosts.

   Note: *When you install VirtualBox, default settings will work, but you can modify them if you prefer (see VirtualBox Tips on page 51 for details.)*

2. Install VirtualBox by running the downloaded file.

   VirtualBox opens automatically when it finishes installing.

   Note: *VirtualBox appears in your Start menu as “Oracle VM VirtualBox”.*

4.1.2 Download Legato Application Development Image

The guest OS on the VM image provided for mangOH Red is 64-bit Ubuntu Linux 16.04, pre-loaded with the Legato toolchain (tools for building Legato applications), and files for building the mangOH Red platform.

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.)*

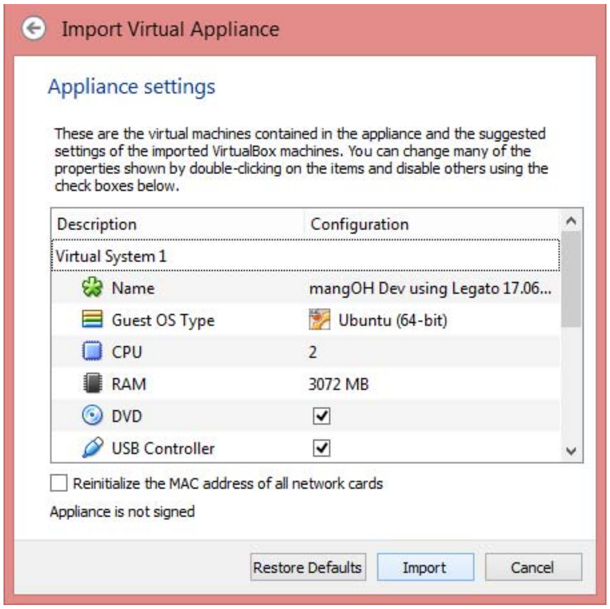
To download the VM image:

1. Go to http://mangoh.io/mangoh-red-resources-getting-started.
2. In the Legato Virtual Machines section, locate and click Download VM.

> **Note:** *The VM image size is ~2.1 GB.*

3. Load (import) the Legato VM into VirtualBox:
   a. In VirtualBox, select File > Import Appliance.
   b. Browse to the local folder where you downloaded the VM image (for example, “mangOH-Legato-17_06-Ubuntu-16_04.ova”), select the file, and click Open.
   c. Click Next.

   VirtualBox opens and displays the Import Virtual Appliance window.



Import Virtual Appliance

Appliance settings

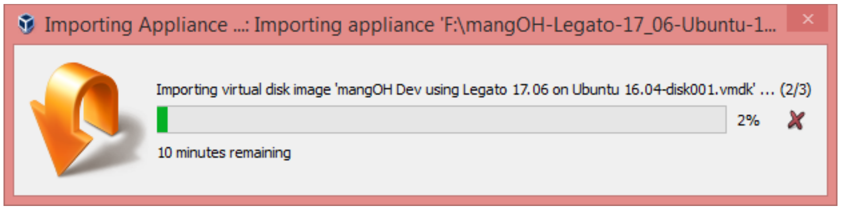
These are the virtual machines contained in the appliance and the suggested settings of the imported VirtualBox machines. You can change many of the properties shown by double-clicking on the items and disable others using the check boxes below.

Description	Configuration
Virtual System 1	
Name	mangOH Dev using Legato 17.06...
Guest OS Type	Ubuntu (64-bit)
CPU	2
RAM	3072 MB
DVD	☑
USB Controller	☑

☐ Reinitialize the MAC address of all network cards

Appliance is not signed

   d. If you want to assign a different name to the VM, double-click the Configuration field beside the Name, type the new name, and press Enter.
   e. Click Import. The Linux VM begins importing into VirtualBox—this may take up to 10 minutes to run, depending on your computer.

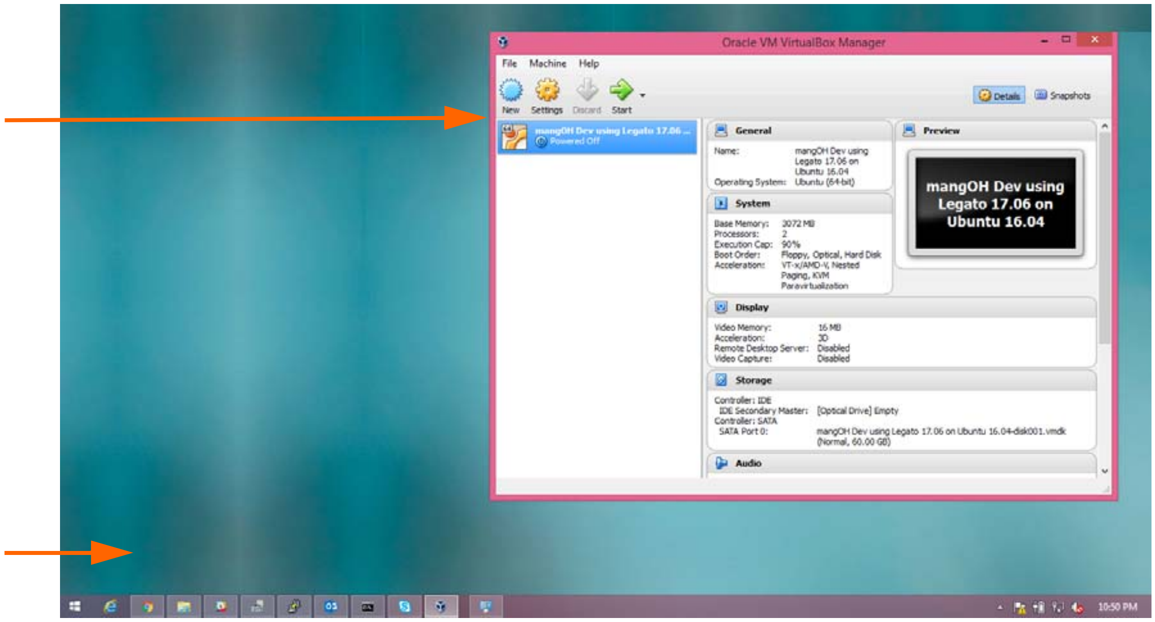


Importing Appliance ...: Importing appliance 'F:\mangOH-Legato-17_06-Ubuntu-1...

Importing virtual disk image 'mangOH Dev using Legato 17.06 on Ubuntu 16.04-disk001.vmdk' ... (2/3)

2%

10 minutes remaining



Oracle VirtualBox with imported Linux VM

Windows desktop

Oracle VM VirtualBox Manager

File
Machine
Help
New
Settings
Discard
Start
Details
Snapshots
mangOH Dev using Legato 17.06 ...
Powered Off
Preview
mangOH Dev using Legato 17.06 on Ubuntu 16.04

General

Name: mangOH Dev using Legato 17.06 on Ubuntu 16.04
Operating System: Ubuntu (64-bit)

System

Base Memory: 3072 MB
Processors: 2
Execution Cap: 90%
Boot Order: Floppy, Optical, Hard Disk
Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization

Display

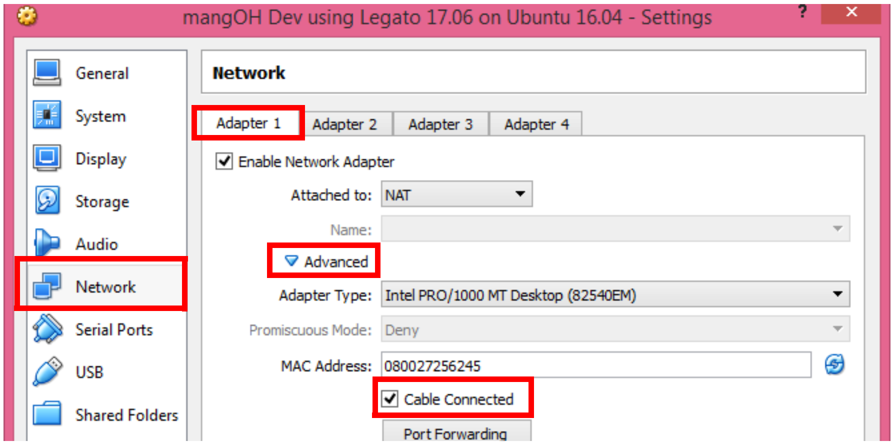
Video Memory: 16 MB
Acceleration: 3D
Remote Desktop Server: Disabled
Video Capture: Disabled

Storage

Controller: IDE
IDE Secondary Master: [Optical Drive] Empty
Controller: SATA
SATA Port 0: mangOH Dev using Legato 17.06 on Ubuntu 16.04-disk001.vmdk (Normal, 60.00 GB)

Audio

4. Make sure the Legato VM is set up to use the Internet connection:
   a. In the VirtualBox window, click Settings. The Settings window appears.
   b. Select Network.
   c. Select Adapter 1.
   d. Click Advanced.
   e. Select Cable Connected.
   f. Click OK.



mangOH Dev using Legato 17.06 on Ubuntu 16.04 - Settings

Network

☑ Enable Network Adapter

Attached to: NAT

Name:

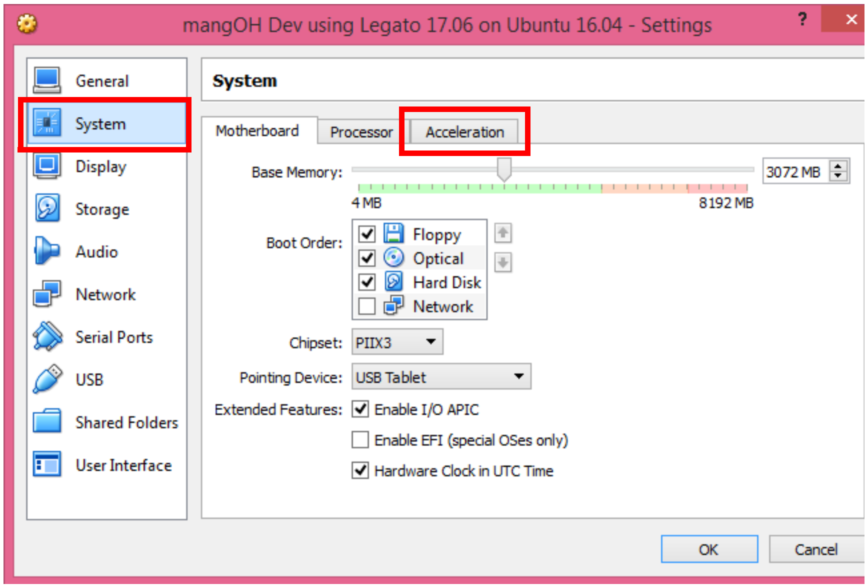
Adapter Type: Intel PRO/1000 MT Desktop (82540EM)

Promiscuous Mode: Deny

MAC Address: 080027256245

☑ Cable Connected

5. Check whether your computer has virtualization enabled (which allows you to run the Linux VM):
   a. In the VirtualBox window, click Settings. The Settings window appears.
   b. Select System.



Base Memory: 3072 MB (4 MB – 8192 MB)

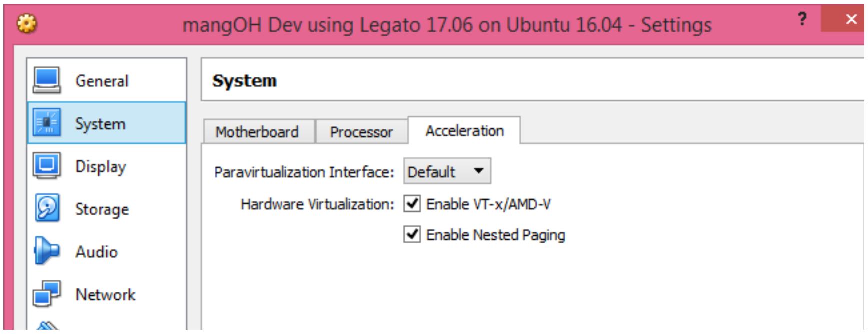
Boot Order:
☑ Floppy
☑ Optical
☑ Hard Disk
□ Network

Chipset: PIIX3

Pointing Device: USB Tablet

Extended Features:
☑ Enable I/O APIC
□ Enable EFI (special OSes only)
☑ Hardware Clock in UTC Time

   c. Try to select Acceleration:
      - If Acceleration cannot be selected (grayed out):
         i. You must enable virtualization in your computer's BIOS. See C.6 Enable virtualization on a Windows computer on page 51 for details.
         ii. After you reboot, launch VirtualBox from your Start menu, and repeat Step 5.
      - If Acceleration can be selected:
         i. Make sure both Hardware Virtualization options are selected.
         ii. Click OK.



Paravirtualization Interface: Default

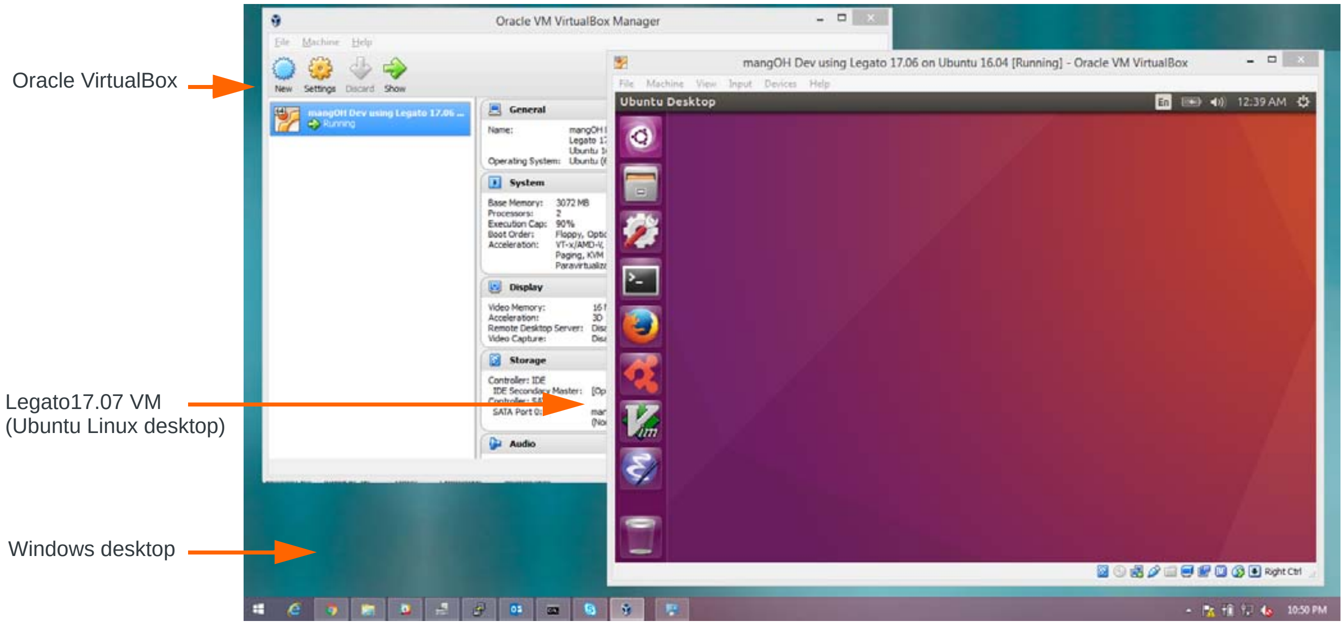
Hardware Virtualization:
☑ Enable VT-x/AMD-V
☑ Enable Nested Paging

6. In the VirtualBox window, launch (double-click, or click to select and click Start) the virtual machine (for example, “mangOH Dev using Legato ...”).

   As VirtualBox begins to load the image, one of the following will happen:

   - A VirtualBox window should appear, showing progress messages as the image loads. This may take a few minutes before the Ubuntu desktop appears.

     If prompted to enter the mangOH password, type “mangoh” and press Enter.


Oracle VirtualBox
Legato17.07 VM
(Ubuntu Linux desktop)
Windows desktop
Oracle VM VirtualBox Manager
File Machine Help
New Settings Discard Show
mangOH Dev using Legato 17.06 ...
Running
mangOH Dev using Legato 17.06 on Ubuntu 16.04 [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help
Ubuntu Desktop
12:39 AM
Right Ctrl
10:50 PM

General
Name: mangOH Legato 17 Ubuntu 1
Operating System: Ubuntu (

System
Base Memory: 3072 MB
Processors: 2
Execution Cap: 90%
Boot Order: Floppy, Optic
Acceleration: VT-x/AMD-V, Paging, KVM Paravirtualiz

Display
Video Memory: 16
Acceleration: 3D
Remote Desktop Server: Disa
Video Capture: Disa

Storage
Controller: IDE
IDE Secondary Master: [Op
SATA Port 0: man (No

Audio

   - If a VirtualBox Error appears with the message “VT-x/AMD-V hardware acceleration is not available on your system...”, you must enable virtualization in your computer’s BIOS. See C.6 Enable virtualization on a Windows computer on page 51 for details.
   - If the image doesn’t load properly (the program hangs, or the desktop does not appear), you must:

     i. Close VirtualBox.

     ii. Start VirtualBox.

     iii. Delete the VM image.

     iv. Re-import the VM image—repeat Download Legato Application Development Image on page 15, beginning at Step 3 on page 16.

Important: *The Linux VM will not lock if it is left unused. However, if you manually lock it, the password to unlock it is ‘mangoh’.*

Now that the VM is loaded and running and you have a terminal emulator installed, you can Prepare Your mangOH Red For Development on page 20 .

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 is set up with the Legato VM (which has Legato already pre-installed and configured), you will:

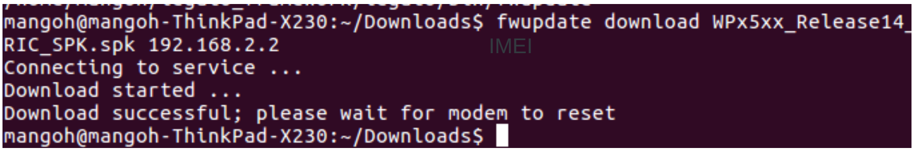
- Build the Legato Platform (development applications) on your dev machine.
- Use the Legato Platform to build the mangOH Red Platform (target applications) and install it onto your target (the CF3 module in your mangOH Red)

IMPORTANT

Important: You MUST do the following step! *The Legato Application Framework and the mangOH Red platform apps that you are going to install in this procedure both require you to have the correct (latest) firmware installed on your CF3 module. The platform apps will not install if you do not have the correct firmware.*

1. Update the target's firmware to the latest available version:
   - **a.** Go to https://source.sierrawireless.com and do the following:
     - **i.** In the Devices section, click AirPrime.
     - **ii.** Click WP series.
     - **iii.** Click your module type.
     - **iv.** In the Software download section, click Firmware to display the list of available firmware packages.
     - **v.** If you did not load the latest Drivers for your module yet, load them now—see Install Drivers on page 10 for instructions.
     - **vi.** In the Combined Images table, click the Download link in the Windows EXE column for the Generic carrier.
   - **b.** Run the downloaded file and follow the instructions that appear.

     Note: *This will take several minutes to run.*



```
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$ 
```

   - **c.** Wait (1–2 minutes) while the module reboots with the new firmware.

d. Verify that the firmware updated:

i. Connect to the mangOH Red:

```
$ ssh root@192.168.2.2
```

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

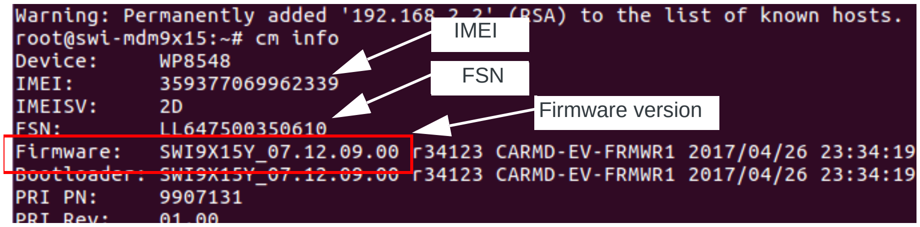
```
It is strongly recommended to setup credentials for remote l
  Please select one of the following options:
    1) Setup ssh keys and disable passwords-based authentica
    2) Setup password (better than nothing)
    3) Do nothing
```

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.*

iii. Display information about the CF3 module and confirm that the Firmware version shown is the one that you downloaded:

```
# cm info
```



```
Warning: Permanently added '192.168.2.2' (RSA) to the list of known hosts.
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 23:34:19
Bootloader: SWI9X15Y_07.12.09.00 r34123 CARMD-EV-FRMWR1 2017/04/26 23:34:19
PRI PN:     9907131
PRI Rev:    01.00
```

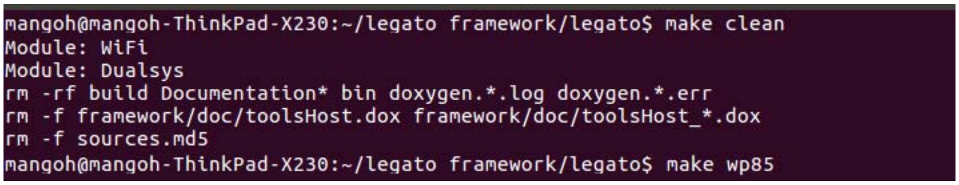
iv. Disconnect from the mangOH Red:

```
# exit
```

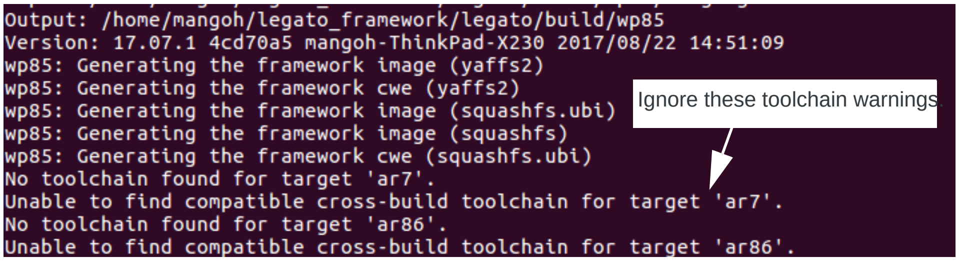
2. In the VM, open a terminal window and then build the Legato Application Framework (AF):

```
$ cd ~/legato_framework/legato
$ make clean     # Optional step to remove clutter from previous builds
$ make wp85      # Build the framework
```

> **Note:** *You don't need to use make clean' the first time you use this procedure to build the Legato AF. If you have to redo the procedure for some reason, use this command to clear out build artifacts (files generated and stored by the 'make wp85' command.).*



```
mangoh@mangoh-ThinkPad-X230:~/legato framework/legato$ make clean
Module: WiFi
Module: Dualsys
rm -rf build Documentation* bin doxygen.*.log doxygen.*.err
rm -f framework/doc/toolsHost.dox framework/doc/toolsHost_*.dox
rm -f sources.md5
mangoh@mangoh-ThinkPad-X230:~/legato framework/legato$ make wp85
```



```
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'.
```

Ignore these toolchain warnings

3. To use the Legato AF’s tools in the terminal window, enter the following command to set the required configurations (this is a shortcut command to run a command deeper in the framework files):

```
$ cfglegato     # Set up the environment
```

Important: *You must enter the ’cfglegato’ command n any terminal window that you open on the dev machine, if you want to use the framework’s tools in that window.*

4. Change directory to the mangoh work directory:

```
$ cd $MANGOH_ROOT
```

5. The VM is pre-installed with the files for the mangOH Red platform. However, you should make sure you have the latest versions of the files using the following git (version control system) commands:

   a. Get the latest files:

   ```
   $ git pull
   ```

   b. Update the git configuration with any new submodules added recently:

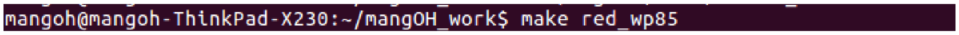
   ```
   $ git submodule init
   ```

   c. Check out the correct version for all of the submodules:

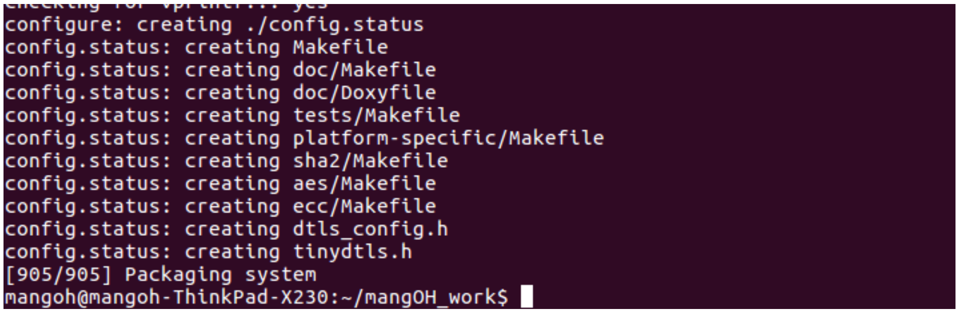
   ```
   $ git submodule update
   ```

6. Build the mangOH Red platform:

```
$ make red_wp85
```



```
mangoh@mangoh-ThinkPad-X230:~/mangOH_work$ make red_wp85
```



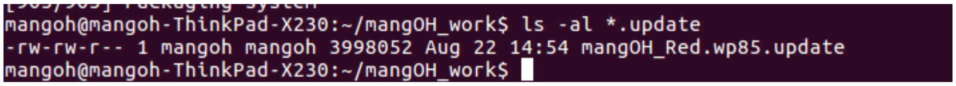
```
configure: creating ./config.status
config.status: creating Makefile
config.status: creating doc/Makefile
config.status: creating doc/Doxyfile
config.status: creating tests/Makefile
config.status: creating platform-specific/Makefile
config.status: creating sha2/Makefile
config.status: creating aes/Makefile
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.*
• *The number of packages listed will vary (newer platform releases will have different numbers of files).*

> **Note:** *In the command "make red_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.*

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
```

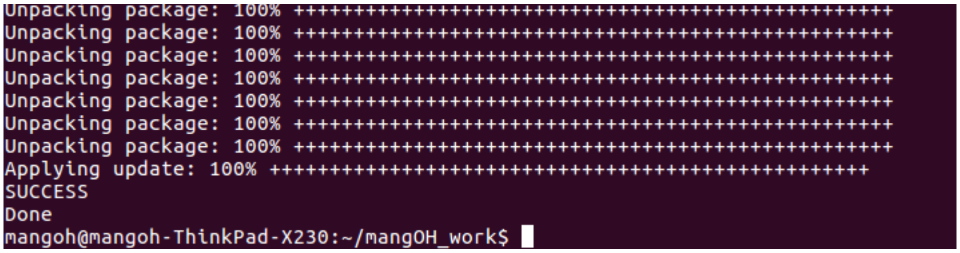
Press Ctrl+C to return to the command prompt.

9. Install the mangOH_Red platform 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".

> **Note:** *If the target has any problems starting the mangOH Red platformat applications, it automatically reboots and restores to its original state (prior to the instsys command). If this happens, the target will not be reachable whlie it is rebooting.*



```
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. Verify the mangOH platform apps installed correctly:

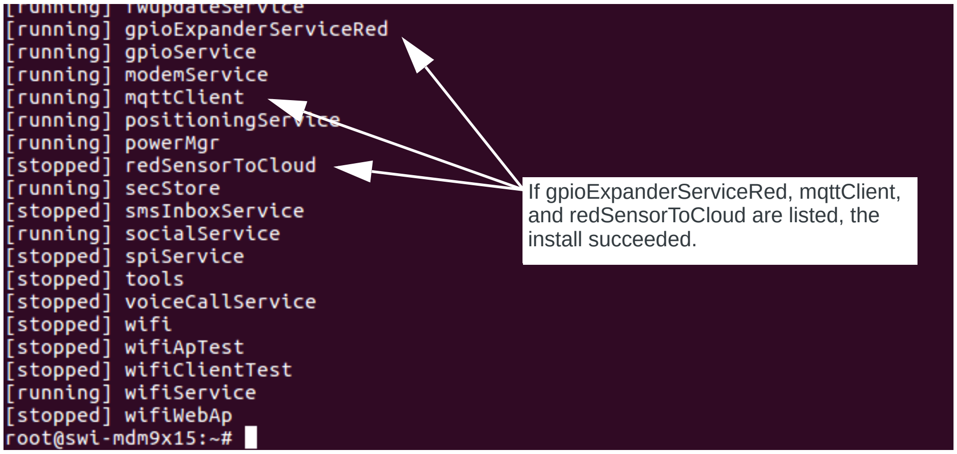
a. Connect to the mangOH Red:

```
$ 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.

c. Disconnect from the mangOH Red:

```
# exit
```

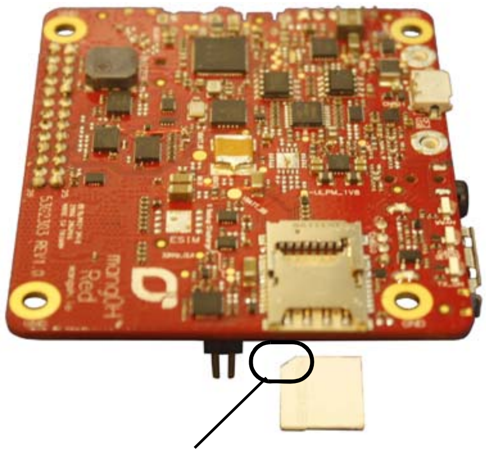
Now that the mangOH Red platform is installed, you will learn how to Connect To Mobile Networks on page 25.

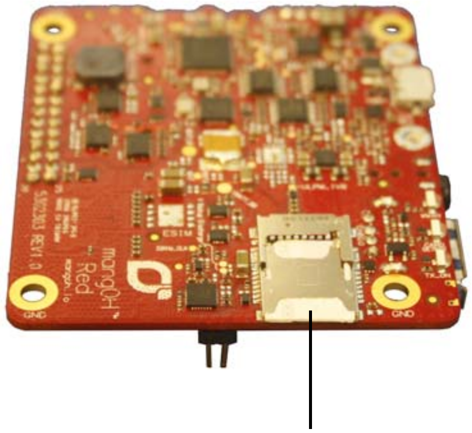
6: Connect To Mobile Networks

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.





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.

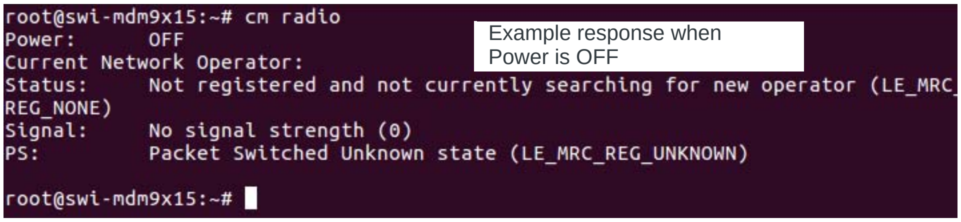
> **Note:** *You must disconnect the power before switching SIMs so the mangOH_Red can detect the SIM while powering on.*

2. Connect to the target:
   a. On the dev machine, open a terminal window.
   b. Connect to the target:

```
$ ssh root@192.168.2.2
```

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

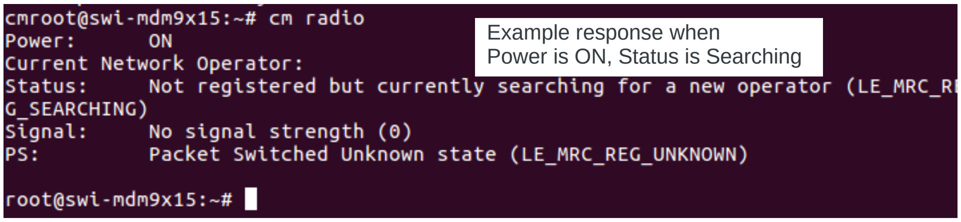
```
# cm radio
```



```
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

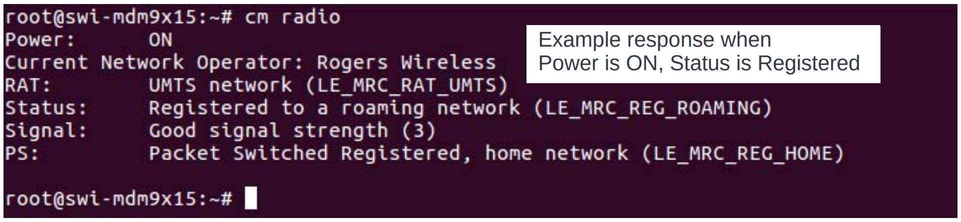


```
cmroot@swi-mdm9x15:~# cm radio
Power:      ON
Current Network Operator:
Status:     Not registered but currently searching for a new operator (LE_MRC_R
G_SEARCHING)
Signal:     No signal strength (0)
PS:         Packet Switched Unknown state (LE_MRC_REG_UNKNOWN)

root@swi-mdm9x15:~# █
```

Example response when Power is ON, Status is Searching

Important: *Typically, your module will register on a network in < 1 minute. However, the very first time your CF3 module and Sierra SIM are used, registration may take from 5–20 minutes.*



```
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

4. If the:

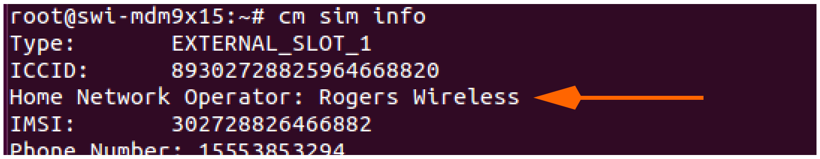
- Power is OFF—Turn on the radio and then repeat Step 3:

  ```
  # 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 3.
- Power is ON and Status is Registered—Continue to Step 6.

5. Make sure the SIM card is installed correctly:

```
# 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
```

Your SIM data should appear as shown above.

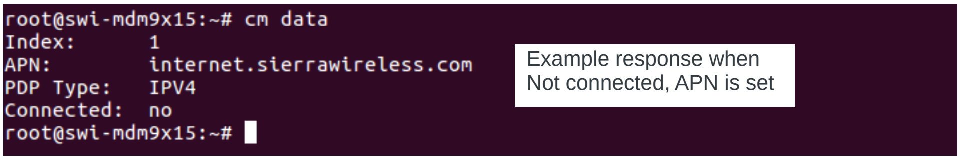
Note: *The Home Network Operator is the ISP that provides the network on which the target is connected. This may be different than the provider of the SIM if you are connecting to a network that your SIM's provider has an agreement with. For example, Sierra Wireless SIMs will connect to a variety of networks as in the example above.*

6. Set the target to use IPv4 addressing (this is required for use with AirVantage later in the guide):

```
# cm data pdp ipv4
```

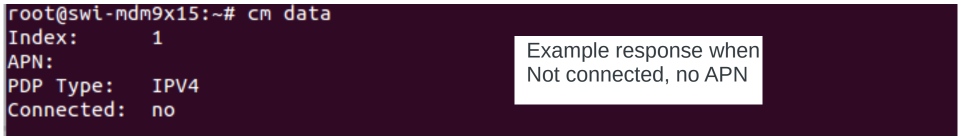
7. Check the connection status:

```
# cm data
```



```
root@swi-mdm9x15:~# cm data
Index:      1
APN:        internet.sierrawireless.com
PDP Type:   IPV4
Connected:  no
root@swi-mdm9x15:~# █
```

Example response when Not connected, APN is set



```
root@swi-mdm9x15:~# cm data
Index:      1
APN:
PDP Type:   IPV4
Connected:  no
```

Example response when Not connected, no APN

a. If "Connected" is:

- "no", and APN has a value—The mangOH Red is ready to connect to the network. Go to Step 8 on page 28.
- "no", and APN is blank—You must set the APN. Continue to the next step (step b).

b. If you need to set the APN for:

- A Sierra Wireless SIM—Enter the following command:

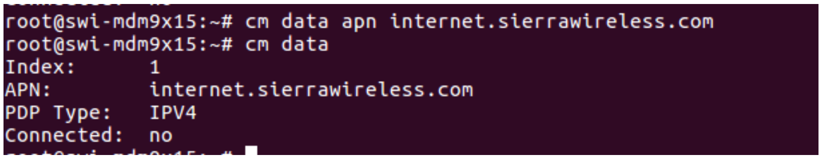
```
# cm data apn internet.sierrawireless.com
```

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

- Other SIM:

i., 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:   IPV4
Connected:  no
```

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.*

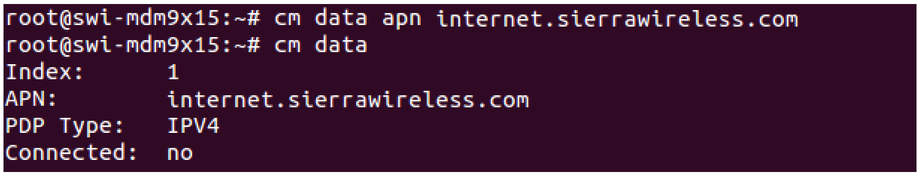
If you do not know the APN for your SIM:

i. Search the Internet for the APN for your Home Network Operator that you showed in Step 5 (for example, search for "Rogers Wireless").

ii. 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.sierrawireless.com
root@swi-mdm9x15:~# cm data
Index:       1
APN:         internet.sierrawireless.com
PDP Type:    IPV4
Connected:   no
```

8. The target is registered on a mobile network, and the SIM is installed and configured with the correct APN. You are now ready to transmit data to the IoT cloud.

In the next section—Connect to the IoT Cloud on page 29, you will set up your free account on the Sierra Wireless AirVantage IoT Acceleration Platform 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

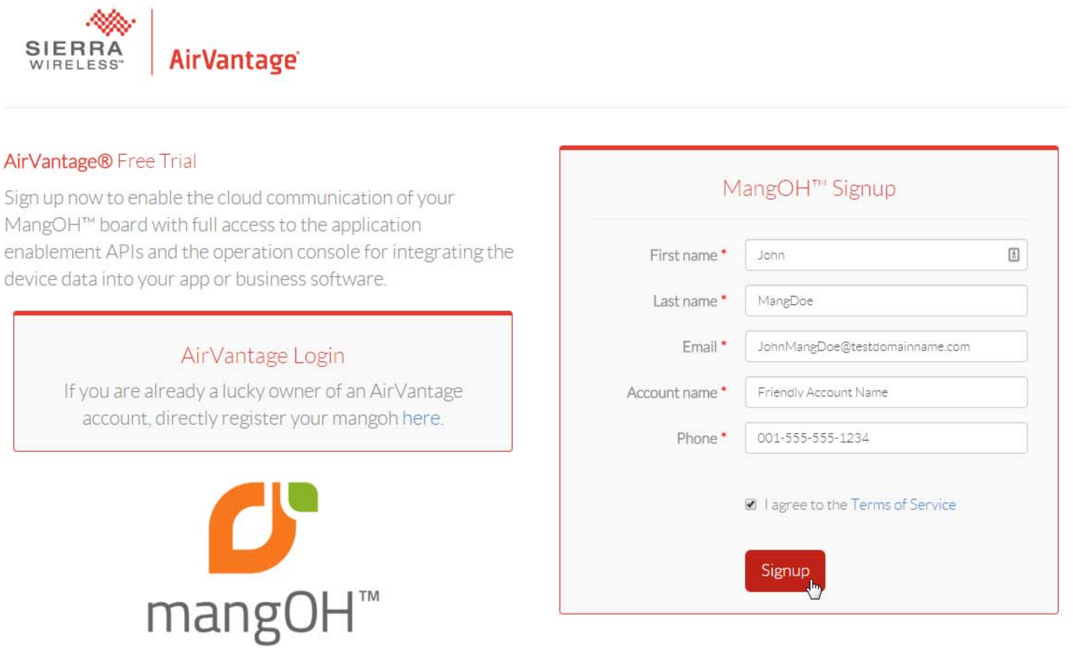
Your mangOH Red kit includes a free account on the AirVantage IoT Acceleration Platform for your CF3 module. This platform provides Sierra Wireless' cloud-based services for over-the-air (OTA) device management and application enablement. These services provide the infrastructure for you to build, connect,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



SIERRA WIRELESS | AirVantage

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™

MangOH™ Signup

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

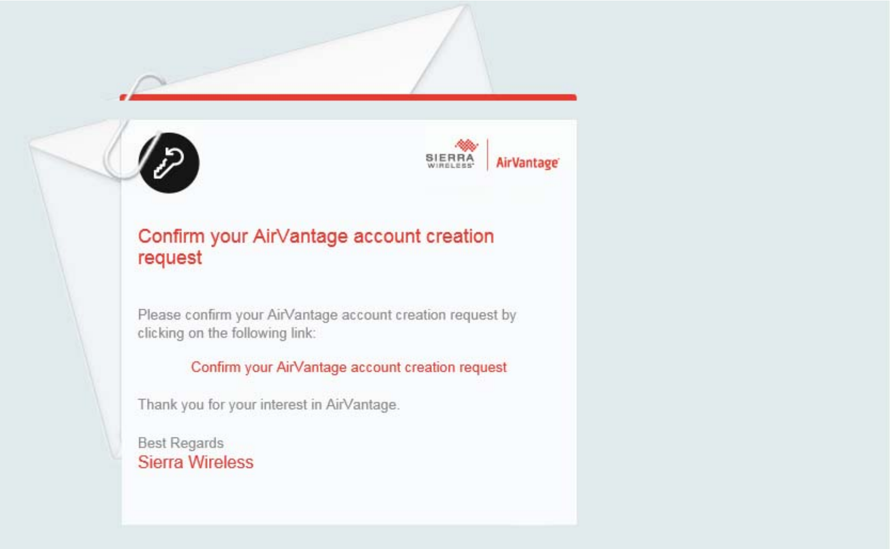
☑ I agree to the Terms of Service

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

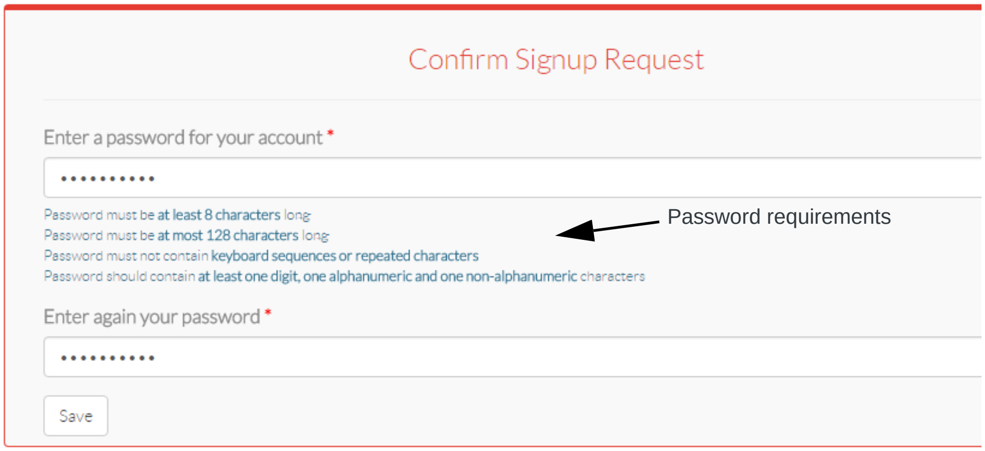
Please confirm your AirVantage account creation request by clicking on the following link:

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 *

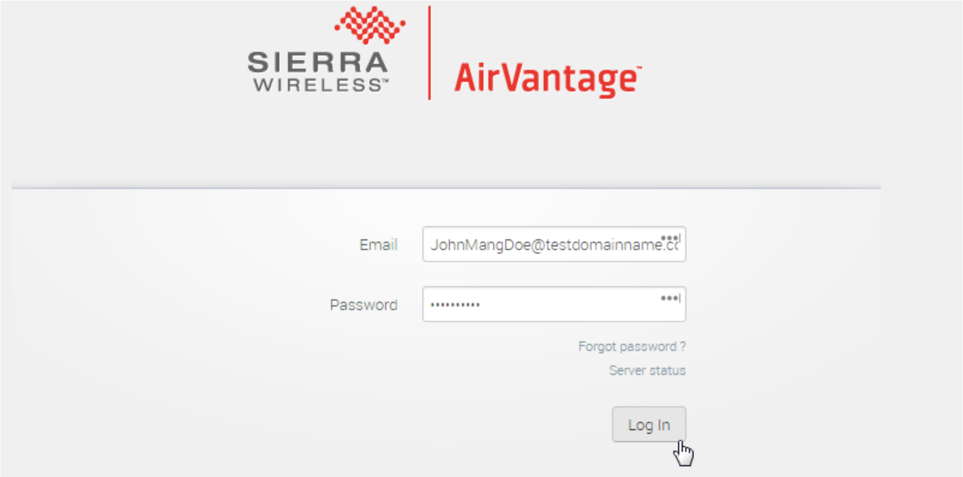
••••••••••

Password requirements

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 20):

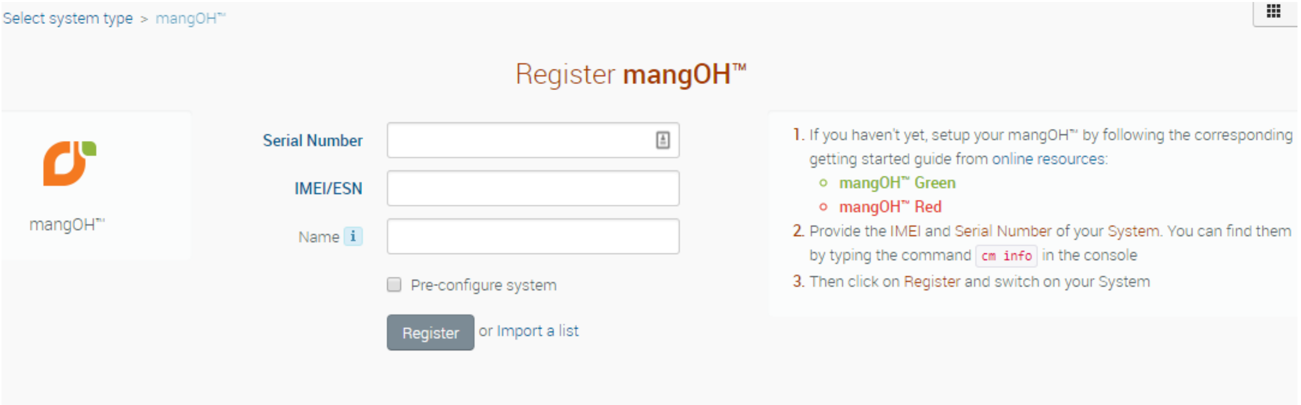
   a. Open a terminal window and connect to the device:

   ```
   $ 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:



Select system type > mangOH™

Register **mangOH™**

mangOH™

Serial Number

IMEI/ESN

Name i

☐ Pre-configure system

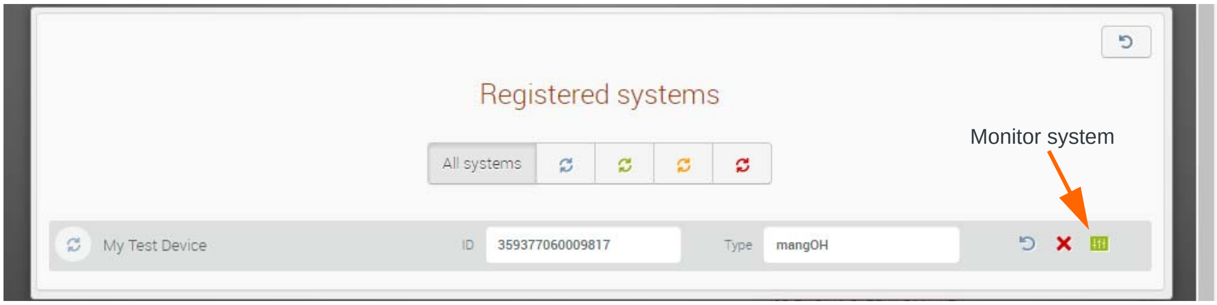
Register or Import a list

1. If you haven't yet, setup your mangOH™ by following the corresponding getting started guide from online resources:
   - mangOH™ Green
   - mangOH™ Red
2. Provide the IMEI and Serial Number of your System. You can find them by typing the command `cm info` in the console
3. Then click on Register and switch on your System

- 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—(IMPORTANT) Do NOT select this option.

11. Click Register.

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



Registered systems

All systems

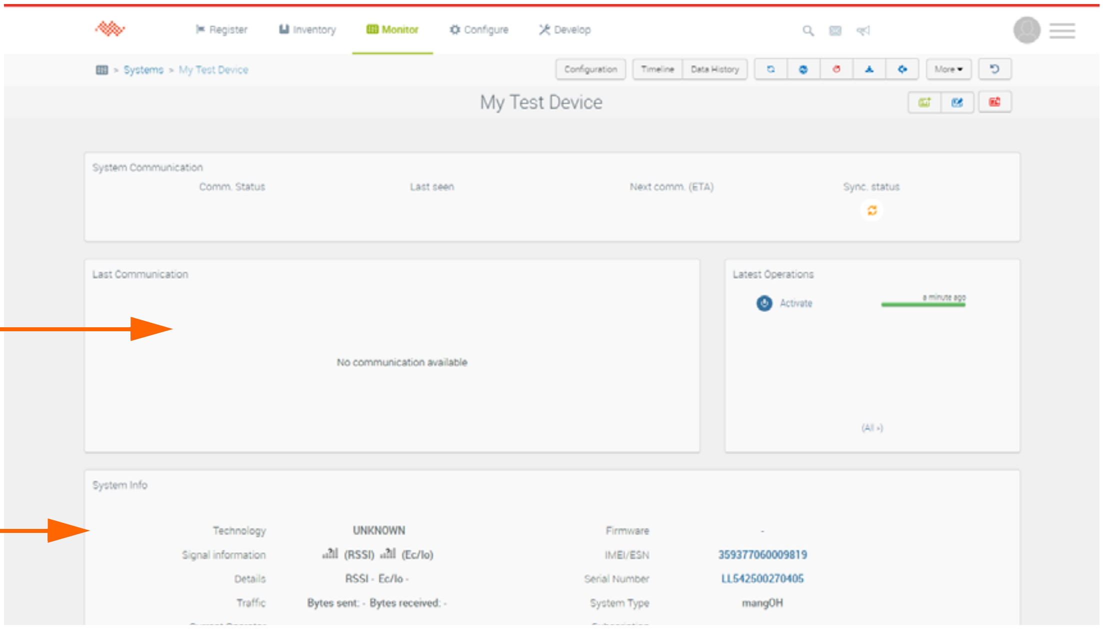
My Test Device ID 359377060009817 Type mangOH

Monitor system

12. Now that your device is registered, click the monitor icon at the right side of your device entry (▦) (or click Monitor at the top of the screen and select Systems) 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 33.



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

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.)

7.1.2 Connect to AirVantage

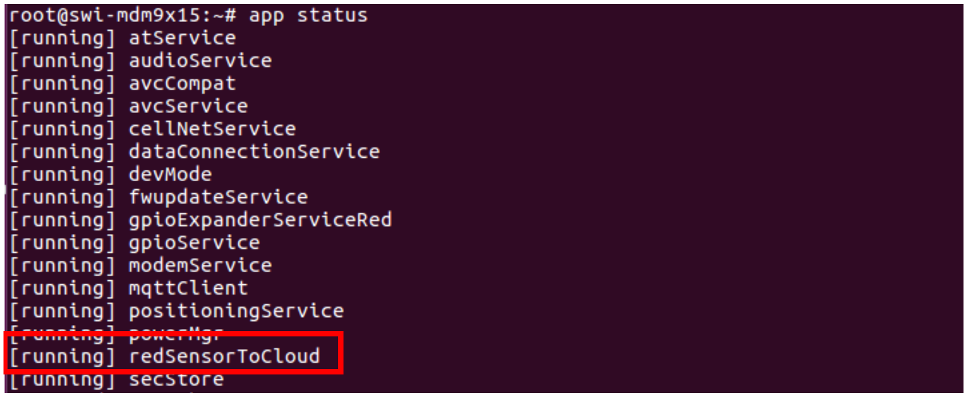
Now that you are registered on AirVantage, connect your mangOH Red to the AirVantage server and begin transmitting data:

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
```

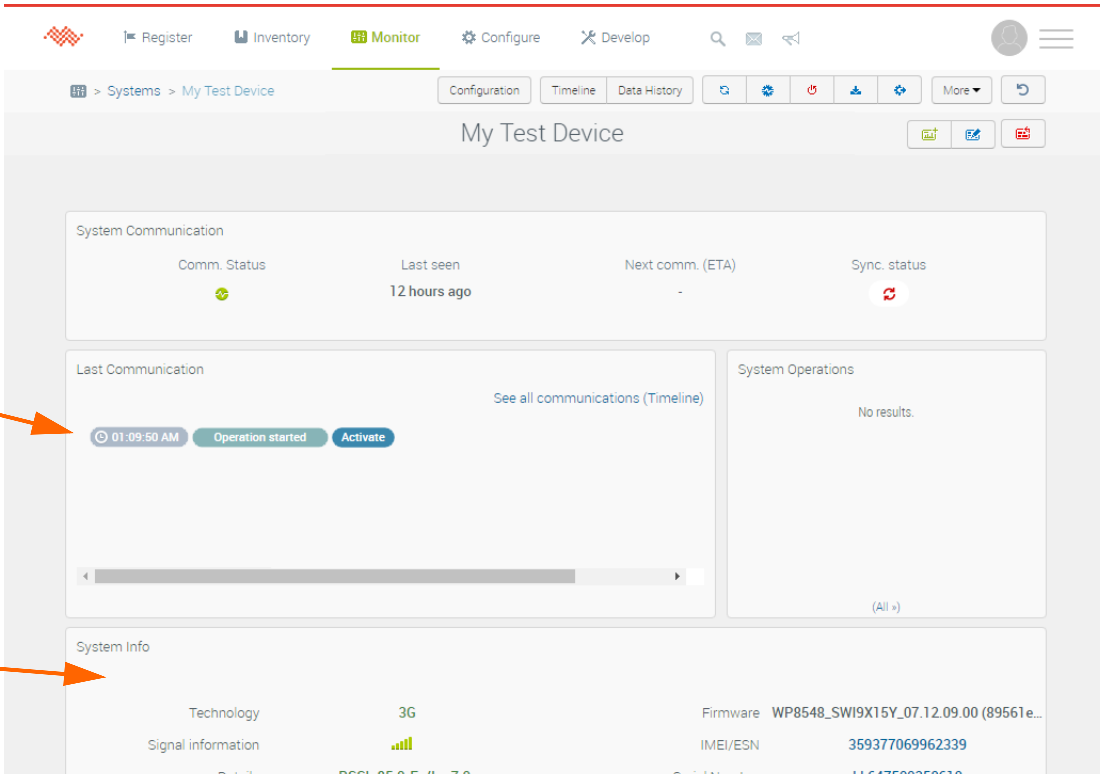
Note: *redSensorToCloud automatically opens a data connection, so you do not need to use "cm data connect".*

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)



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

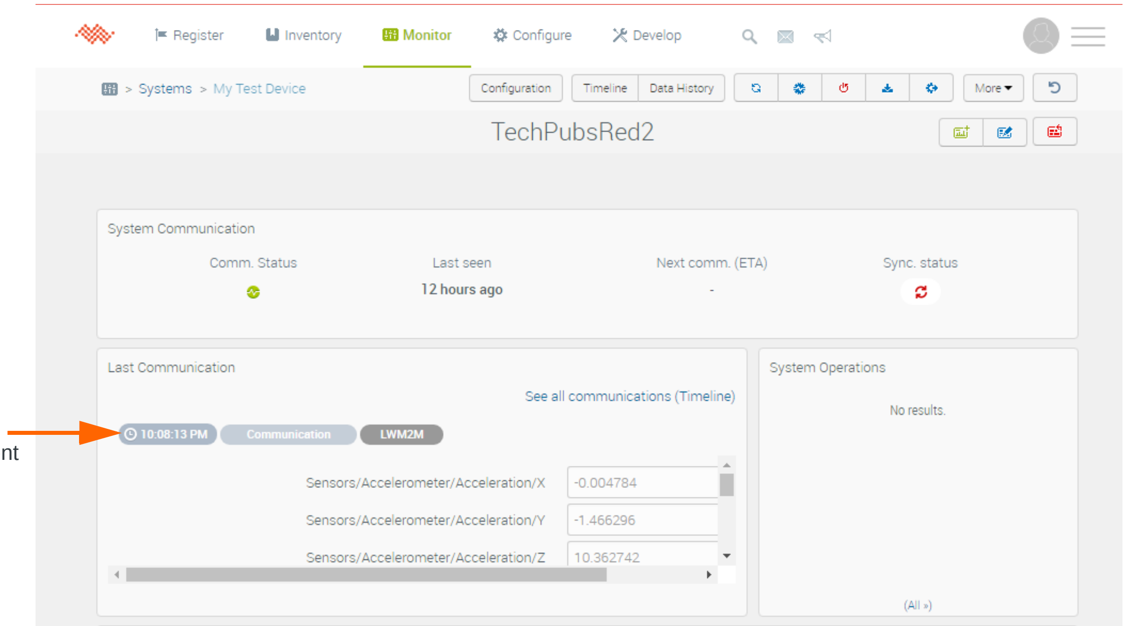
No results.

(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.



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

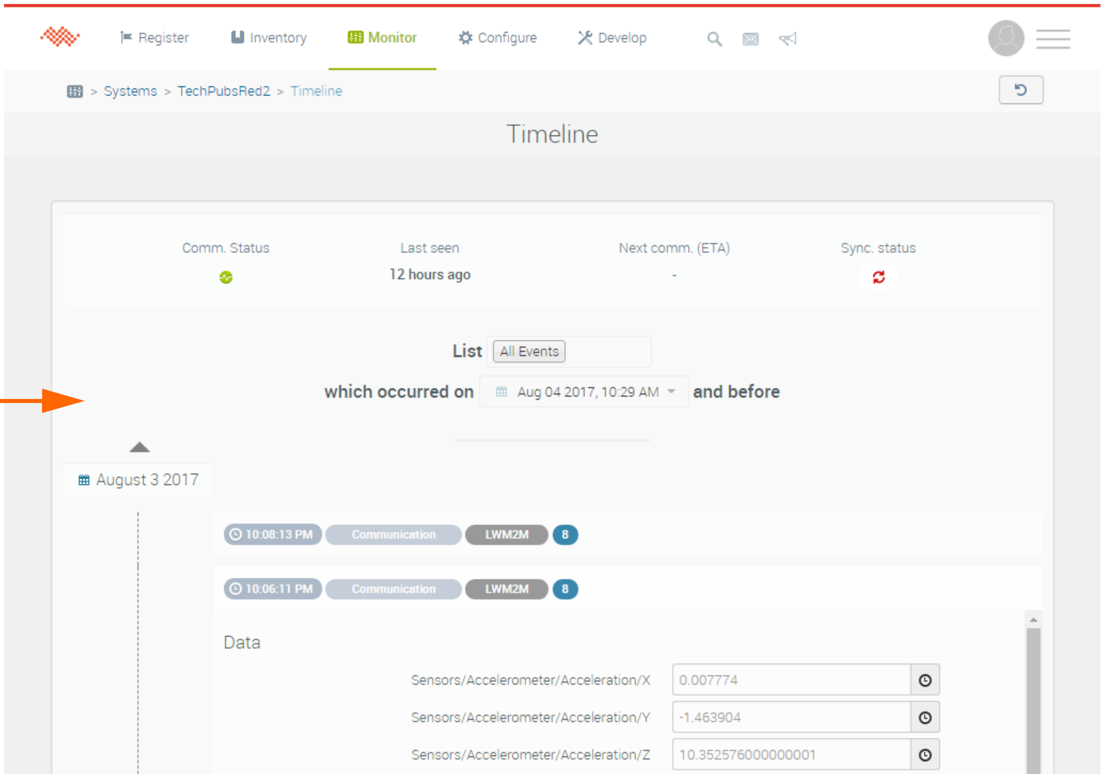
Sensors/Accelerometer/Acceleration/X	-0.004784
Sensors/Accelerometer/Acceleration/Y	-1.466296
Sensors/Accelerometer/Acceleration/Z	10.362742

System Operations

No results.

(All »)

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



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

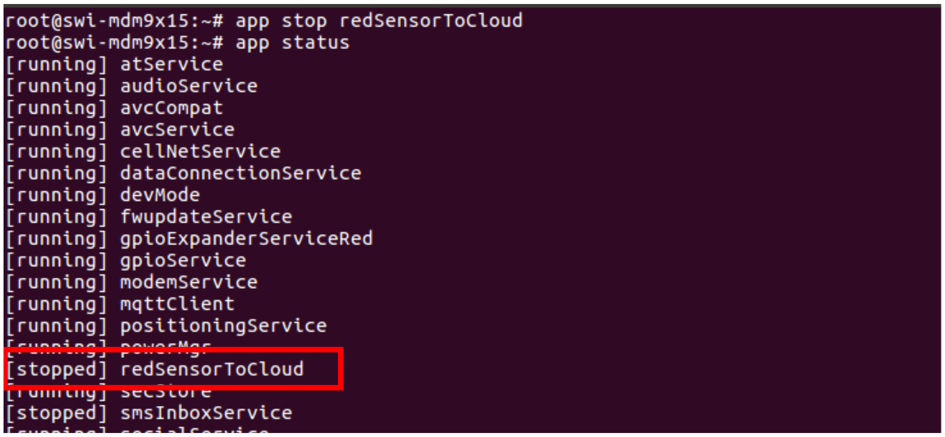
Data

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 Getting Started 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 37.

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.*

Note: *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

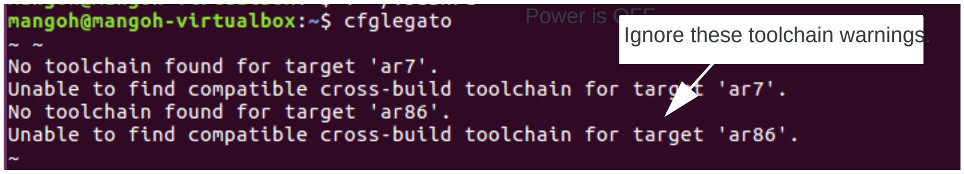
Note: *If you installed Legato to a subdirectory of your home directory using a different name than ’legato’, replace "~/legato" with "~/<yourDirectory>" in the commands in this section.*

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

Each time you open a new terminal window, do the following:

1. Configure the window:

```
$ cfglegato
```

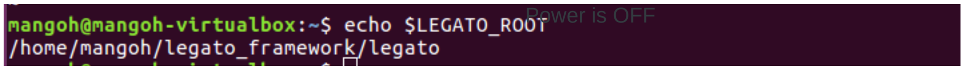


```
mangoh@mangoh-virtualbox:~$ cfglegato
~ ~
No toolchain found for target 'ar7'.
Unable to find compatible cross-build toolchain for target 'ar7'.
No toolchain found for target 'ar86'.
Unable to find compatible cross-build toolchain for target 'ar86'.
~
```

Note: *One thing the command does is check to see which toolchains you have on your development machine and warn 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
   ```



```
mangoh@mangoh-virtualbox:~$ echo $LEGATO_ROOT
/home/mangoh/legato_framework/legato
```

   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 20 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:

   ```
   $ cfglegato
   ```

3. Change directory 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—change directory 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.

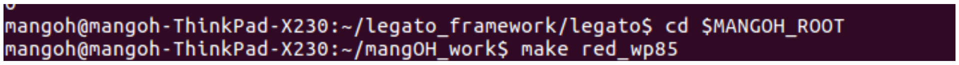
At this point, you have modified the redSensorToCloud application’s source code. Now you have to build (compile) it.

This application was created as part of the mangOH Red platform; to rebuild the application, you will rebuild the whole 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).

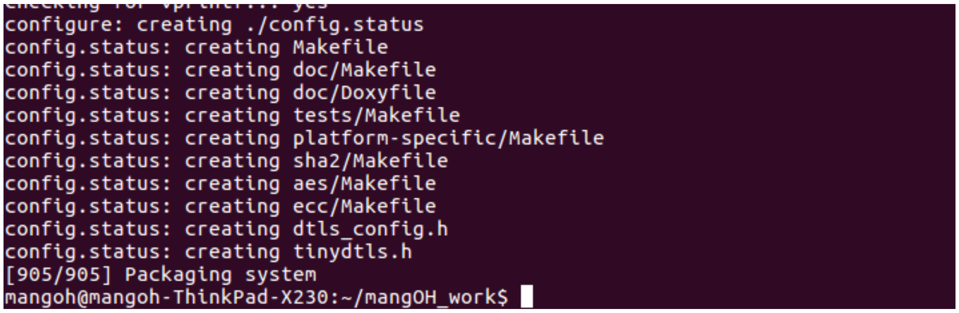
To rebuild mangOH Red platform, including redSensorToCloud with your changes, and install it onto your mangOH Red:

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
```



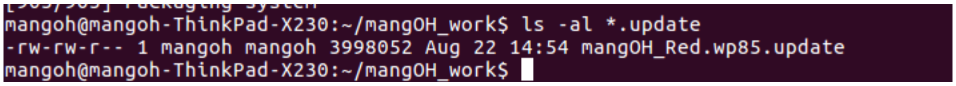
```
checking for vprintf... yes
configure: creating ./config.status
config.status: creating Makefile
config.status: creating doc/Makefile
config.status: creating doc/Doxyfile
config.status: creating tests/Makefile
config.status: creating platform-specific/Makefile
config.status: creating sha2/Makefile
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
```

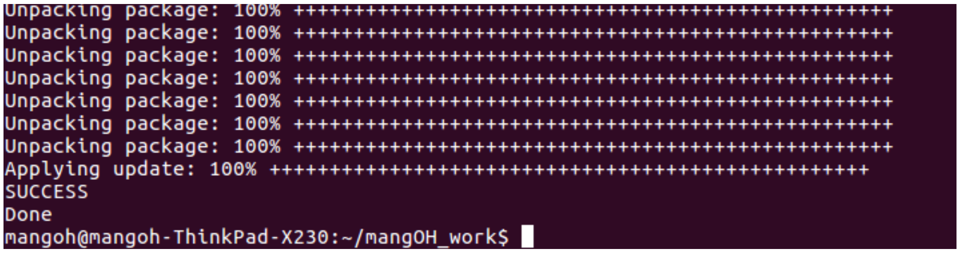
Press Ctrl+C to return to the command prompt.

9. Install the mangOH Red platform 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".

Note: *If the target has any problems starting the mangOH Red platformat applications, it automatically reboots and restores to its original state (prior to the instsys command). If this happens, the target will not be reachable whlie it is rebooting.*



```
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:

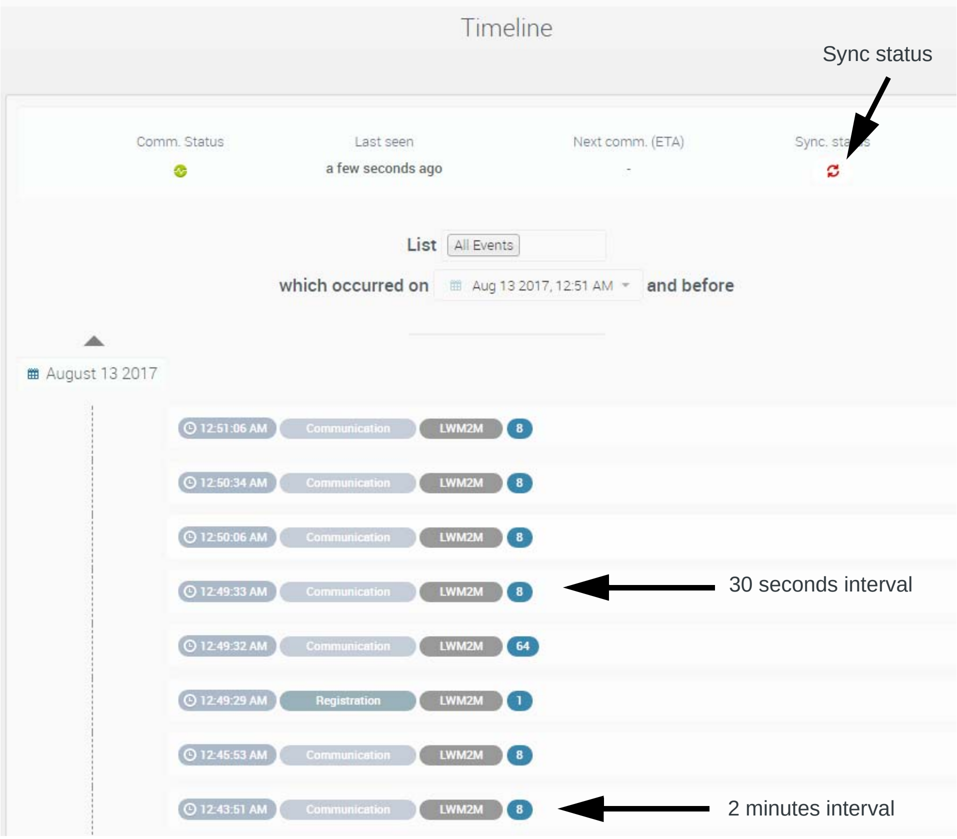
```
$ ssh root@192.168.2.2
```

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 as shown in the following figure. (To see new reports received while this screen is being viewed, click the Sync. status icon.)



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

Sync status

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. Configure the window for development:

```
$ cfglegato
```

3. Change directory to the sample application directory for Hello World:

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

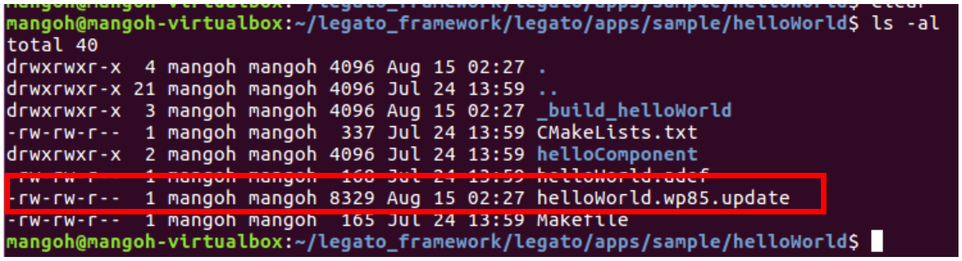
4. Compile the application.

```
$ 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 38.*

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

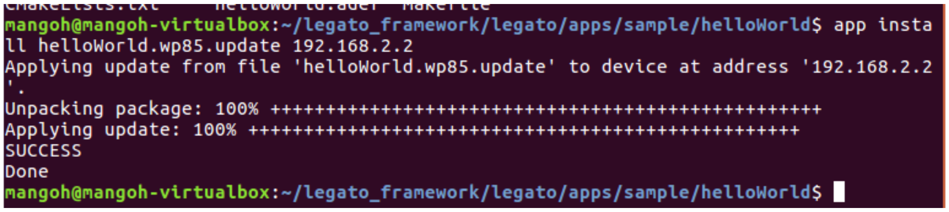
```
$ ls -al
```



```
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
```



```
CMakeLists.txt     helloWorld.adef  Makefile
mangoh@mangoh-virtualbox:~/legato_framework/legato/apps/sample/helloWorld$ app insta
ll 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-virtualbox:~/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:

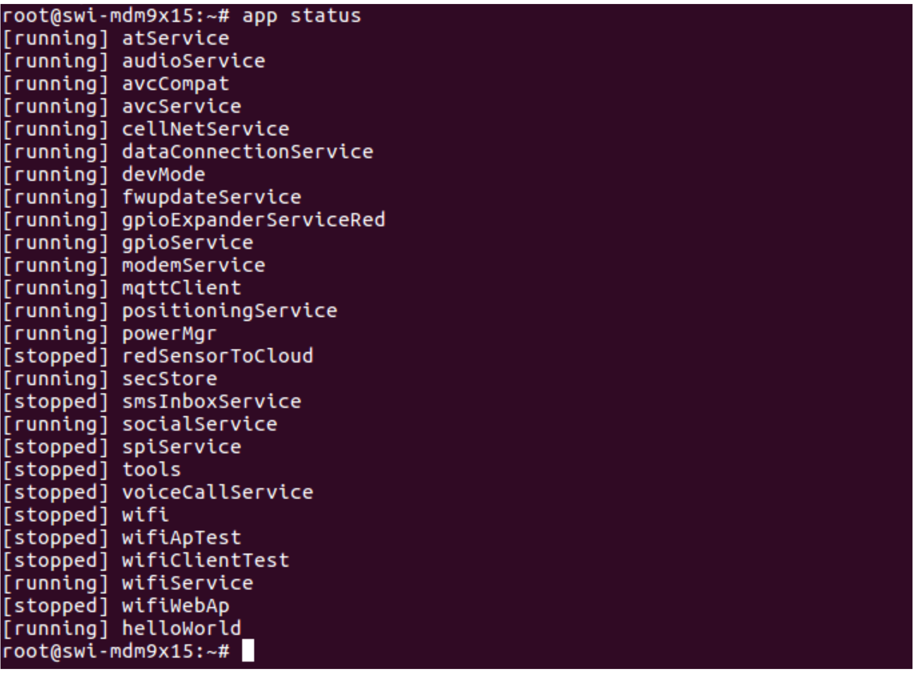
a. Open a terminal window to run the application (referred to as APP_TERM in this procedure).

b. Connect to the target:

```
$ ssh root@192.168.2.2
```

c. Check that the application is installed:

```
# app status
```



```
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:~# 
```

Hello World application

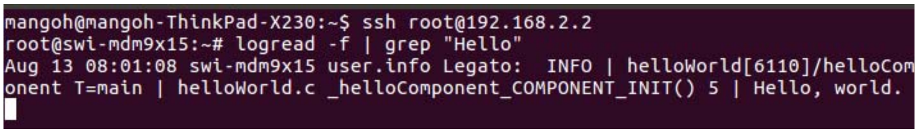
The "hello world" application should appear in the list with a status of ’running’. The application was built to run automatically; when you write your own applications, you can make them install without running, if you prefer.

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:

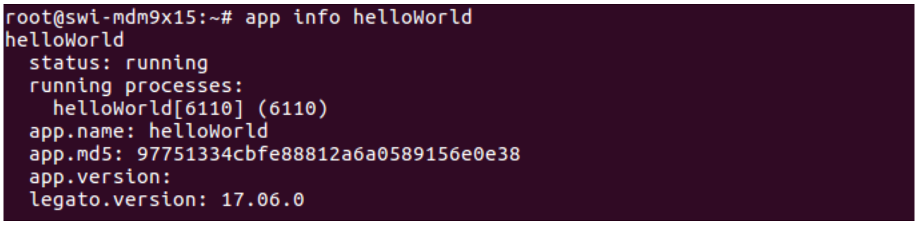
```
# app start helloWorld
```



```
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

The Legato VM that you installed on your dev machine in Download Legato Application Development Image on page 15 was pre-configured with 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

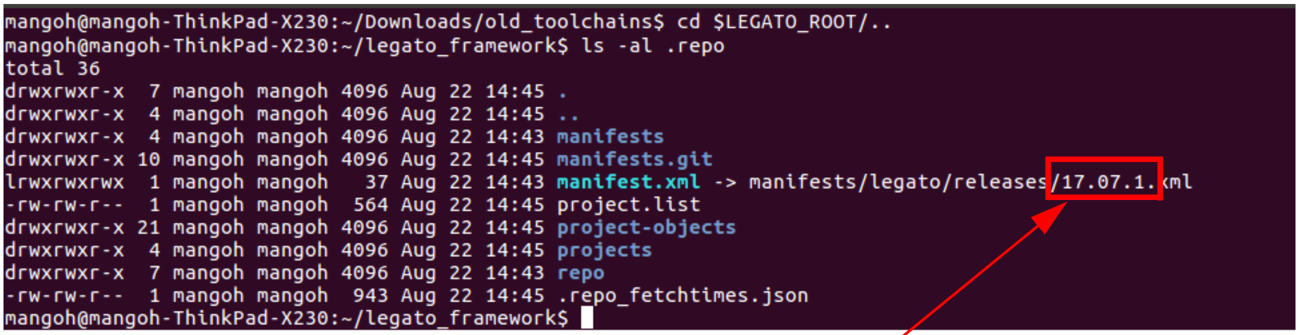
To update the Legato AF in the VM on your dev machine:

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
   ```

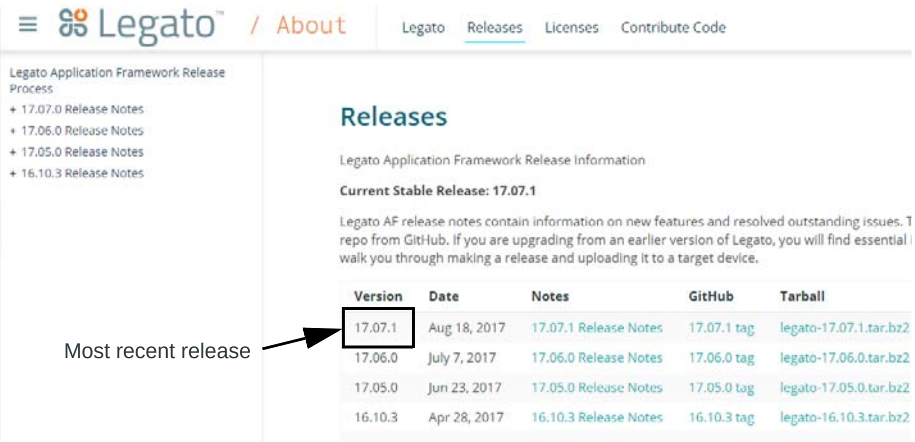


```
mangoh@mangoh-ThinkPad-X230:~/Downloads/old_toolchains$ cd $LEGATO_ROOT/..
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ ls -al .repo
total 36
drwxrwxr-x  7 mangoh mangoh 4096 Aug 22 14:45 .
drwxrwxr-x  4 mangoh mangoh 4096 Aug 22 14:45 ..
drwxrwxr-x  4 mangoh mangoh 4096 Aug 22 14:43 manifests
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 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

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):

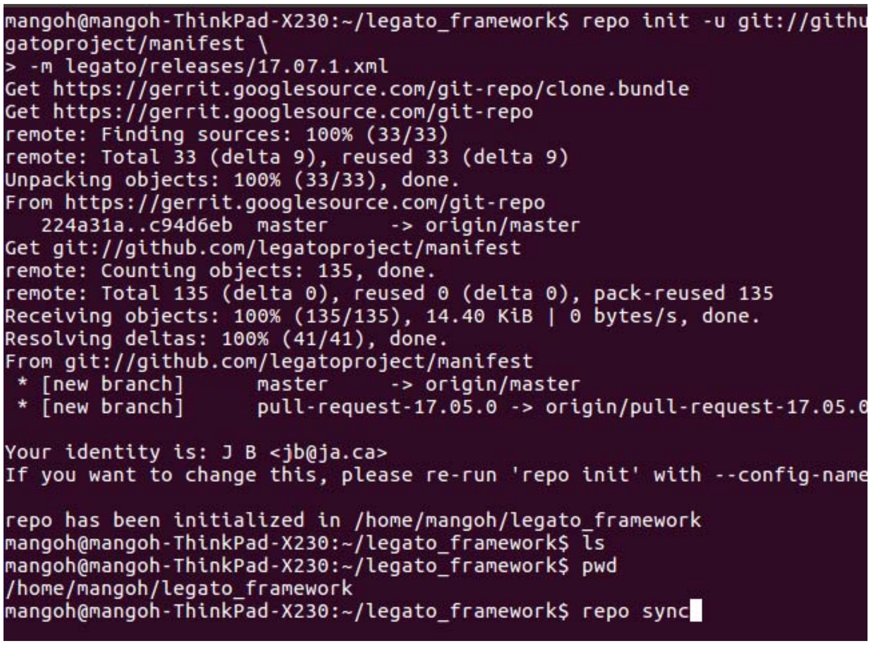
   > **Note:** *Through the rest of this guide, "legato_framework" is assumed to be the file you created. If you used a different name, make sure to use that name in any commands that refer to legato_framework.*

      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 and follow any prompts that may appear:

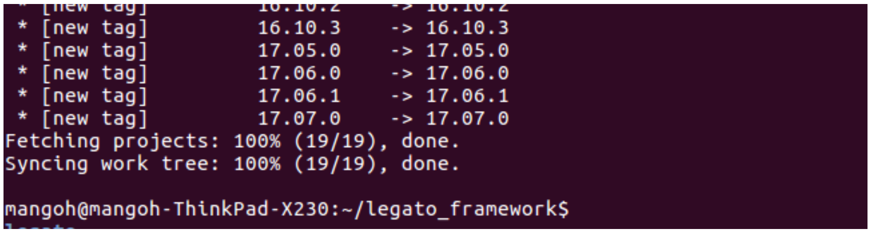
```
$ repo init -u git://github.com/legatoproject/\
        manifest -m legato/releases/17.07.1.xml
$ repo sync
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework$ repo init -u git://githu
gatoproject/manifest \
> -m legato/releases/17.07.1.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: J B <jb@ja.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
```



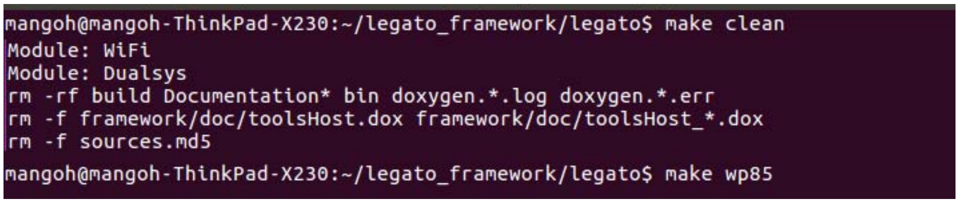
```
 * [new tag]         16.10.2    -> 16.10.2
 * [new tag]         16.10.3    -> 16.10.3
 * [new tag]         17.05.0    -> 17.05.0
 * [new tag]         17.06.0    -> 17.06.0
 * [new tag]         17.06.1    -> 17.06.1
 * [new tag]         17.07.0    -> 17.07.0
Fetching projects: 100% (19/19), done.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

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

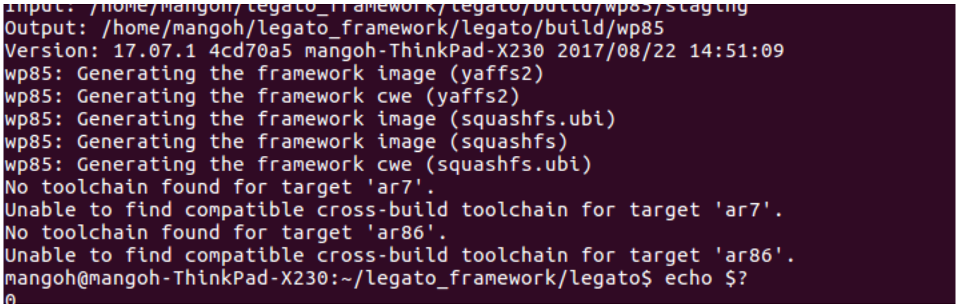
> **Note:** *This may take several minutes to run.*

6. Build and install the Legato AF:

```
$ cd legato
$ make clean     # Optional step to remove clutter from previous builds
$ make wp85      # Build the framework
$ cfglegato      # Set up the environment
```



```
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ make clean
Module: WiFi
Module: Dualsys
rm -rf build Documentation* bin doxygen.*.log doxygen.*.err
rm -f framework/doc/toolsHost.dox framework/doc/toolsHost_*.dox
rm -f sources.md5
mangoh@mangoh-ThinkPad-X230:~/legato_framework/legato$ make wp85
```



```
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.

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 (e.g. WP8548 is a 3G-only module—the APN for the network operator’s 3G network should be used).

Examples:

- Sierra Wireless—internet.sierrawireless.com
- Rogers Wireless—internet.com (GPRS); ltemobile.apn (LTE)
- 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 module’s model, IMEI, FSN (serial number), and firmware and bootloader versions.
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

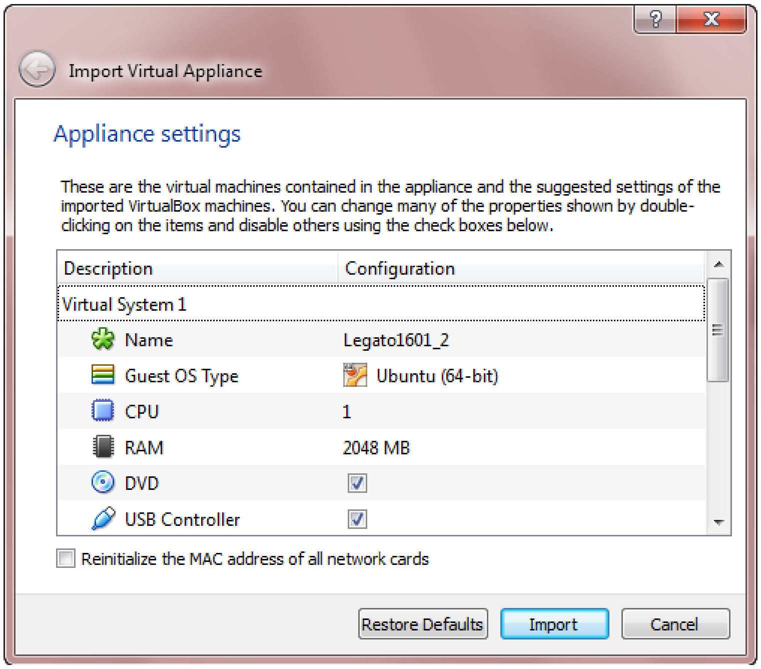
Table C-3: Definitions

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.

C.5 VirtualBox Tips

C.5.1 Modifying resources

When you open a virtual machine (.ova) file, the Import Virtual Appliance window opens, showing the suggesting settings for VirtualBox. Before you click Import to load the VM into VirtualBox, you can adjust the CPU and RAM settings to fine-tune its performance if necessary.



Import Virtual Appliance

Appliance settings

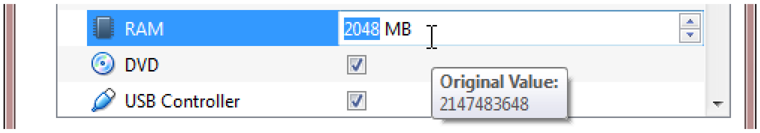
These are the virtual machines contained in the appliance and the suggested settings of the imported VirtualBox machines. You can change many of the properties shown by double-clicking on the items and disable others using the check boxes below.

Description	Configuration
Virtual System 1	
Name	Legato1601_2
Guest OS Type	Ubuntu (64-bit)
CPU	1
RAM	2048 MB
DVD	☑
USB Controller	☑

□ Reinitialize the MAC address of all network cards

To adjust the CPU or RAM value:

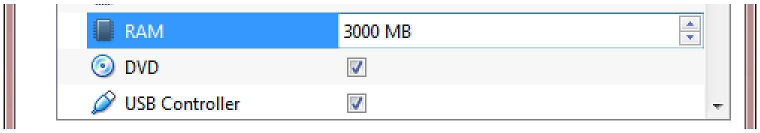
1. Double-click the value.



RAM	2048 MB
DVD	☑
USB Controller	☑

Original Value: 2147483648

2. Type your new value and press Enter.



RAM	3000 MB
DVD	☑
USB Controller	☑

C.6 Enable virtualization on a Windows computer

1. Consult your computer’s BIOS manual (or search online for instructions) to find where your ‘Virtualization’ setting is stored. This may be called “Secure Virtual Machine”, “... Virtualization Technology”, etc., and may be under your Advanced, Config, Security, or CPU options (location varies by computer).

2. If you do not know how to boot directly into your computer’s BIOS, check online for instructions specific to your operating system. Some typical methods include:
   - Windows 7—Reboot the computer and press the appropriate key to go to the BIOS screen (for example, F2, Esc, Del, blue ThinkVantage on Lenovo machines, etc.)
   - Windows 8—Search online for “windows 8.1 bios access” for tips, and add your computer type to the search string to refine your results.
   - Windows 10—See http://acer.custhelp.com/app/answers/detail/a_id/37064/~/windows-10%3A-access-the-uefi-bios for details. You can also search online for “windows 10 bios access” for tips and add your computer type to the search string to refine your results.
3. Reboot the computer and go to the BIOS screen (press F2, Delete, etc.—whichever key is appropriate).
4. Go to the BIOS screen that has the Virtualization setting. This will currently be disabled. Change this to ‘Enabled’.
5. Save and Exit.
6. When the computer boots, open Virtual Box, go to System > Acceleration. and make sure both Hardware Virtualization options are selected.
7. You should now be able to launch the Legato 1604 VM.

D: Hardware Tips

D.1 Dipswitch Settings

The multi-function dipswitch block (SW401) is used to control module signals.

Note: *The 'Default' switch positions are the settings recommended when using this guide.*

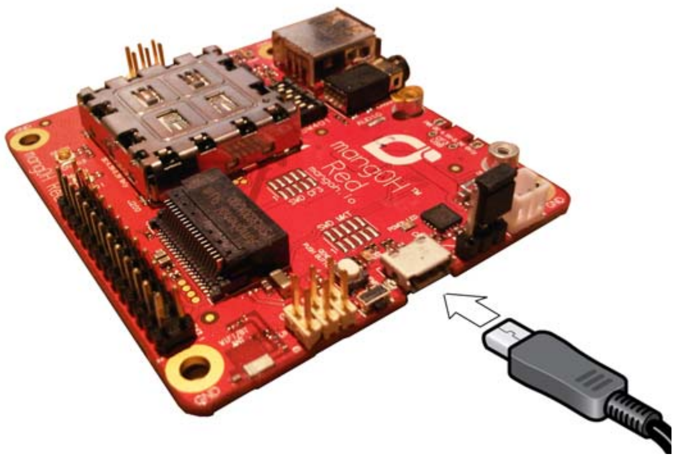
Signal	Dip	On/Off	State
1	PWR_ON	On (Default)	Enable CF3 module's POWER_ON signal
		Off	Disable POWER_ON signal
2	WIFI_UART1_TX	On	Enable CF3 module's firmware download (recovery) mode. Note: *Similar functionality to TP1_BOOT*
		Off (Default)	Normal operation
3	VCC_3V7_ULPM	On (Default)	While in ULPM, sensors receive power
		Off	While in ULPM, sensors are not powered
4	HL_MODE	On	When combined with LowPower_RESET, indicates that board is in HL mode.
		Off (Default)	When combined with LowPower_RESET, indicates that board is in WP mode.
5	BATT_TS+	On (Default)	Enable backup battery charging.
		Off	Disable backup battery charging.
6	CONS_DIR	On	Console USB connector accesses the Wi-Fi/Bluetooth module's console. Note: *To download firmware to the Wi-Fi module, set CONS_DIR OFF and WIFI_UART1_TX ON.*
		Off (Default)	Console USB connector access the CF3 module's console.
7	TP1_BOOT	On	Enable CF3 module's TP1 (boot) signal functionality. Pull the signal low to enter download mode for firmware updates.
		Off (Default)	CF3 module functions normally.
8	LowPower_RESET	On (Default)	When combined with HL_MODE, indicates that board is in WP mode.
		Off	When combined with HL_MODE, indicates that board is in HL mode.

E: Console Access

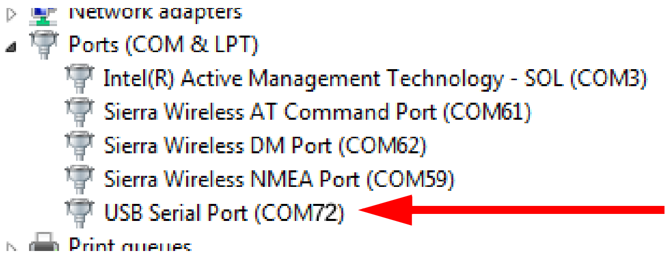
If you have two USB ports on your dev machine, you can use one of them to display the mangOH Red's diagnostic messages when the device boots, when certain commands are run, etc.

To set up a window to display diagnostic messages:

1. Use a micro-USB cable to connect the mangOH Red's CONSOLE USB port to a USB port on the dev machine.

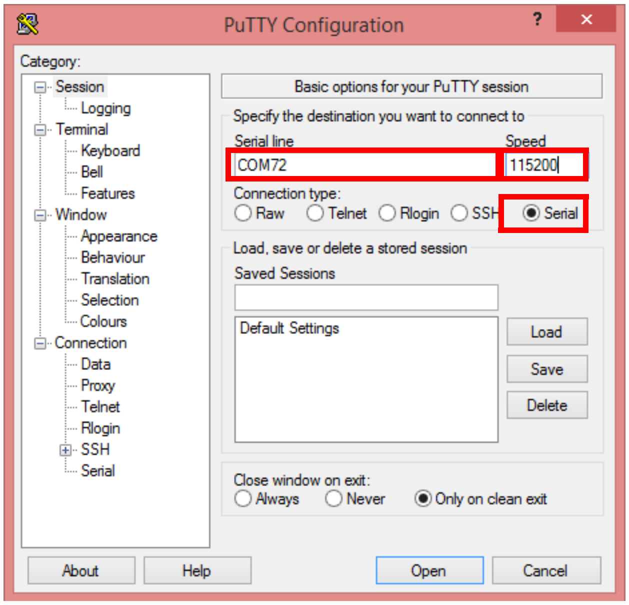


2. Open a terminal window connected to the target's Linux console as follows:
   a. Open Windows Device Manager, then expand Ports (COM &LPT) and check which COM port is used for the USB Serial Port.



```
▷ Network adapters
◢ Ports (COM & LPT)
    Intel(R) Active Management Technology - SOL (COM3)
    Sierra Wireless AT Command Port (COM61)
    Sierra Wireless DM Port (COM62)
    Sierra Wireless NMEA Port (COM59)
    USB Serial Port (COM72)
▷ Print queues
```

   b. Open a terminal window (e.g. PuTTY) connected to the mangOH Red's console using the following settings:
      - Connection type = Serial
      - Serial line = [USB Serial port COM port]
      - Speed = 115200



Specify the destination you want to connect to

Serial line: COM72

Speed: 115200

Connection type: ○ Raw ○ Telnet ○ Rlogin ○ SSH ● Serial

Saved Sessions

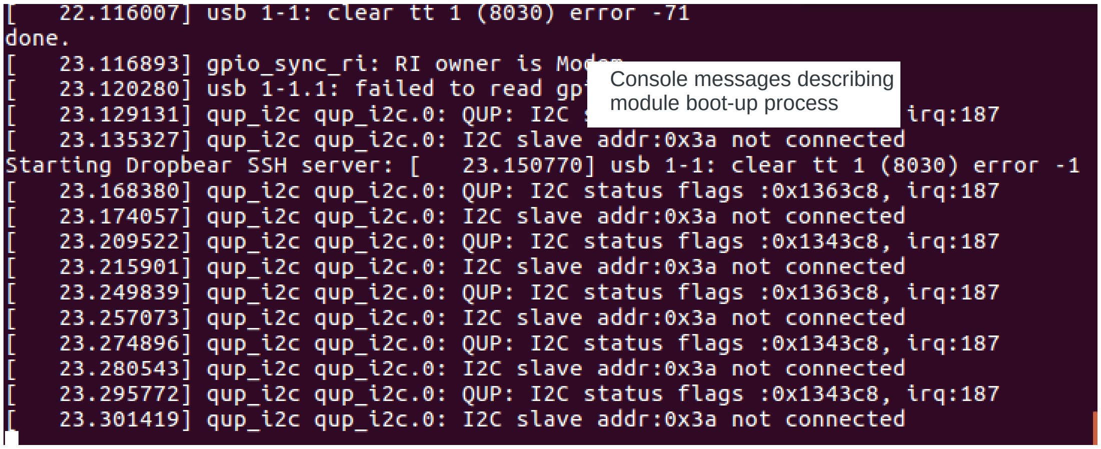
Close window on exit: ○ Always ○ Never ● Only on clean exit

c. Click Open. The window will remain empty until you power up the mangOH Red in the next step.

Note: *Only one console connection can be opened at any time since it locks the USB serial port.*

Example

If you open the console terminal window before you connect power to the mangOH Red, you will see the messages that are generated during the module boot process:



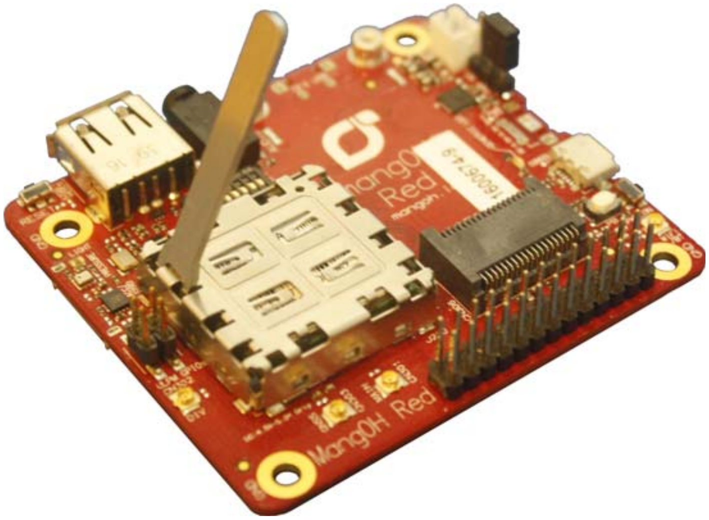
```
[   22.116007] usb 1-1: clear tt 1 (8030) error -71
done.
[   23.116893] gpio_sync_ri: RI owner is Modem
[   23.120280] usb 1-1.1: failed to read gp
[   23.129131] qup_i2c qup_i2c.0: QUP: I2C s                  irq:187
[   23.135327] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
Starting Dropbear SSH server: [   23.150770] usb 1-1: clear tt 1 (8030) error -1
[   23.168380] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1363c8, irq:187
[   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, irq:187
[   23.215901] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
[   23.249839] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1363c8, irq:187
[   23.257073] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
[   23.274896] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1343c8, irq:187
[   23.280543] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
[   23.295772] qup_i2c qup_i2c.0: QUP: I2C status flags :0x1343c8, irq:187
[   23.301419] qup_i2c qup_i2c.0: I2C slave addr:0x3a not connected
```

F: Removing/Inserting a CF3 Module

F.1 Removing a CF3 module

To remove a CF3 module from the mangOH Red:

1. Remove the module cover using the module cover removal tool—Starting at one corner, insert the tool in the pair of holes and carefully pry the cover away from the module.
2. Repeat at the other locations (pairs of pry holes are on each side).

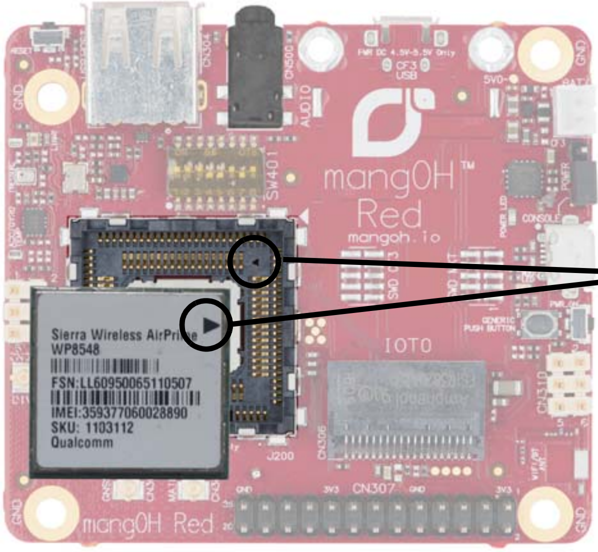


3. Lift the cover off the module.
4. Carefully lift the module straight up out of the socket.

F.2 Inserting a CF3 module

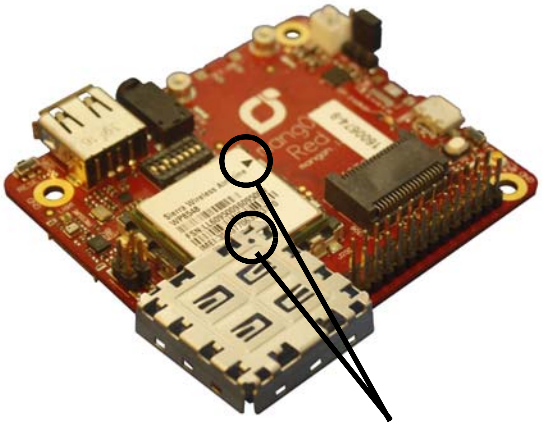
To insert a CF3 module on the mangOH Red board:

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!)

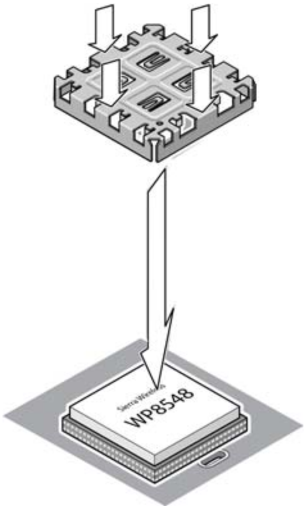


The triangle on the label matches the position of the triangle on the socket.

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.



G: Quick Reference—Commands in this Guide

The following table contains a list of the commands that are used in this guide with explanations of their purposes.

Table G-1: Commands Used in the Getting Started Guide

Command	Description
app install <update_file> <ip_address>	Install the specified file on the device at <ip_address>.
app start <appname>	Start (run) the specified application
app status	Display the status (running/stopped) of all installed applications.
app stop <appname>	Stop the specified application
cd <directory>	Change directory to the specified <directory> Note: '~' is an alias of the user's home directory.
cfglegato	This is an 'alias' that you set up in your ~/.bashrc file. The .bashrc is a startup script that runs each time a new terminal window is opened. This is a shortform command to run the longer series of commands needed to go to the Legato AF directory and set up the environment variables used for Legato development.
cm Refer to http://legato.io/legato-docs/latest/toolsTarget_cm.html for more details and command options.	
cm data	Display current connection status details (information about the current profile).
cm data apn	Show the APN value currently being used for the SIM card.
cm data apn <APN>	Set the APN value to use for the SIM card.
cm data connect	Start a mobile network data connection.
cm data connect -1	Stop the mobile network data connection.
cm data pdp ipv4	Set the IP addressing method to IPv4.
cm info	Display the module's model, IMEI, FSN (serial number), and firmware and bootloader versions.
cm radio	Display the power status of the CF3 module's radio (ON/OFF).
cm radio on	Power on the CF3 module's radio.
cm sim info	Display information about the SIM.
echo <parameter>	Display the <parameter> information. e.g.: • echo $?—Display the error code returned by the previous command (typically, '0' indicates the previous command completed successfully (no errors)) • echo $LEGATO_ROOT—Display the pathname held in the LEGATO_ROOT environment variable.
exit	Close the terminal window

Table G-1: Commands Used in the Getting Started Guide (Continued)

Command	Description
git pull	Retrieve any updates that have been made to the revision history of the remote git repository, and merge the current (local) branch with the corresponding remote branch.
git submodule init	Update the git configuration with any new submodules added recently.
git submodule update	Check out the version of the submodule specified by the current version of the parent repository.
instsys <update_file> <ip_address>	Install the specified file on the device at <ip_address>
logread -f | grep "Hello"	Print any new syslog messages that contain the string "Hello"
ls -al <files>	List details about the identified <files>.
make <target_list>	Build the programs for each listed target. Targets are named after module types and other unique features. e.g.: • wp85—Build for wp85 modules • wp750x—Build for wp750x modules • red_wp85—Build for wp85 modules used in mangOH Red boards • green_wp85—Build for wp85 modules used in mangOH Green boards.
make clean	Remove ’build artifacts’ (clutter left over from previous builds)
mv <file> <destination>	If <destination> is an existing directory name, move the <file> into that directory. Otherwise, rename the <file> using the <destination> name.
ping <ip_address>	Test the connection between the device and the a network host at <ip_address>.
repo init -u git:<path> -m <manifest>	First, clone the manifest repository indicated by ’-u’ option (e.g. git://github.com/legatoproject/manifest). Then use the <manifest> located in that cloned repository to clone and check out the specified version of each repository in the manifest.
repo sync	Get the latest updates for all git repositories and perform all updates allowed by the manifest.
ssh root@<ip_address>	Log in as the root user to the device at <ip_address>.