mangOH™ Green

mangOH Fundamentals—Windows (Linux VM) + Legato CLI

4118961-WinCLI
Rev 4
Contents subject to change

Important Notice

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

Limitation of Liability

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

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

Patents

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

Document details

Title: mangOH Green User Guide

Author: Sierra Wireless

Source: http://mangoh.io/

Copyright

Disclaimer

Indicate any modifications made to the original document.

Trademarks

mangOH™ and the mangOH logo are trademarks of Sierra Wireless.

Other trademarks are the property of their respective owners.

Revision History

Revision number	Release date	Changes
1	April 2016	Document created
2	April 2016	Identified alternate methods of accessing attachments in main document introduction.
3	June 2016	Added steps in procedures in Prepare your computer for Legato development on page 13 to optionally download newer installation files from mangoh.io. Added link to legato AirVantage tutorial at end of Connect to AirVantage on page 31
4	June 2016	Updated Ubuntu version and Legato version references to 16.04. Updated Developer Studio procedures to reflect latest build (behavior when Welcome screen closes, and behavior when creating new project). Updated Install Required Packages procedure step for installing dependencies—replaced java8-runtime with openjdk-8-jre, and removed steps describing using user-defined directory names for legato.

Contents

1: Getting Started

Now that you have your mangOH Green, it's time to start using it.

When you finish this tutorial, you will know how to assemble the mangOH Green, prepare your computer for Legato development, and develop, install, and run applications on the mangOH Green, and connect to the IoT Cloud via AirVantage, which is Sierra Wireless' cloud-based services platform for over-the-air (OTA) device management.

Tip: *If you have only one monitor, you may want to print this document and use it when you don't want to switch back and forth between the PDF and the various windows/applications you'll be opening during the tutorial.*

This tutorial includes:

Note: This tutorial includes instructions for Windows® computers using the Legato CLI (character interface).

Important: *To get maximum benefit from this tutorial, you are strongly recommended to carefully follow the procedures as described, since the tutorial continually builds on earlier procedures and results. If you skip steps or use alternate methods, you may encounter difficulty completing the tutorial.*

2: Before you begin

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

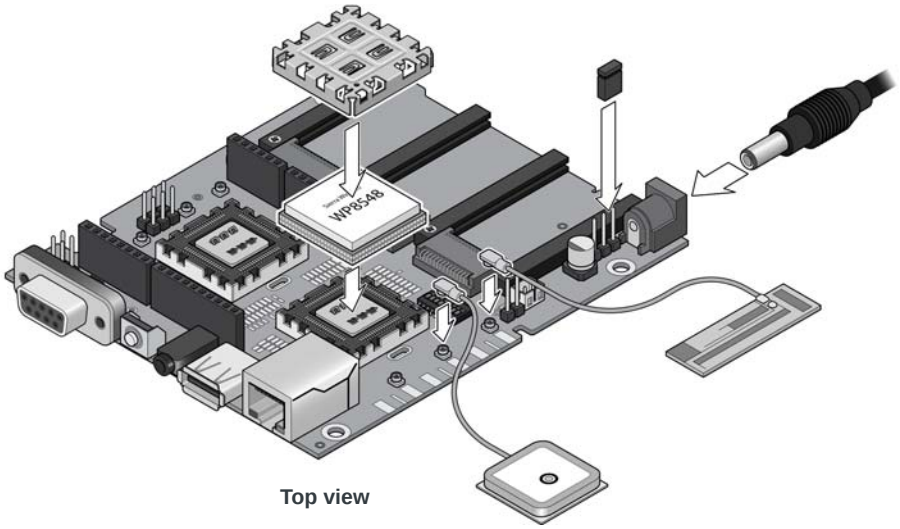
- Make sure your computer meets the requirements for Legato development. See Table 4-1, Minimum System Requirements, on page 13.
- A few terms:
  - “CF3”—The mangOH Green supports CF3 (Common Form Factor) embedded modules, such as the WP8548.
    Throughout this tutorial,”CF3” is used to refer to the module that comes with your mangOH Green kit.
  - In this tutorial, the ‘host’ is your computer, and the ‘target’ is the CF3 module in your mangOH Green.
- Some symbols used in this document:
  - Shell (console) commands are shown with a symbol before the command:
    - ‘$’—Command is entered on the Linux virtual machine
    - ‘#’—Command is entered on the target (the CF3 module in your mangOH Green)
    - ‘>’—Command is entered on the Windows host (your computer)
  - ‘~’ and “$HOME” both represent your ‘home directory’ in Linux
- Passwords, etc:
  - CF3 module:
    - USB ECM IP address—192.168.2.2
    - User name—root
    - Password—<none>
  - The Linux virtual machine’s legato User password is “legato”. You will need to use this to unlock the VM if you manually lock it.

3: Set up your mangOH Green

In this section, you will see how to connect the basic components of your mangOH Green that are needed to begin using it for developing applications.

Your mangOH Green kit comes with the basic parts you need to set up and begin developing applications:

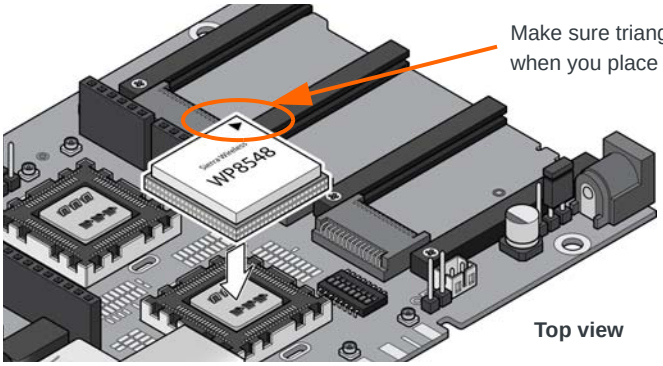
- mangOH Green board
- CF3 (Common Form Factor) module, cover, and release tool
- micro-USB cable
- AC adapter
- Antennas (main and GNSS)
- USB Flash drive (adapter with microSDHC card), pre-loaded with Linux and Windows installation files (Note: For the latest installation files, visit mangoh.io/getting-started.)



Top view

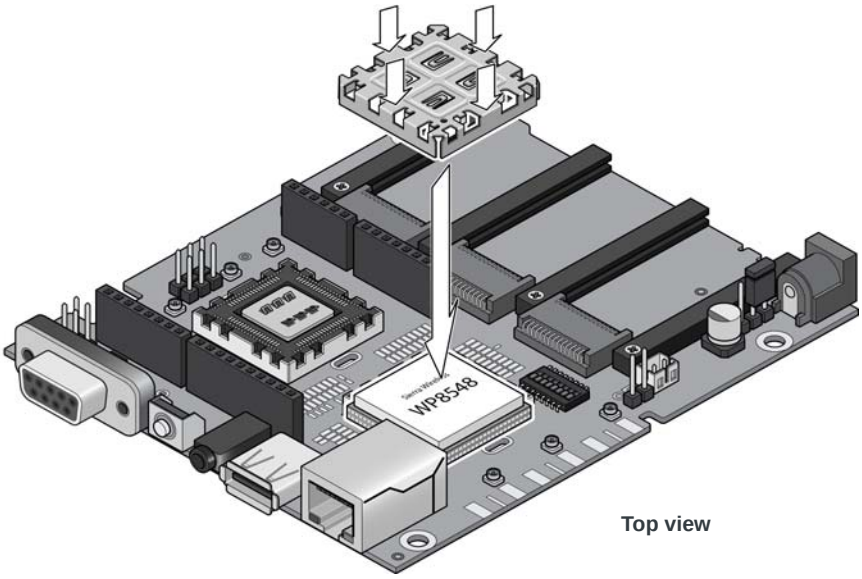
To set up the mangOH Green with these components:

1. Insert the CF3 module in the primary slot as shown. (Position matters!)



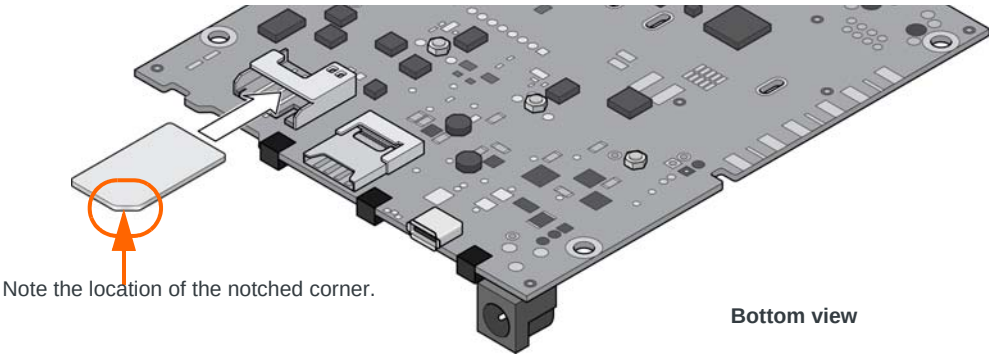
Top view

2. Place the cover over the module and press it (on the edges) in to place.



Top view

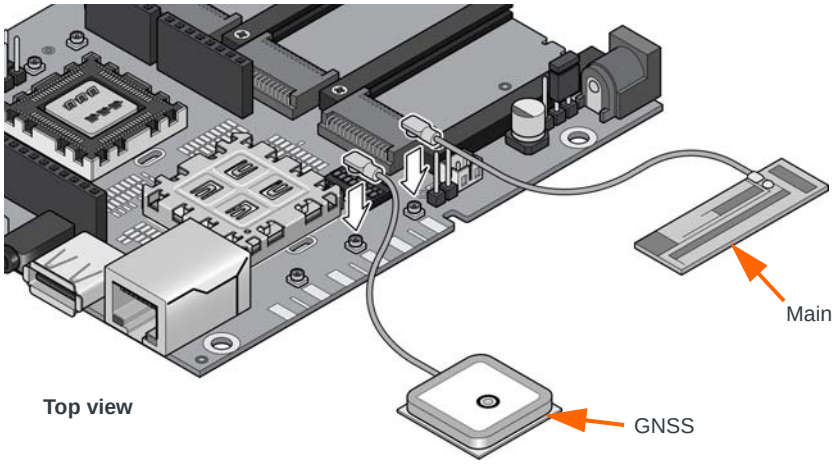
3. If you have a mini-SIM that has been activated by a mobile network provider, insert it in the appropriate slot on the bottom side of the mangOH Green. (micro-SIM support is forthcoming.)
(Note: The SIM is needed if you want to connect the mangOH Green to a mobile network later in the tutorial. You can continue the tutorial without a SIM until Connect To Mobile Networks on page 24.)



Bottom view

4. Attach the antennas.

   (Note: The main antenna is required if you want to connect the mangOH Green to a mobile network in Connect To Mobile Networks on page 24. The GNSS antenna is not used in this tutorial.)

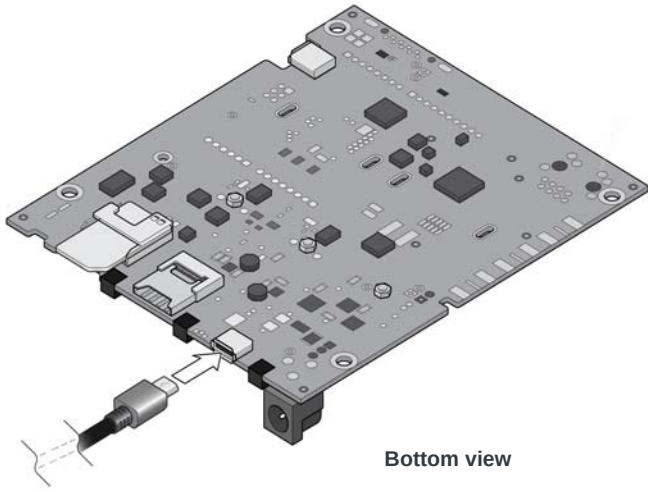


Top view

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

5. Load the USB drivers for your mangOH Green as follows:
   a. Plug the USB drive into your computer.
   b. In Windows Explorer, navigate to the Windows folder on the USB drive.
   c. Run (double-click) DriverSetup.exe and follow the prompts to install USB drivers for mangOH Green.
6. Connect the mangOH to your computer with the micro-USB cable.

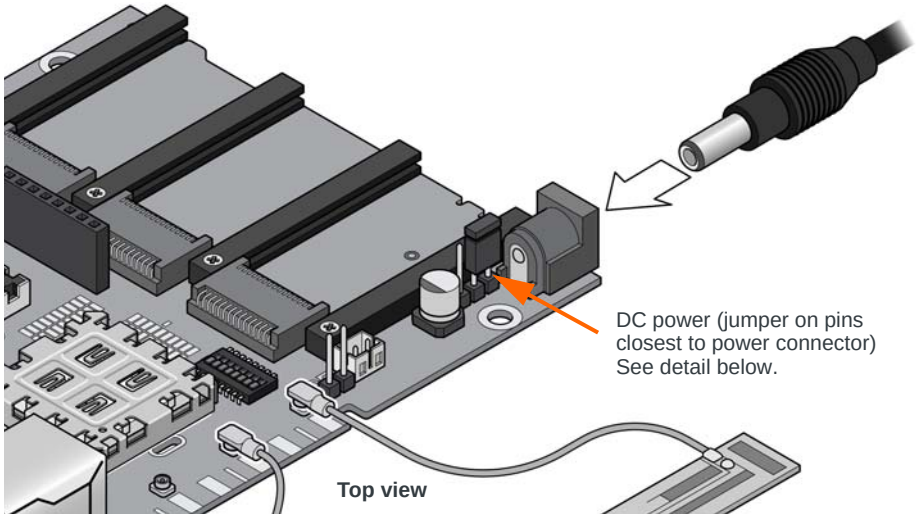
Computer



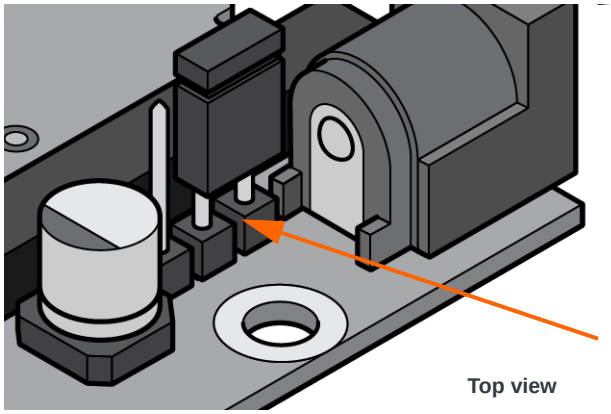
Bottom view

7. Power up the mangOH using the power adapter or micro-USB cable:
   - Using the power adapter

     Move the power select jumper to select DC power, if required. (Note: The board comes with DC power selected).



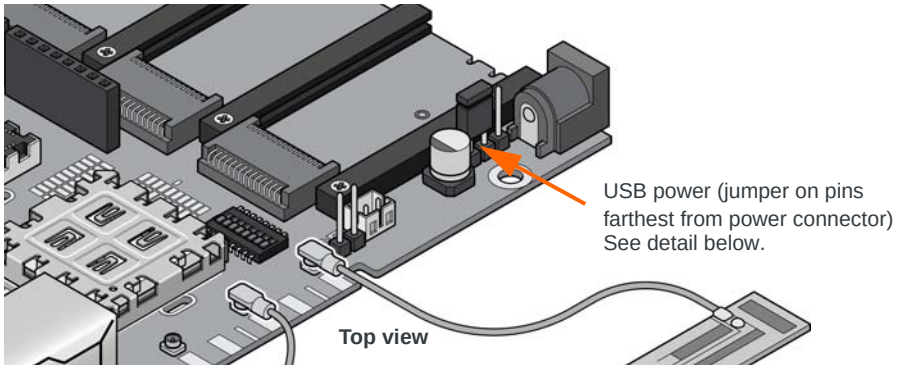
Top view

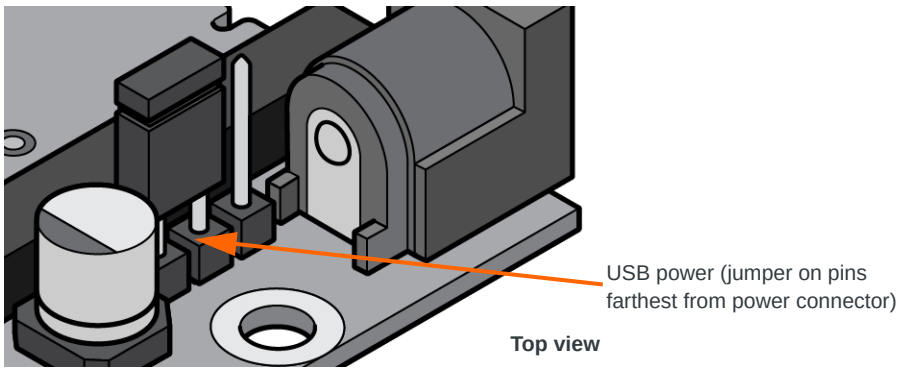


Top view

- Using USB

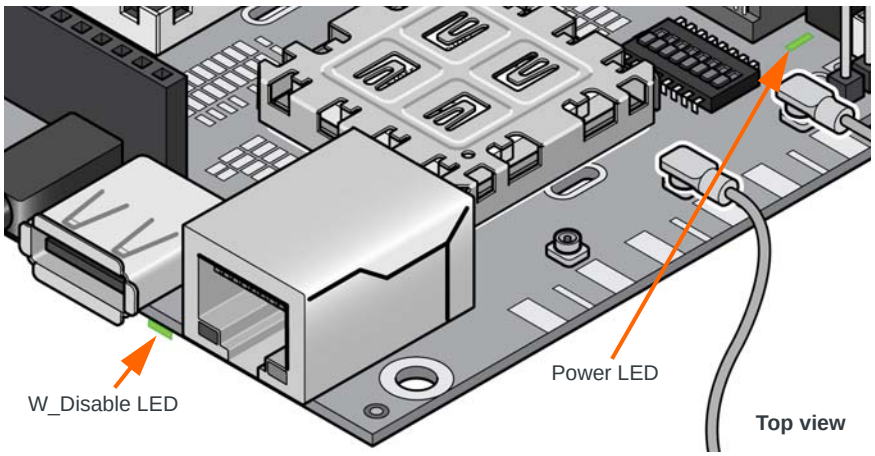
  Move the power select jumper to select USB power, if required. (Note: The board comes with DC power selected).





When the mangOH is powered:

- The Power LED turns on immediately—The mangOH is working.
- The W_Disable LED turns on as the CF3 module tries to connect to the mobile network (the CF3 module will not be able to connect until you set up the APN in the next tutorial)



Now you are ready to Prepare your computer for Legato development on page 13.

4: Prepare your computer for Legato development

In this section, you will prepare your Linux or Windows computer for application development by installing the Legato development environment and any required applications or packages.

4.1 System requirements for using Legato

To install and use Legato, your computer must meet the requirements below.

Table 4-1: Minimum System Requirements

	Windows
O/S	Windows 7 and higher
CPU	Dual core @ 2.6 GHz
RAM	4 GB
HDD	10 GB free space

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

Use your Legato installation USB drive to prepare your Windows computer for the Legato development environment.

Note: The USB drive pre-loaded with Windows installation files. You can use these files, or visit mangoh.io/getting-started to check whether there is a newer version available to download.

Note: The Legato development environment runs natively on a Linux computer, or in a Linux virtual machine on a Windows computer. Performance on a Windows computer will be decreased (typically) due to the overhead of running the virtual machine, but functionality is the same on both computer types.

4.2 Prepare a Windows computer

To use your Windows computer for Legato development, you must:

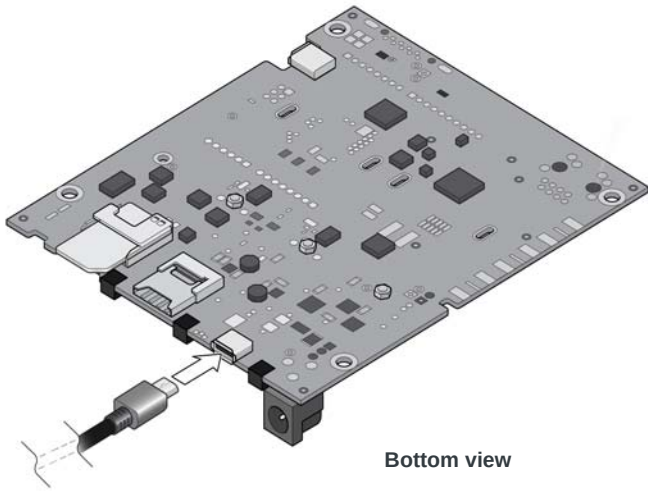
- Connect the mangOH Green to your computer on page 14
  Install the USB drivers for mangOH Green (if not already done), which lets your computer enumerate (recognize) the mangOH Green, and optionally install the PuTTY SSH client, which Windows uses to connect to the mangOH Green.

- Install Oracle VirtualBox on page 15
  Install the VirtualBox 'software virtualizer', which is used to run virtual machines (VMs), and import a Ubuntu Linux VM that is pre-configured for Legato development.

4.2.1 Connect the mangOH Green to your computer

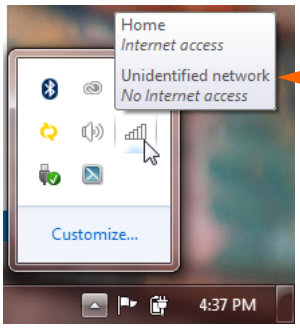
1. Prepare to use the appropriate Windows installation files:
   - If you will be using the installation files on the USB drive (that is, you are not downloading a newer version from mangoh.io):
     i. Plug the USB drive into your computer.
     ii. (Optional for this tutorial) The USB drive contains a microSD card that can be re-used (after this tutorial) in the mangOH Green. Before you re-use the card, you should backup the Windows folder from the USB drive to a local directory, in case you need to re-install the files on this computer or install on another computer. (Note: This may take several minutes.)
   - If you are downloading a newer version of the installation files from mangoh.io:
     i. Download the windows zip archive from mangoh.io/getting-started.
     ii. Extract the archive to a local directory.
2. If you have not installed the mangOH Green USB drivers yet (back in Set up your mangOH Green on page 8), load them now. In Windows Explorer:
   a. Navigate to the Windows folder on the USB drive, or to the local directory where you copied/extracted the files.
   b. Run (double-click) DriverSetup.exe and follow the prompts to install USB drivers for mangOH Green.
3. Test the USB connection to the mangOH Green:
   a. If not already connected, connect the computer to the mangOH Green using the micro-USB cable.

Computer



Bottom view

b. Wait until the device has enumerated (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.

4. You need to have a terminal emulator that supports SSH on your computer, which will be used to connect to the mangOH Green. If you do not have one (or are not sure), you can install the PuTTY SSH client that is included on the USB drive:

a. In Windows Explorer, navigate to the Windows folder on the USB drive, or to the local directory where you copied/extracted the files.

b. Run (double-click) the PuTTY installer file (putty-0.67-installer or similar) and follow the prompts to install the client.

Your mangOH Green is now connected to your computer. Continue preparing your computer by installing Oracle VirtualBox.

4.2.2 Install Oracle VirtualBox

1. In Windows Explorer, navigate to the Windows folder on the USB drive, or to the local directory where you copied/extracted the files.

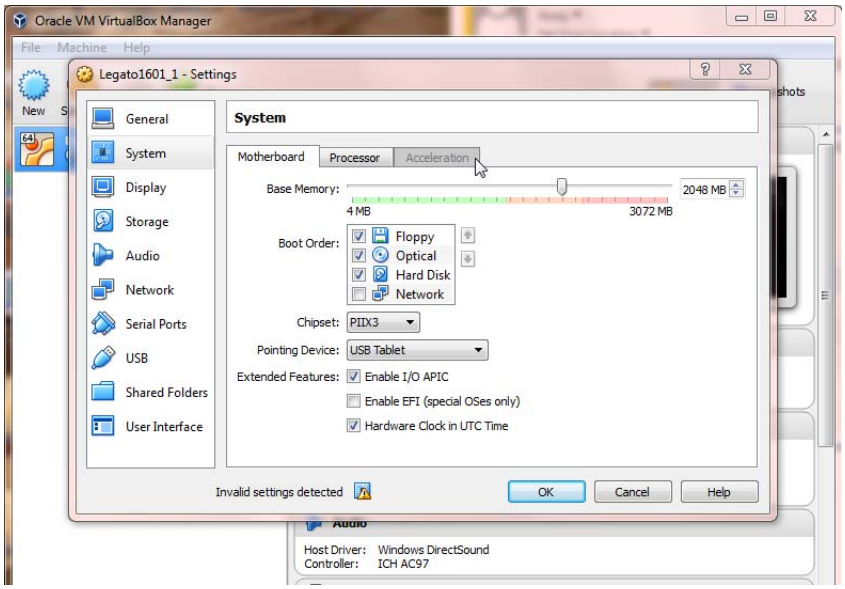
2. Run (double-click) the VirtualBox installer file (VirtualBox-5.0.16-105871-Win or similar) and follow the prompts. Default settings will work, but you can modify them if you prefer. (See VirtualBox Tips on page 36 for details.)

VirtualBox will open when it finishes installing. (Note: VirtualBox appears in your Start menu as “Oracle VM VirtualBox”.)

3. Check whether your computer has virtualization enabled (which allows you to run the Linux VM):

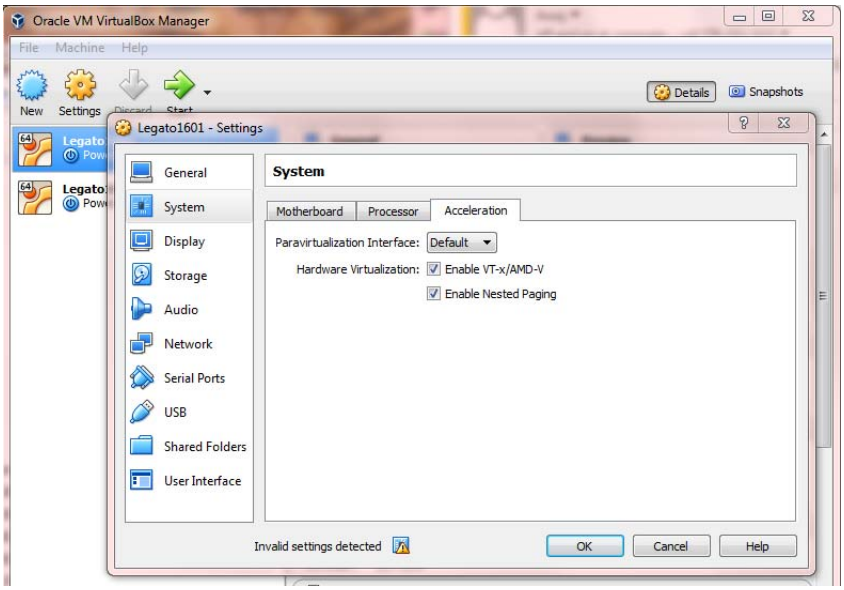
a. In the VirtualBox window, click Settings. The Settings window appears.

b. Select System.



c. Try to select Acceleration:

- If Acceleration cannot be selected (grayed out):
  - **i.** You must enable virtualization in your computer's BIOS. See A.6 Enable virtualization on a Windows computer on page 37 for details.
  - **ii.** After you reboot, launch VirtualBox from your Start menu, and repeat Step c.
- If Acceleration can be selected:
  - **i.** Make sure both Hardware Virtualization options are selected.
  - **ii.** Click OK.



Oracle VirtualBox is now installed and ready to have a virtual machine loaded into it.

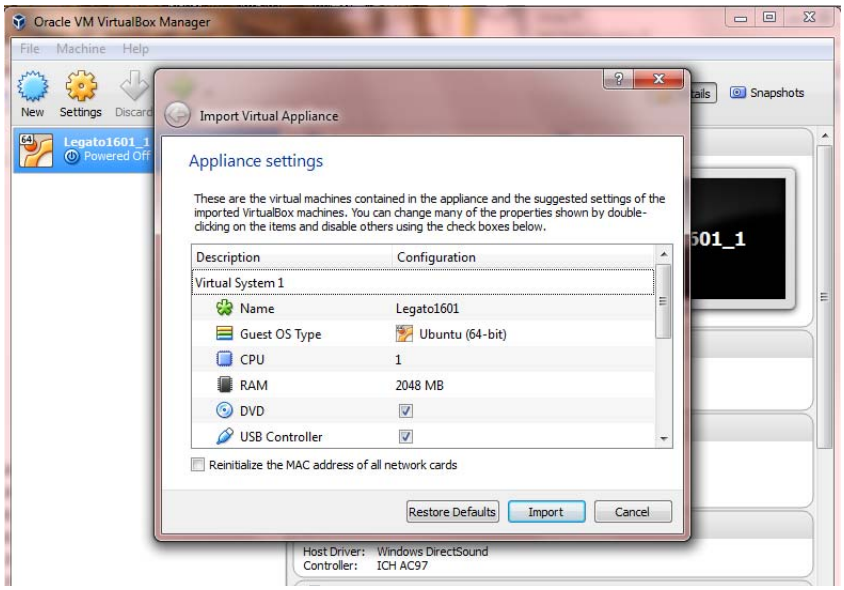
4.2.3 Load the Linux VM

1. Now that VirtualBox is installed, you can load it with “virtual machines” (such as the virtual Linux system included on your USB drive).

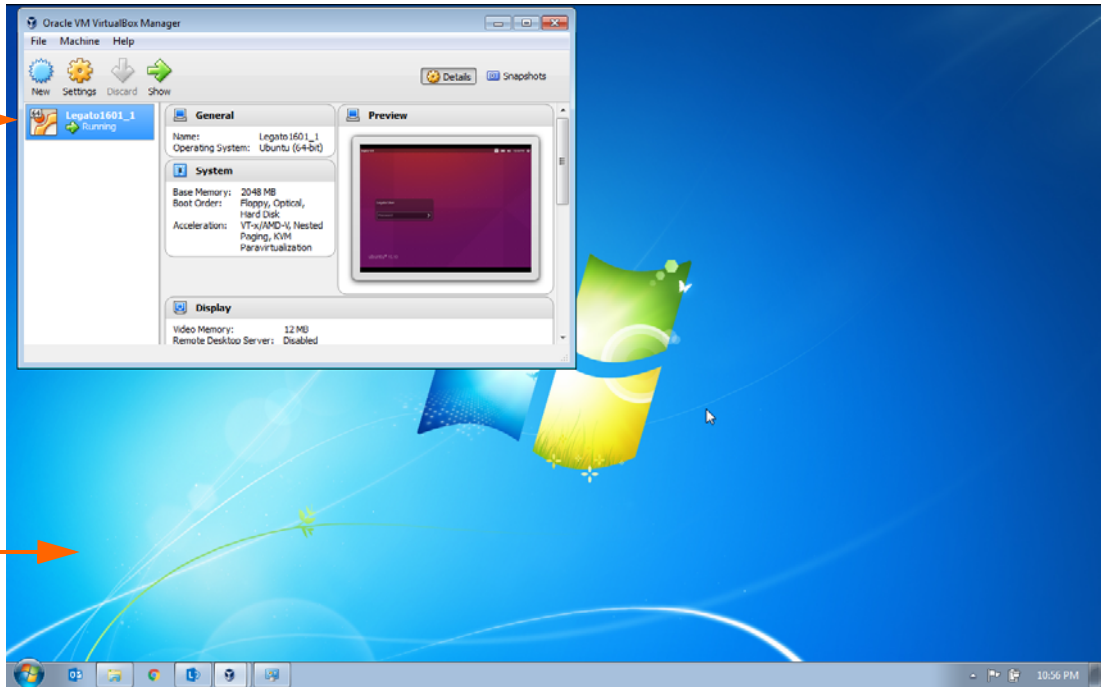
   Load (import) the Ubuntu Linux VM into VirtualBox as follows:

   a. In Windows Explorer, navigate to the Windows folder on the USB drive, or to the local directory where you copied/extracted the files.

   b. Open (double-click) the “Ubuntu 16.04 for Legato 16.04 Devel.ova” file. VirtualBox opens and displays the Import Virtual Appliance window.

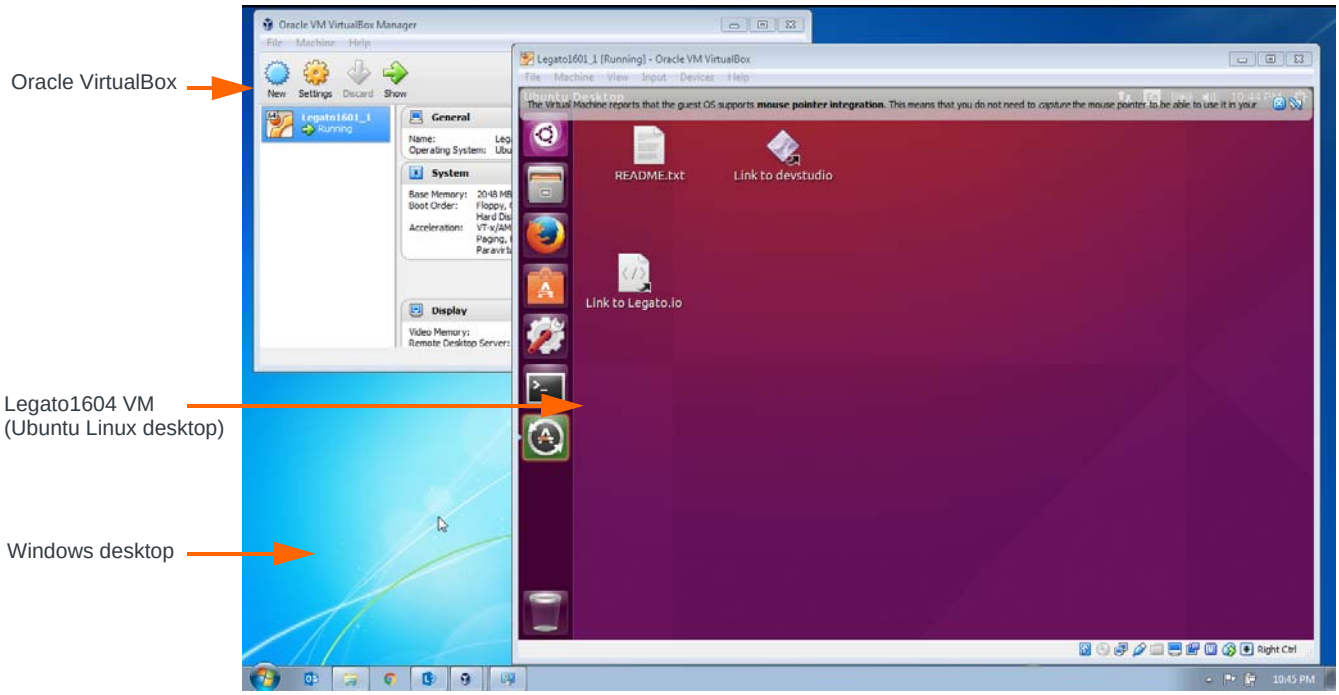


c. Click Import. The Linux VM begins importing into VirtualBox—this may take up to 10 minutes to run, depending on your computer.



2. In the VirtualBox window, launch (double-click, or click to select and click Start) the Legato1604 VM (Linux virtual machine). (Note: This may take a few minutes to display the Ubuntu desktop—The Ubuntu version number appears, then the screen turns black until the VM is loaded.)

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 A.6 Enable virtualization on a Windows computer on page 37 for details.



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

Now that the Linux VM is loaded and running, you can begin to Develop and test applications on page 20 using the Legato CLI (Command Line Interface).

5: Develop and test applications

In this section, you will learn how to use the Legato development environment to build a simple application (“Hello World”), install it onto the CF3 module in your mangOH Green, and test that the application runs.

Legato provides two interfaces for developing applications:

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

This document describes development using CLI.

Tip: *This tutorial touches on the basics of using the Legato development environment. For detailed references, forums, etc., see http://legato.io/legato-docs/latest/mangOH_developers.html.*

5.1 Develop using the CLI (Command Line Interface)

5.1.1 Develop and test applications

When you installed Legato, sample application files were also stored, including a “hello world” application. This section uses the “hello world” application for examples.

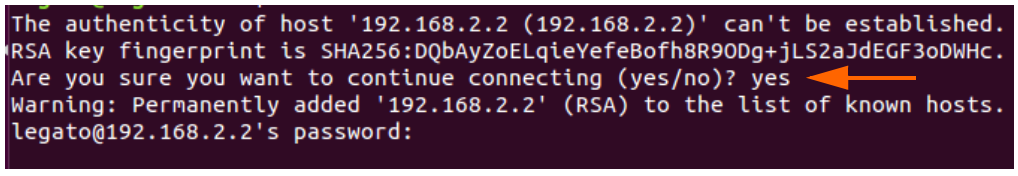
Compile an application on the host computer, and install it on the target:

1. Connect the mangOH Green to the host using the micro-USB cable.
2. On the host, open a new terminal window (referred to as DEV_TERM in this procedure).
3. Go to the sample application directory for Hello World:

   ```
   $ cd $LEGATO_ROOT/apps/sample/helloWorld
   ```
4. Compile the application for the correct target type. In this example, we are using a WP85XX CF3 module, and the target type is “wp85”.

   ```
   $ make wp85
   ```
5. Install the application on the target:

   ```
   $ instapp helloWorld.wp85.update 192.168.2.2
   ```
6. If the message “The authenticity of host ...” appears, type “`yes`” and press Enter to continue.



Run the application on the target:

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's console:

      `$ ssh root@192.168.2.2`

   c. The first time you use a ssh (secure shell) connection to your device, the following error message may appear.

```
legato@legato-VM:~$ ssh root@192.168.2.2
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
@    WARNING: REMOTE HOST IDENTIFICATION HAS CHANGED!     @
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
IT IS POSSIBLE THAT SOMEONE IS DOING SOMETHING NASTY!
Someone could be eavesdropping on you right now (man-in-the-middle attack)!
It is also possible that a host key has just been changed.
The fingerprint for the RSA key sent by the remote host is
SHA256:DQbAyZoELqieYefeBofh8R9ODg+jLS2aJdEGF3oDWHc.
Please contact your system administrator.
Add correct host key in /home/legato/.ssh/known_hosts to get rid of this message
.
Offending RSA key in /home/legato/.ssh/known_hosts:1
  remove with:
  ssh-keygen -f "/home/legato/.ssh/known_hosts" -R 192.168.2.2
RSA host key for 192.168.2.2 has changed and you have requested strict checking.
Host key verification failed.
```

If it does appear:

i. Enter the command:

   `$ ssh-keygen -f "/home/legato/ssh/known_hosts" -R 192.168.2.2`

```
legato@legato-VM:~$ ssh-keygen -f "/home/legato/.ssh/known_hosts" -R 192.168.2.2
# Host 192.168.2.2 found: line 1
/home/legato/.ssh/known_hosts updated.
Original contents retained as /home/legato/.ssh/known_hosts.old
legato@legato-VM:~$
```

ii. Try again to connect to the target's console:

   `$ ssh root@192.168.2.2`

iii. If prompted to continue connecting, type "yes" and press Enter.

Prompt to continue

```
\The authenticity of host '192.168.2.2 (192.168.2.2)' can't be established.
RSA key fingerprint is c6:a0:f5:16:14:03:b6:4e:9f:3a:4f:94:81:ea:a6:a5.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.2.2' (RSA) to the list of known hosts.
Linux swi-mdm9x15 3.14.29ltsi-5d7a6bf7c6_ed88cc68b5 #2 PREEMPT Sat Feb 6 02:37:18
root@swi-mdm9x15:~#
```

d. 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 ion in the next step. Leave this command running until after you see the Hello World output, then you can press Ctrl+C to terminate it.

2. Run the application:

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

b. Connect to the target‘s console:

```
$ ssh root@192.168.2.2
```

c. Check that the application is installed:

```
# app status
```

Hello World application

```
root@swi-mdm9x15:~# app status
[running] audioService
[running] avcService
[running] cellNetService
[running] dataConnectionService
[running] fwupdateService
[running] gpioService
[running] modemService
[running] positioningService
[running] powerMgr
[running] secStore
[stopped] smsInboxService
[stopped] tools
[stopped] voiceCallService
[running] helloWorld
```

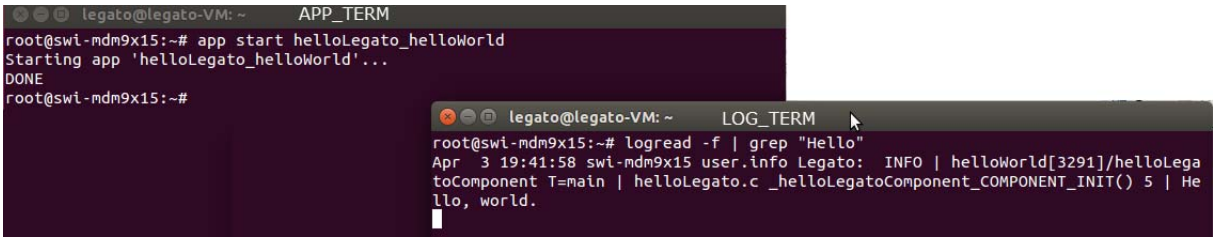
The “hello world” application should appear in the list with a status of ‘Running’. The application was built to run automatically; when you write your own applications, you can make them install without running, if you prefer.

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 LOG_TERM:

```
# app start helloWorld
```



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

```
# app info helloWorld
```

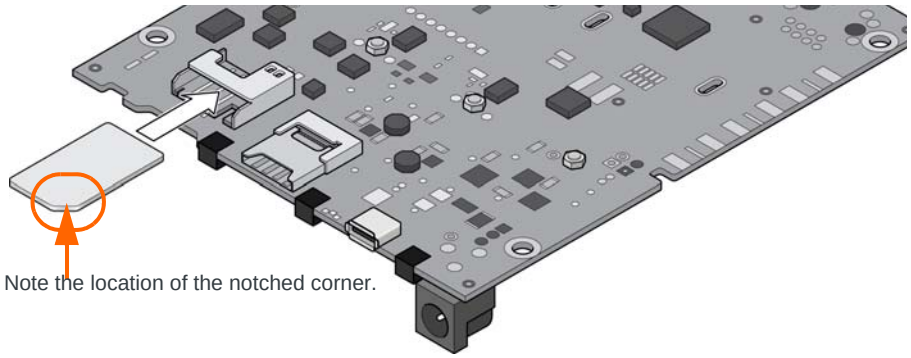
```
root@swi-mdm9x15:~# app info helloWorld
helloWorld
  status: running
  running processes:
    helloWorld[3291] (3291)
  app.name: helloWorld
  app.md5: 0818a88021e74e8b9031613898804f2f
  app.version: 1.0.0.20160331123800
  legato.version: 16.01.0.Beta
```

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

Now you are ready to Connect To Mobile Networks on page 24.

6: Connect To Mobile Networks

In this section, you will learn how to connect your device to a mobile network. (Note: You must have an activated mini-SIM in the mangOH Green.



6.1 Connect the target to a mobile network

If you have installed an activated SIM in the mangOH Green, you can connect the target (the CF3 module) to a mobile network:

1. Connect to the target's console:
   a. On the host, open an existing or new terminal window.
   b. Connect to the target as the root user using the target's default USB ECM IP address:

      ```
      $ ssh root@192.168.2.2
      ```

2. Start a data connection:
   a. Enter the following commands:

      ```
      # cm info
      ```

      This shows information about the target. Record the FSN (serial number) and IMEI in case you need them in the future for support.

      ```
      root@swi-mdm9x15:~# cm info
      Device:     WP8548
      IMEI:       359377060009817
      FSN:        LL542500270403
      Firmware:   SWI9X15Y_07.08.02.00 r31088 CARMD-EV-FRMWR1 2016/02/05
      Bootloader: SWI9X15Y_07.08.02.00 r31088 CARMD-EV-FRMWR1 2016/02/05
      ```

      ```
      # cm radio
      ```

      This shows information about the mobile network the target is registered on.

      ```
      root@swi-mdm9x15:~# cm radio
      Current Network Operator: Rogers Wireless
      RAT:        UMTS network (LE_MRC_RAT_UMTS)
      Status:     Registered, home network (LE_MRC_REG_HOME)
      Signal:     Strong signal strength (4)
      ```

```
# cm data
```

This shows the connection status. Because your SIMs APN is not set yet, the device cannot connect to the network.

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

b. Set the APN, replacing "<your apn>" with the actual APN (for example "cm data apn internet.com" for a Rogers Wireless SIM):

```
# cm data apn <your apn>
```

```
root@swi-mdm9x15:~# cm data apn internet.com
```

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

If you do not know the APN for your SIM:

i. Get your Home Network Operator name:

```
# cm sim info
```

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

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

c. (Optional) If you want to make sure you set the APN correctly, enter:

```
# cm data
```

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

d. The target is now set up to attempt a data connection. Enter the following command (the ampersand ('&') runs the process in the background so you can keep working in the terminal):

```
# cm data connect &
```

```
root@swi-mdm9x15:~# cm data connect &
root@swi-mdm9x15:~# Connected through interface 'rmnet0'
```

When the data connection is established, the 'Connect through interface ...' message appears, and the Connection LED turns on.

e. (Optional) To prove that the target has a data connection to the mobile network, 'ping' a URL that you know is working:

```
# ping mangoh.io
```

```
root@swi-mdm9x15:~# ping mangoh.io
PING mangoh.io (185.31.17.133): 56 data bytes
64 bytes from 185.31.17.133: seq=0 ttl=39 time=571.464 ms
64 bytes from 185.31.17.133: seq=1 ttl=41 time=510.178 ms
64 bytes from 185.31.17.133: seq=2 ttl=39 time=529.834 ms
^C
--- mangoh.io ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 510.178/537.158/571.464 ms
```

Note: To stop the ping responses, press Ctrl+C.

Now that you know how to start a data connection, you are ready to Connect to the IoT Cloud on page 27 to load your application to the 'cloud'.

7: Connect to the IoT Cloud

In this section, you will register your device with Sierra Wireless'AirVantage platform. which is a cloud-based service that you can use to collect data from your device.

7.1 Register and connect to AirVantage

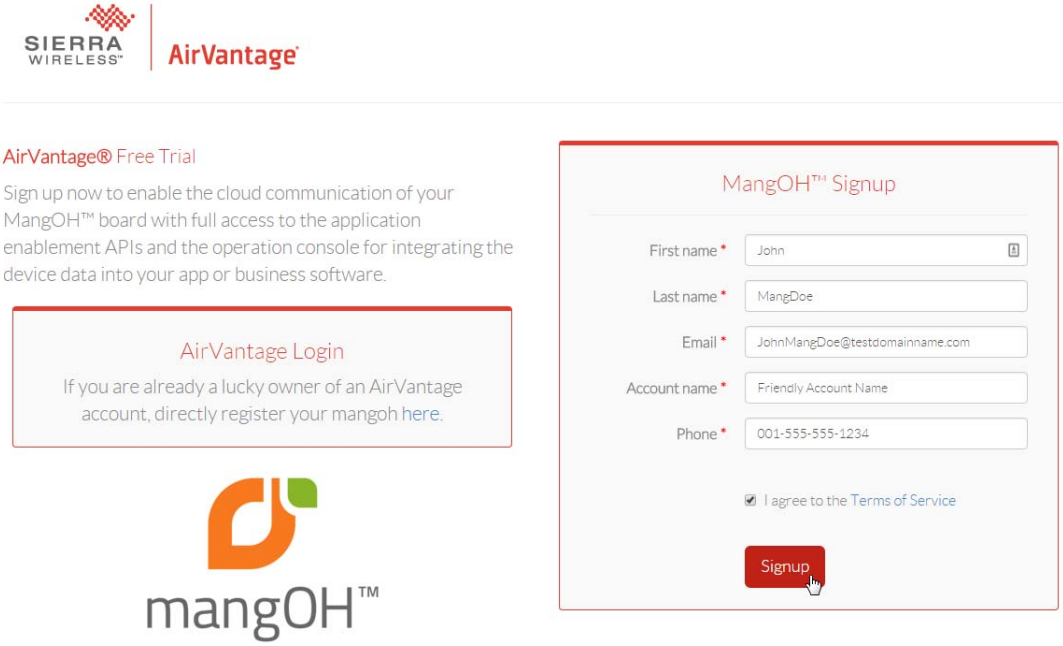
Your mangOH Green kit includes a free account on the AirVantage IoT Acceleration Platform for your CF3 module. This platform provides Sierra Wireless' cloud-based services for over-the-air (OTA) device management and application enablement. These services provide the infrastructure you need to build,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

Note: Your free account allows you to register up to five devices.

Before you can use AirVantage, you must register your device with AirVantage, and then start a connection to the AirVantage server.

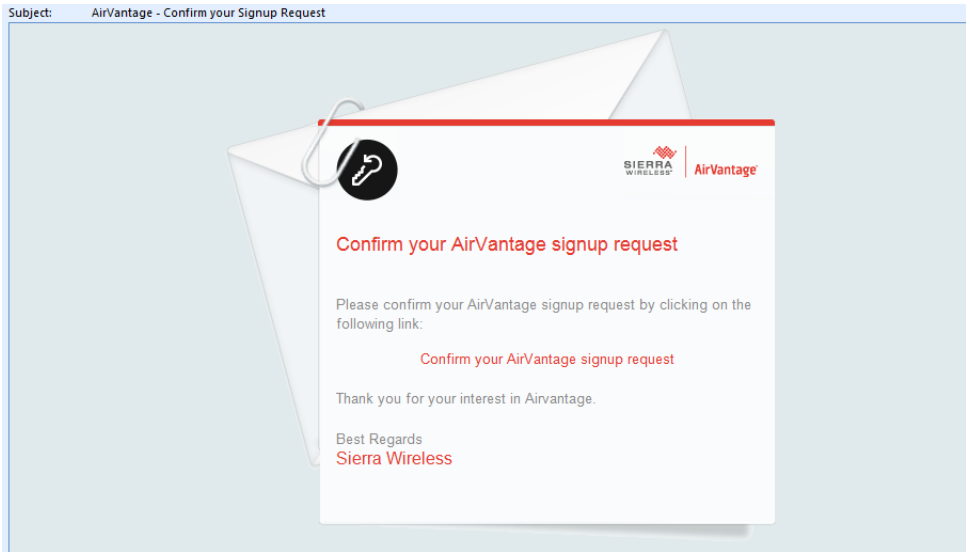
7.1.1 Register with AirVantage

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

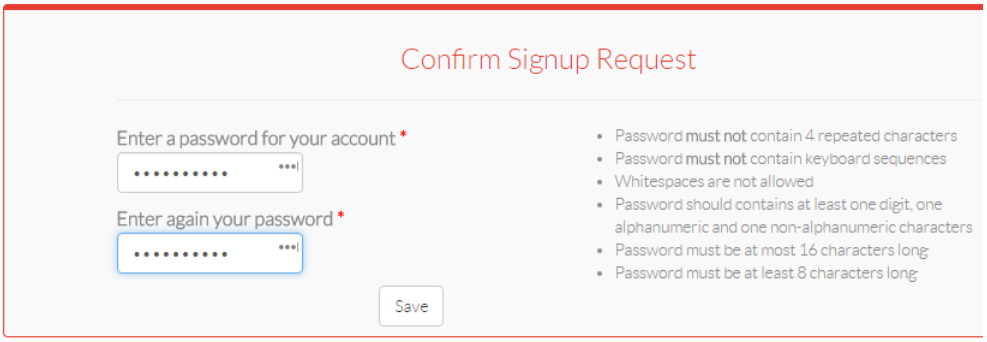


2. In the MangOH Signup area, enter your:
   - First and last names
   - Email address—Use a valid address. This is needed to complete the registration process and is also used as your account name.
   - Account name—Use a unique name such as a combination of your company name, the project name, your 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 AirVantage signup request.



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



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.

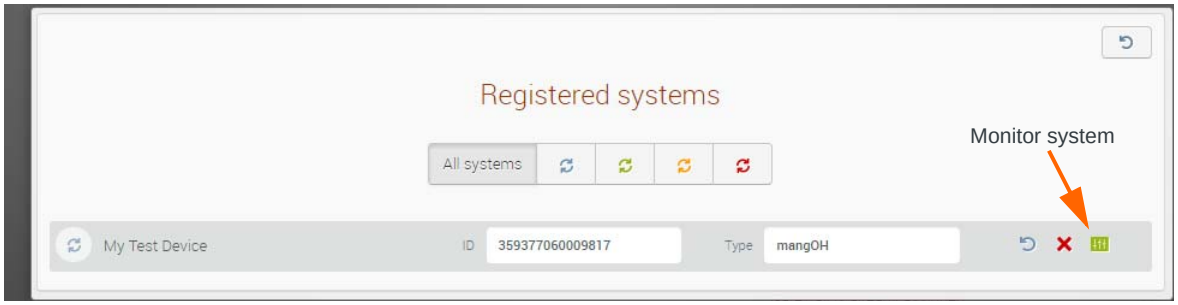
Note: What you are registering on AirVantage is the CF3 module that is included with your mangOH Green Kit. If you purchase another module and want to use it with AirVantage (using the same mangOH Green), you must register that module separately.

9. In the Register mangOH section, enter the Serial Number (FSN) and IMEI of the module in your mangOH Green. If you did not record them earlier, open a terminal window and connect to the module's console, then use the command "`cm info`" to display the information.

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

10. Click Register.

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



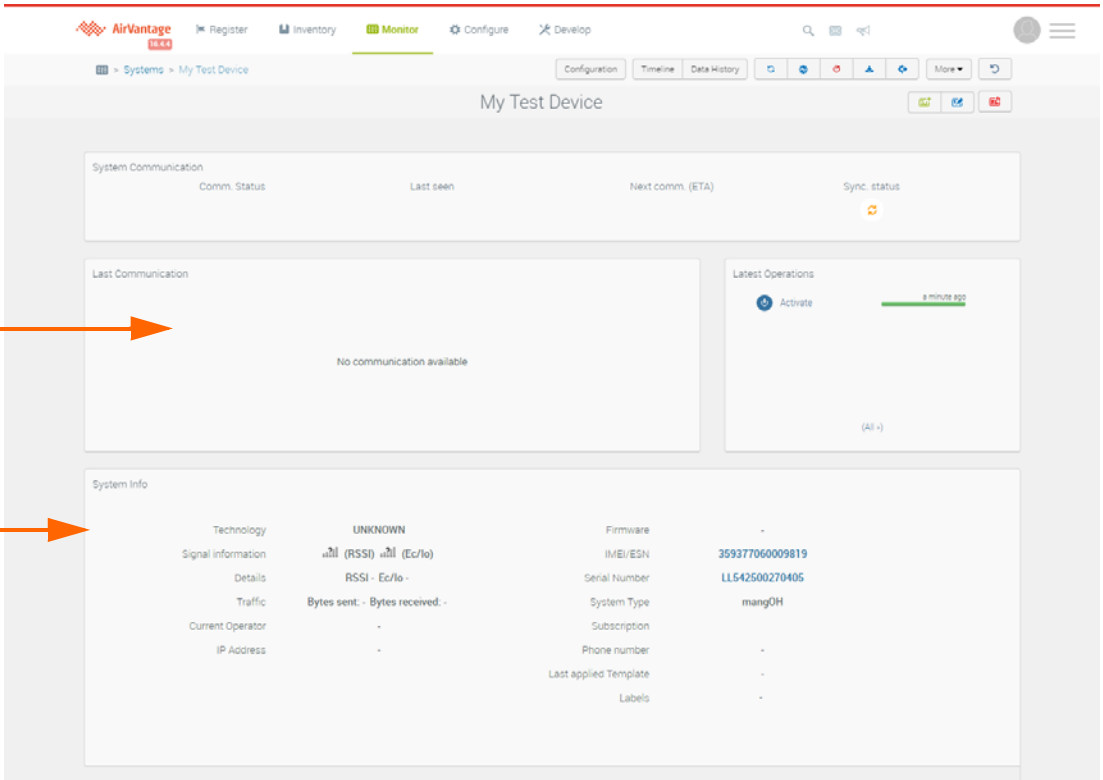
11. Now that your device is registered, click the monitor icon at the right side of your device entry ( ) to go to the System Details screen (see next step).

12. The System Details screen displays several widgets that report information about your device, communications received from it, running applications, etc.

    The areas shown below (Last Communication andSystem Info) are both blank because you have not connected your mangOH Green to AirVantage yet. Leave this browser window open and continue to Connect to AirVantage on page 31.

Last Communication
(When you have your device registered, your last communication will appear here.)

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



7.1.2 Connect to AirVantage

1. Start a connection to AirVantage:
   a. On the host, open an existing or new terminal window.
   b. Connect to the target as the root user using the target's default USB ECM IP address:

      ```
      $ ssh root@192.168.2.2
      ```

   c. Open an AT port on the target—after you enter this command, you will not see a command prompt (you are in the AT command entry mode):

      ```
      # microcom -E /dev/ttyAT
      ```

Waiting for you to enter AT commands →

```
root@swi-mdm9x15:~# microcom -E /dev/ttyAT
```

   d. Make sure you can enter AT commands—Type "`at`" and press Enter. If this is working, the command returns "`OK`":

```
root@swi-mdm9x15:~# microcom -E /dev/ttyAT
at
OK
```

   e. Type "at+wdsi = 8191" and press Enter. This configures your CF3 module to connect to the AirVantage server.

```
at+wdsi = 8191
OK
```

   f. Type "at+wdss=1,1" and press Enter. This connects your CF3 module to the AirVantage server. If the command returns OK, you have connected to AirVantage.

Connected to AirVantage →

```
at+wdss=1,1
OK

+WDSI: 4

+WDSI: 6

+WDSI: 23,1
```

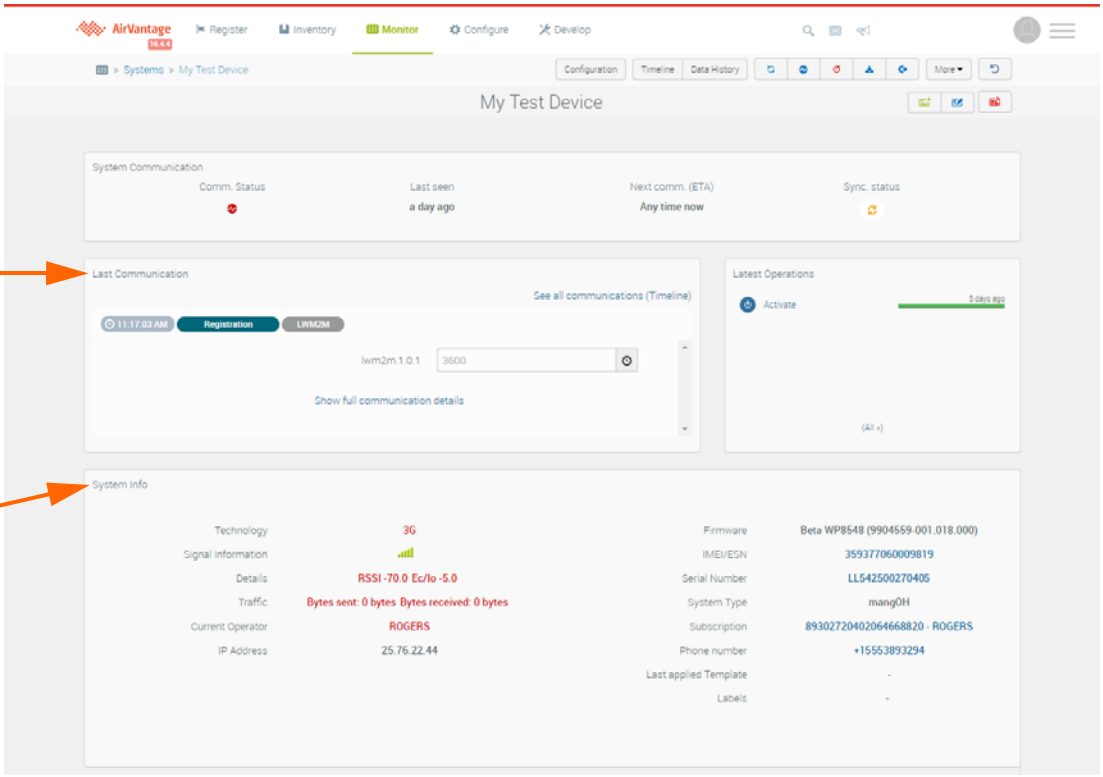
Note: The values shown in the response above may vary. The "+WDSI" parts of the response are internal status codes. The key part of the response is the "OK" message. If you receive an error instead of "OK", redo step e and step f.

   g. Press Ctrl+X to leave AT entry mode and return to the command prompt.

h. Refresh the AirVantage System Details screen in your web browser—the System Info section now shows details about your module, and the Last Communication section shows the connection you just completed.

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)



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

To begin developing applications to communicate with AirVantage, work through the tutorial at https://source.sierrawireless.com/airvantage/av/howto/hardware/samples/legato-asset-data/.

A: Tips

A.1 Finding your SIM's APN

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

Common APNs:

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

A.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 computer and the CF3 module in the mangOH Green.

For this tutorial, here are some useful tips:

- Open a terminal window. 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.

A.3 Useful Linux commands for this tutorial (and more)

The following table describes the Linux commands you will use in this tutorial, plus other useful commands.

Table A-1: Linux commands

Command types	Command	Description
Versioning	cm info	Display the modules model, IMEI, FSN (serial number), and firmware and bootloader versions.
	legato version	Display the Legato framework version.
Radio	cm radio	Display the radio status.
	cm radio on cm radio off	Enable or disable the radio.
	Refer to cm radio (http://www.legato.io/legato-docs/latest/tools_target_cm.html) 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://www.legato.io/legato-docs/latest/tools_target_cm.html) 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://www.legato.io/legato-docs/latest/tools_target_cm.html) 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://www.legato.io/legato-docs/latest/tools_target_app.html) for more details and command options.	

Table A-1: Linux commands (Continued)

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

A.4 Definitions

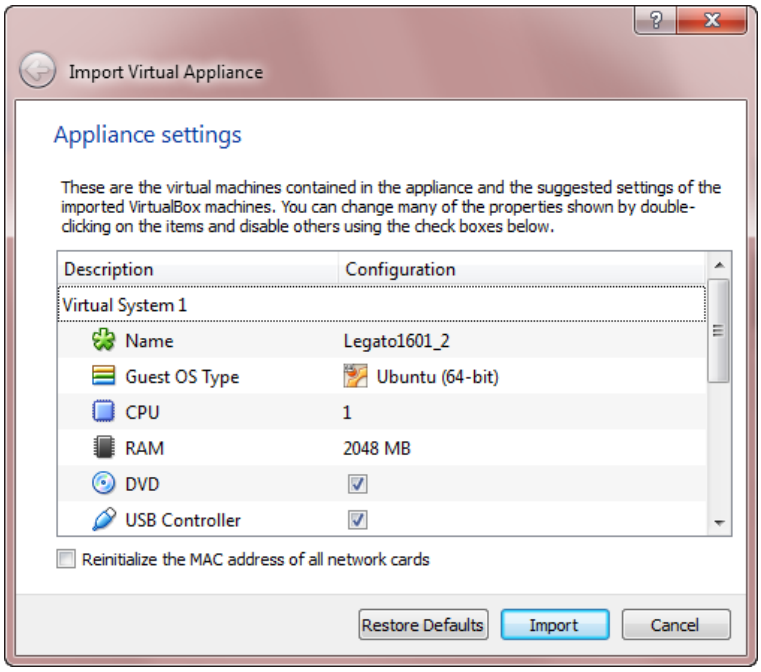
Table A-2: Definitions

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	Open source platform for developing applications.
wget	Gets files from a web server
.bashrc	A shell script that runs when you open a Linux terminal window.
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 strcuture, a panel for entering Terminal commands, etc.

A.5 VirtualBox Tips

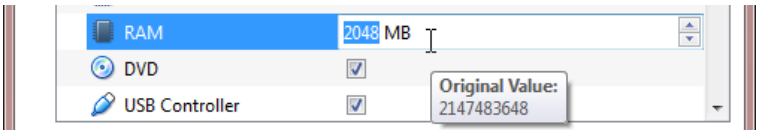
A.5.1 Modifying resources

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.

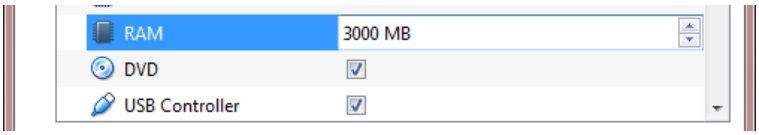


To adjust the CPU or RAM value:

1. Double-click the value.



2. Type your new value and press Enter.



A.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. Add your computer type to the search string to refine your results.(Google search: https://www.google.ca/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=windows%208.1%20bios%20access).
   - 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. (Google search: https://www.google.ca/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=windows+10++bios+access)
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.