

LoRa IOT Starter Kits

User's Guide



Table of contents

Section

Page

Go	oal of this Kit	
••••		
Ra	-	
4.2.	Access using PuTTY	
4.3.	Access using UNIX terminal console	11
Ap	oplication Software Locations	12
St	arting / Stopping the demon scripts	13
Se	erver MySQL database	14
	Cleanup	
7.2.	MySQL server users	
Up	odates and Upgrades	16
Er	nd-devices firmware	16
9.1.	LoRaMote	16
9.2.	mbed	16
9.3.	How-to upgrade the RaspberryPi SD card	16
Or	rdering Information	17
Tr	oubleshooting	17
	Ci G 3.1. 3.2. R; 4.1. 4.2. 4.2. 4.3. Af Si Si 7.1. 7.2. Ul Er 9.1. 9.2. 9.3. O	 3.2. Connection using an Ethernet Cable



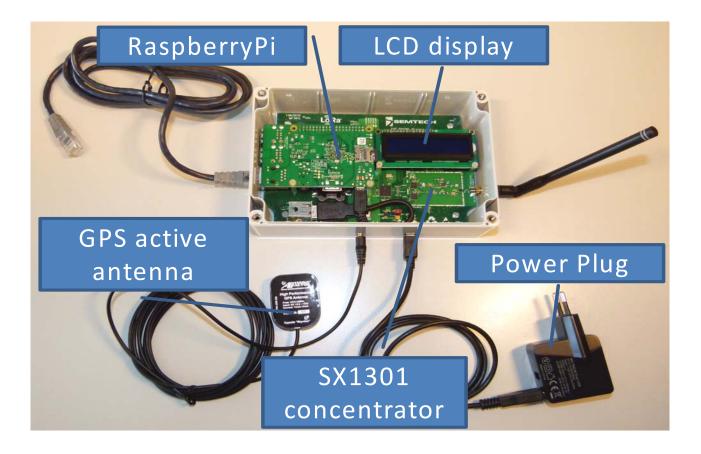
1. Goal of this Kit

This kit is designed to offer a self-contained Plug'n Play local loop for all IOT object designers, allowing them to verify that their design is able to connect to a public IOT network following the LoRaWAN specification.

No connection to an Ethernet network is required, simplifying the setup. A simple cross over Ethernet cable can be used to access the kit.

2. Contents of the development kit

- RaspberryPi B+ with its LoRa IOT shield unit and pre-installed micro SD card
- SX1301-based concentrator reference design
- Active GPS antenna
- USB cables
- Power adapter
- Example end-point: LoRaMote or MBED shield unit. It is provided as a reference to confirm the functionality of this setup.





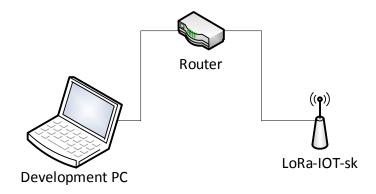
3. Getting Started

Two ways to get connected to the starter kit are possible.

- Connection to an Ethernet network composed of a router and a DHCP server.
- Connection using an Ethernet cable connected between the development PC and the starter kit.

3.1. Connection to an Ethernet Network

1) Plug the simplified network setup as per the picture below. It must be connected to the same network as the one your development PC is connected to.



2) When all ready, power it up and wait about 2mn for the device to boot-up.

3) Look-up the LCD screen to see the IP address that the RaspberryPi was given by the DHCP server.

4) On your PC, launch a web browser session and type this IP address into the web browser address bar.

5) The following page will appear:





6) Click on "Demonstration" link



7) Click on the "RecentActivity" link:

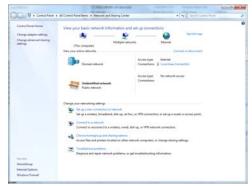
- 8) Power up the provided end-point device.
- 9) Its packets should start flowing in the database and will be displayed on the screen (hit F5 to refresh).

A local network has been successfully deployed on your bench. Any proprietary end-point design can now try and connect to the network.



3.2. Connection using an Ethernet Cable

- 1) Connect the RaspberryPi to your PC using an Ethernet cable.
- 2) On the PC, go to Network settings.



3) Click on "Local Area Connection"

Local Area Connectio	on Status	×
General		
Connection		
IPv4 Connectivity:		Internet
IPv6 Connectivity:		No Internet access
Media State:		Enabled
Duration:		3 days 05:38:38
Speed:		1.0 Gbps
Details		
Activity		
	Sent —	Received
Bytes: 2'2	90'536'560	11'935'680'944
Properties	Disable	Diagnose
		Glose



4) Click on "Properties"

Connect using:		
Intel(R) 825	79LM Gigabit Network Connection	
		Configure
This connection us	es the following items:	
	Microsoft Networks	*
VMware E		
	y Anti-Virus NDIS 6 Filter	=
	Bridged Networking Driver	
QoS Pack		
	ninter Sharing for Microsoft Network rotocol Version 6 (TCP/IPv6)	(S
Internet P	III	
•		
l <u>n</u> stall	<u>U</u> ninstall	roperties
Description		
Transmission Co	ntrol Protocol/Internet Protocol. Th	ne default
	ork protocol that provides communic nterconnected networks.	cation

5) Select "Internet Protocol Version 4 (TCP/IPv4)

Local Area Connection Properties	X
Networking Sharing	
Connect using:	
Intel(R) 82579LM Gigabit Network Connection	
Configure	
This connection uses the following items:	
Williams Bridge Protocol Williams Bridge Protocol Williams Bridge Anti-Virus NDIS 6 Filter Williams Bridged Networking Driver Williams Bridged Networks williams Bridged Version 6 (TCP/IPv6) williams Bridged Version 6 (TCP/IPv6) williams Bridged Version 4 (TCP/IPv6) williams Bridge	
Description	
Transmission Control Protocol/Internet Protocol. The defaul wide area network protocol that provides communication across diverse interconnected networks.	t
ОК Са	incel

6) Click "Properties" button

Int	ernet Pr	otocol Versio	n 4 (TCP/I	Pv4) P	rope	rties			2	X
-	General	Alternate Cor	figuration							
	this cap	ı get IP setting ability. Otherw appropriate IP	ise, you ne							
	o <u>o</u> t	otain an IP add	ress autom	atically	ļ					
		e the following	IP address	:						
	IP ac	ldress:								
	Sybn	et mask:					1			
	<u>D</u> efa	ult gateway:								
	() O <u>b</u>	tain DNS serve	er address a	automa	itical	y				
	- O Us	e the following	DNS serve	r addre	esses	:				
	Prefe	erred DNS serv	er:				1.			
	<u>A</u> lter	nate DNS serv	er:							
	- V	aļidate settings	upon exit					Ad	vanced	
							ОК		Ca	ncel



7) Select "Use the following IP address:"

General	
	automatically if your network supports ed to ask your network administrator
Obtain an IP address automa	atically
• Use the following IP address:	
IP address:	192.168.1.101
Subnet mask:	255 . 255 . 255 . 0
Default gateway:	
Obtain DNS server address a	utomatically
• Use the following DNS server	addresses:
Preferred DNS server:	
Alternate DNS server:	
Valjdate settings upon exit	Ad <u>v</u> anced
	OK Cancel

8) Enter the IP address like 192.168.1.XXX where XXX is different from 100 as it is the Raspberry static IP address.

9) Click the "OK" button.

10) Click the "OK" button on "Local Area Connection Properties" window.

11) Close "Local Area Connection Status".

12) Please follow the same steps as on previous chapter starting from step 4. REMARK: Don't forget to replace the IP address for 192.168.1.100 instead of the one assigned by DHCP

A local network has been successfully deployed on your bench. Any proprietary end-point design can now try and connect to the network.



4. RaspberryPI Software

The LoRaWAN server and gateway software run on the RaspberryPI.

Once the RaspberryPI has boot up the LCD screen will show information about the LoRaWAN server and gateway applications status, the percentage of used disk space on the SD card as well as the DHCP and static IP addresses.



The indications meaning of the LCD first line are:

- G: Indicates if the gateway application is running dor not
- S: Indicates if the LoRaWAN server application is running or not
- D: Used disk space in percent

The second line displays the DHCP assigned IP address as well as the static IP address. Each one is displayed every 5 seconds when both are available.

4.1. RaspberryPI Command Line Access

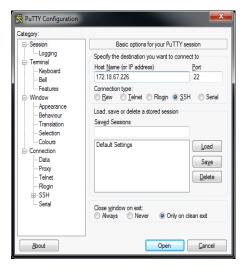
To access the RaspberryPI one must use an SSH client such PuTTY on Windows platforms or a terminal console on UNIX based systems.

The RaspberryPI user name is lora and the password lora.



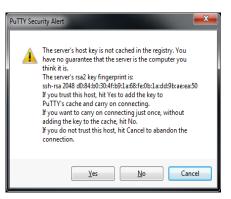
4.2. Access Using PuTTY

1) Launch PuTTY



2) Enter the IP address displayed on the RaspberryPI LCD display

- 3) Click the "Open" button
- 4) If a security alert window is displayed Please click on "Yes" button.



5) The login prompt is then displayed





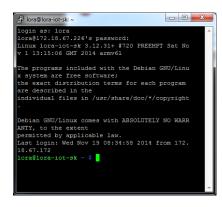
6) Please enter lora as username



7) Please enter lora as password

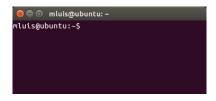


8) You are now logged on



4.3. Access Using UNIX Terminal Console

1) Launch a terminal console

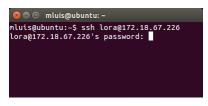




- 2) Please enter the following command in the terminal window
 - \$ ssh lora@RaspberryPi-IP-address



3) After pressing the Enter key, enter the password Lora



4) You are now logged on



5. Application Software Locations

All the software applications used by the RaspberryPI to run the IOT starter kit are located under /opt/lora-net.

This directory contains 4 directories:

gateway, this directory contains the

1) lora_gateway, SX1301 control library source code

https://github.com/Lora-net/lora_gateway.git

This source code has been adapted to use the RaspberryPI hardware SPI as well as the control of the SX1301 board reset pin.

2) packet_forwarder, gateway application source code

https://github.com/Lora-net/packet_forwarder.git

The configuration JSON files have been modified in order to use the GPS module as well as the network server connection parameters.

3) Ir-nwk-gw, gateway script to start/stop/restart the daemon.

- misc, contains the Python and shell scripts need for the LCD management.
- server, contains the precompiled LoRaWAN network server as well as the script to start/stop/restart the daemon
- www, contains the web server pages



6. Starting / Stopping the Demon Scripts

To control the server and gateway daemons the following commands must be issued:

- Starting The server: sudo /etc/init.d/lr-nwk-srv start The gateway: sudo /etc/init.d/lr-nwk-gw start
- Stopping The server: sudo /etc/init.d/lr-nwk-srv stop The gateway: sudo /etc/init.d/lr-nwk-gw stop
- Restarting
 The server: sudo /etc/init.d/lr-nwk-srv restart
 The gateway: sudo /etc/init.d/lr-nwk-gw restart
- Getting the demon status The server: sudo /etc/init.d/lr-nwk-srv status The gateway: sudo /etc/init.d/lr-nwk-gw satus

The 2 daemons output their logs to files located in the /tmp directory. The LCD "G:" and "S:" indicate the 2 daemons status



7. Server MySQL Database

The RaspberryPI disk usage will increase over the time by recording all the end-devices frames onto the MySQL database.

It is advisable that once the disk usage displayed on the RaspberryPI LCD screen is getting close to 90% of disk usage that the database is cleaned up.

7.1. Cleanup

It is possible to clean-up the database for a fresh-start.

- 1) Please stop the server application as described in chapter "Starting / Stopping the demon scripts"
- 2) Open a web browser

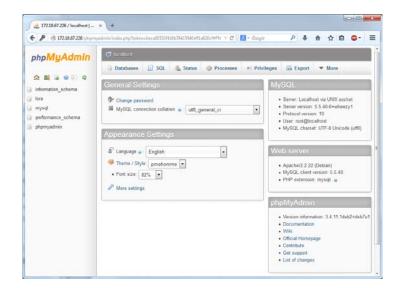
3) Type the IOT Starter Kit IP address followed by the following text "/phpmyadmin" to the web browser address bar.

Admin			
Go			

4) The user name is root and password is also root



5) Click "Go" button



6. Click "lora" database on the left of the window

C 3 172.18.67.226/phpmyadmin	Augerbub; apelloratio	Ren=beca0033/1418b/84135	abentianzoch Y C	• boogse	₽ ♦	Π	☆ 🗉 💁 -
phpMyAdmin	🗊 localhost 🖡 🖬						
	M Structure	🔝 SQL 🛛 🔍 Search	🔄 Query 🔛	Export 📑 Impo	n #	Operatio	ens 🗢 More
2 2 6 6 6 C C	Table _	Action			Rows	Туре	Collation
lora 🔽	gateways	🔲 Browse 🔀 Structur	e 🎕 Search 🕌 Inser	t 🕃 Empty 🥥 Drop	1	InnoDB	latin1_swedish_
🔟 gateways	📋 nodes	🔄 Browse 🖟 Structur	e 🔹 Search 🛃 Inser	🕄 Empty 🤤 Drop	4	InnoDB	latin1_swedish_
nodes packets	🔄 packets	🔄 Browse 🔀 Structur	e 🔍 Search 🚰 Inser	t 📋 Empty 🥥 Drop	-82,090	InnoDB	Latin1_swedish_
ranges	🔄 ranges	🖀 Browse 🖗 Structur	e 😨 Search 🕌 Inser	🖀 Empty 🤤 Drop	0	InnoDB	latin1_swedish_
serverversion	📋 serverversion	🔄 Browse 🔀 Structur	e 🔍 Search 🛃 Inser	t 🕃 Empty 🤤 Drop	1	InnoDB	armscii8_genera
Create table	5 tables	Sum			-32,093	InnoDB	armscil8_gene
	Print view 👼 Da		h selected.				
	Name:	ore on database fora	Number of column				
							G

7) Click on "Empty" (trash can icon) link for each table

7.2. MySQL Server Users

Three more users have been defined (in addition to the root user) to access the database:

- loraadmin, has full access to the database (password: loraadmin)
- lorarw, has the right to read and update the tables (password: lorarw). The server uses this user to access the database.
- loraro, has the right to only read the tables (password: loraro). Used by the web server to access the tables.



8. Updates and Upgrades

Semtech will issue some releases of the network software under the form of a new RaspberryPi image file to be programmed onto a SD card. Please ask your Semtech representative for an update.

The current delivery of the IOT kits contains the following versions of the different components:

- LoRaWAN specification R3.0 (production)
- Server release v1.4.2 (Semtech's example network server implementation)
- LoRaMote end-point firmware v3.0
- mbed platform end-point firmware (not yet available)

9. End-devices Firmware

9.1. LoRaMote

LoRaWAN firmware projects are available as source code in GitHub at the following address:

https://github.com/Lora-net/LoRaMac-node.git

The firmware must be configured to use activation by personalization and the NwkSKey and AppSKey must be modified to:

- NwkSKey: {0x11,0x22,0x33,0x44,0x55,0x66,0x77,0x88,0x99,0xAA,0xBB,0xCC,0xDD,0xEE,0xFF,0x00}
- AppSKey:
 {0x11,0x22,0x33,0x44,0x55,0x66,0x77,0x88,0x99,0xAA,0xBB,0xCC,0xDD,0xEE,0xFF,0
 x00}

These keys correspond to the application server implemented in this demo. They are hardcoded and compiled in the LoRaWAN server and can't be changed in this release.

9.2. mbed

LoRaWAN firmware projects aren't yet available at the time of this document release. Please check:

http://www.mbed.org

as sources will be provided by Semtech soon.

9.3. How-to Upgrade the RaspberryPi SD Card

To upgrade the SD card you can follow the instructions described in the following link:

http://www.raspberrypi.org/documentation/installation/installing-images/

The image to be used is the one that you get from Semtech.



10. Ordering Information

Option 1: LoRaMote with integrated antenna

- A variety of sensors to select from
- GPS is built-in
- Download sources for Keil and Ride on: https://github.com/Lora-net/LoRaMac-node

Ordering Code: IOT868STKLM1

Option 2: MBED shield unit plugged onto MBED Freedom platform

- MBED-enabled, with online development environment
- Multiple ARM vendors to select from
- Download sources on: http://mbed.org/components/SX1276MB1xAS/

Ordering Code: IOT868STKMB1

11. Troubleshooting

Q: The IP address I type doesn't lead me to the corresponding landing page.

A: It is probably because the Raspberry Pi device did not get a DHCP lease from the network router (this depends of companies' network policies, please talk to your IT manager). If it is not possible to whitelist this device, the fall back solution is to use the second connection option described in "Connection using an Ethernet cable connected between the development PC and the starter kit." chapter.







© Semtech 2015

All rights reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent or other industrial or intellectual property rights. Semtech assumes no responsibility or liability whatsoever for any failure or unexpected operation resulting from misuse, neglect improper installation, repair or improper handling or unusual physical or electrical stress including, but not limited to, exposure to parameters beyond the specified maximum ratings or operation outside the specified range.

SEMTECH PRODUCTS ARE NOT DESIGNED, INTENDED, AUTHORIZED OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT APPLICATIONS, DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF SEMTECH PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE UNDERTAKEN SOLELY AT THE CUSTOMER'S OWN RISK. Should a customer purchase or use Semtech products for any such unauthorized application, the customer shall indemnify and hold Semtech and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs damages and attorney fees which could arise.

Contact information

Semtech Corporation Wireless, Sensing & Timing Products Division 200 Flynn Road, Camarillo, CA 93012 Phone: (805) 498-2111 Fax: (805) 498-3804 E-mail: sales@semtech.com support_rf@semtech.com Internet: http://www.semtech.com

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Semtech:

IOT470STK1-8 IOT780STK1-8 IOT922STK1-8 IOT434STK1-8