You need:
- 1x SmartRF06EB
- 2x X.IP4T SmartModule+Demo Board or X.IP5 SmartMachine devices
- 1x USB pen Drive
- 1x Raspberry Pi2/Pi3
- 1x Micro SD card (16Gb min)
- 1x HDMI cable
- 1x LAN cable
- 1x HDMI monitor
- 1x JTAG cable
- 3x Power cable (USB micro-USB)

1. Download the .zip file containing the image of Raspbian(the version used in this guide is "2016-09-23-raspbian-jessie") from http://www.raspberrypi.org/downloads .

2. Unzip the file and save it in a folder on your PC.

3. Write the O.S. ISO image with a tool for writing images such as "**Win32DiskImager"** (the instructions for 4 to 10 describe how to use this programm)

4. Download the software **Win32DiskImager** from http://www.sougeforce.net/projects/win32diskimager.

5. Install the software.

6. Run the software Win32DiskImager with **Administrator**.

7. Select the unzipped ISO file.

8. Select the drive containing the micro SD and proceed with the installation.

9. Push the botton "**Write**" and wait for the end of the process.

10. Close the software and extract the micro SD.

11. Insert the micro SD in Raspberry Pi 2.

12. Connect to Raspberry Pi 2, an HDMI monitor, cable LAN,USB mouse and USB keyboard

13. Power the Raspberry Pi2 and, if the previous operations were successful,, the device will appear on the desktop.

14. If the system is properly connect to the network, the arrows at the top right on the header bar will be light blue color as shown in picture 1.

Picture 1

15. Install **Contiki OS** following these instructions (17-18).

16. Open the **command prompt** by clicking on the icon in the upper-left.

17. Type in this string.

"**sudo git clone --recursive https://github.com/contiki-os/contiki**" and press **Enter**. (Waiting Time:6 min)

18. Update the Contiki OS module with the "**cc13xxware**" latest release typing these strings.

"**cd contiki**" and press **Enter**.

"**sudo git submodule sync && sudo git submodule update --init**" and press **Enter**.

19. Update the **Toolchain ARM GCC** (Contiki includes the needed toolchain for CC13xx/CC26xx) typing these strings

"cd"

"**sudo wget http://www.cl.cam.ac.uk/freshers/raspberrypi/tutorials/os/downloads/arm-none-eabi.tar.bz2**"

and press **Enter**.(Waiting Time:2 min)

"**sudo tar xjvf arm-none-eabi.tar.bz2**" and press **Enter**. (Waiting Time:1 min)

"**export PATH=$PATH:$HOME/arm-2008q3/bin**" and press **Enter**.

"**sudo apt-get install gcc-arm-none-eabi**" and press **Enter**. (Waiting time: 7 min)

Answer **Yes** ("**Y**") to any questions

20. Install **6lbr Border router** following these instructions (28-41)

21. From the command line type this block of instructions

"**sudo apt-get install libncurses5-dev**" and press **Enter**.

Answer **YES ("Y")** to any questions

"**sudo apt-get install bridge-utils**" and press **Enter**.(Waiting Time:2 min)

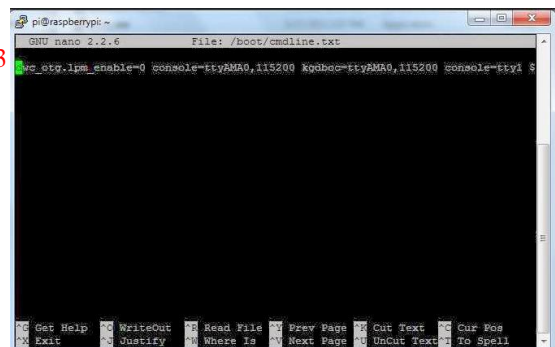22. Edit the parameters configuration file (**cmdline.txt**) typing

"**sudo nano /boot/cmdline.txt**" and press **Enter**.

23. In the opened mask (Picture 3), add at the beginning of line this string

"**dwl_otg.speed=1** "

Picture 3

24. Press "**Ctrl**" ed "**X**".

25. Press "**Y**".

26. Press **Enter** to save the file just edited.

27. Type in succession these commands to update the "6lbr"

"cd" and **press Enter**

"**sudo git clone --recursive** https://github.com/cetic/6lbr **-b** develop- 20170121 "

and press **Enter** (Waiting Time 5min).

"**cd 6lbr**" and press **Enter**.

"**sudo git submodule update –init --recursive**" and press **Enter**

"**cd examples/cd 6lbr**" and press **Enter**.

"git checkout develop-20170121" and press **Enter**

"make all #all_native for version <1.4" and press **Enter** (WaitingTime: 15min)

"sudo make plugins" and press **Enter**

"sudo make tools" and press **Enter**

"sudo make install" and press **Enter**

"sudo make plugins –install" and press **Enter**

"update –rc.d 6lbr defaults" and press **Enter**

28. Create the **configuration file** for the network by typing this string

"sudo nano /etc/6lbr/6lbr.conf" and press **Enter**.

29. A blank screen will be open, type in the following block of commands

MODE=ROUTER

RAW_ETH=1
BRIDGE=0
DEV_BRIDGE=br0
DEV_TAP=tap0
DEV_ETH=eth0
RAW_ETH_FCS=0

DEV_RADIO=/dev/ttyUSB0 # XIP4T+EB or XIP5 will be enumerated with USB0
BAUDRATE=115200

30. Press "**Ctrl**" ed "**X**".

31. Press "**Y**".

32. Press **Enter** to save the file just edited.

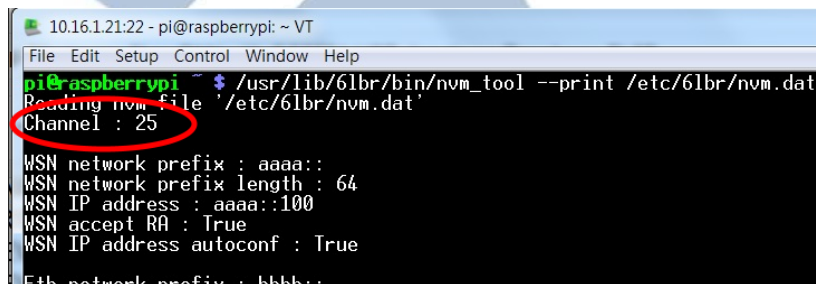33. Change the **channel** of communication with this istruction (Contiki OS uses the channel **25**)

"sudo /usr/lib/6lbr/bin/nvm_tool --update --channel 25 /etc/6lbr/nvm.dat" and press **Enter**.

34. Verify that the change has been applied (Picture 4) with this command

"/usr/lib/6lbr/bin/nvm_tool --print /etc/6lbr/nvm.dat" and press **Enter**.

Picture 4

35. See the ReadMe on GitHub (steps 3-7) link: https://github.com/MarCast-6lbr-on-Telecontrolli-Devices/XIP

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36. Generate the file "**slip-radio.bin**" by following next steps (37-42).

37. Edit the file "**project-conf.h**" by running this block of comands

   "**cd**"   and press **Enter**.

   "**cd contiki/examples/ipv6/slip-radio**"   and press **Enter**.

   "**sudo nano project-conf.h**"   end press **Enter**.

38. In the opened mask (Picture 4) write this string "**#define RF_CORE_CONF_CHANNEL 25**" before the line "**#undef UIP_CONF_ROUTER**"

39. Press "**Ctrl**" ed "**X**".

40. Press "**Y**".

41. Press **Enter** to save the file just edited.

42. Type the following steps

   "**sudo make clean**"   and press **Enter**.

   "**sudo make TARGET=srf06-cc26xx BOARD=srf06/cc13xx slip-radio.bin**" and press **Enter** (Waiting Time 2min).

43. Copy the file "**slip-radio.bin**" just generated on a pen-drive USB; to perform this operation follow these steps 44-47.

44. Click on the folders icon located in the upper left of the header bar (Picture 5)

Picture 5

45. Go to the folder "**home/pi/contiki/examples/ipv6/slip-radio**"

46. Copy the file "**slip-radio.bin**" on the pen-drive USB using "**copy-paste**"(ctrl-c/ctrl-v) method.

47. Upload the file on "**X.IP4T**" (steps 48-54)

48. Download (registration required) and install on a Windows computer the software "Flash Programmer 2" from the site http://www.ti.com/tool/flash-programmer

49. Connect the module X.IP4T on "SmartRF06EB" board respecting the position of the Pin1

50. Connect the interface to the "SmartRF06EB" with the JTAG cable respecting, also in this case, the position of the Pin1

51. Connect with a USB cable to the "SmartRF06EB" to your Windows PC where you have previously installed the "Flash Programmer2"

52. Open the Flash Programmer 2 and select CC1310 device on the left side of the screen. Click the right mouse button and click "connect". (See Picture 6)
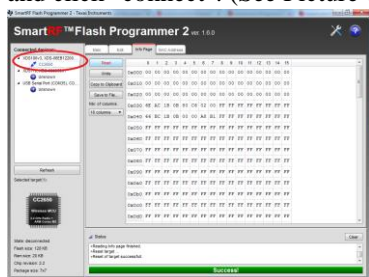
53. On the main screen click the "browser" button to find the downloaded bin file and click on the "Play" button to upload it. If the progress bar is green, the upload is successfully.
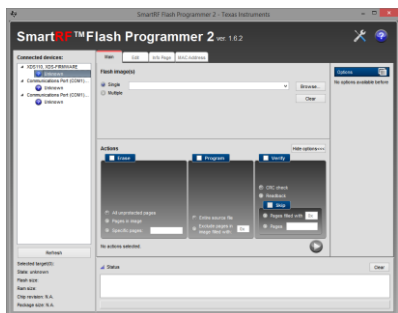
54. Disconnect the SmartRF06EB from the PC and the X.IP4T device from SmartRF06EB, and

re-connect the X.IP4T device with the Raspberry.

55. Edit the parameters configuration file of the border-router to have a secure and reliable connection, by typing the command prompt:

"**cd contiki/examples/ipv6/rpl-border-router"**   and press **Enter.**

"**sudo nano project-conf.h"**   and press **Enter.**

56. In the opened mask (Picture 4) write the following strings:

"**#undef NETSTACK_CONF_RDC**

#define NETSTACK_CONF_RDC   nullrdc_driver"

"**#undef NETSTACK_CONF_MAC**

#define NETSTACK_CONF_MAC   nullmac_driver"

57. Press "**Ctrl"** ed "**x"**

58. Press **"Y"**

59. Press **Enter** to save the file just edited.

60. It is necessary to install the drivers so the operating system is able to communicate with the hardware. Type on the command prompt the following strings:

" **lsusb"** to search the VID and PID on device,   and press **Enter.**

You should see (Bus 001 Device 002: ID 10c4:ea60 Cygnal Integrated Produts

"**sudo modprobe ftdi_sio vendor=0x10c4 product=0xea60**"   and press **Enter.**

"**sudo modprobe ftdi_sio**"   and press **Enter.**

"**sudo chmod 777 /sys/bus/usb_serial/drivers/ftdi_sio/new_id**"   and press **Enter.**

"**sudo echo 10c4 ea60> /sys/bus/usb-serial/drivers/ftdi_sio/new_id**   and press **Enter.**

61. The device should be enumerated as '/dev/ttyUSB0'. To check it go to type:
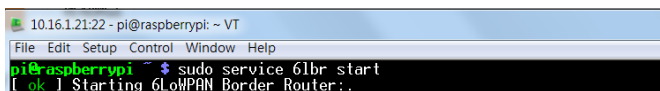
   "**ls/ dev**"

62. Reboot the system

63. Open command prompt and type:

   "**sudo service 6lbr start**"   and press **Enter.**

   If the procedure is correct the system works.

64. Open Mozilla Firefox browser on your PC.

65. In the search bar, type the gateway address "**http://[bbbb::100]**"

66. The page of 6LBR with all settings will open (Picture 7):

67. To create the new sensor, take the other X.IP4T device

68. Generate the file "**cc26xx-web-demo.bin**" by following the next steps (69-71)

   "**cd contiki/examples/cc26xx/cc26xx-web-demo**"

   "**sudo make clean**"

   "**sudo make TARGET=srf06-cc26xx BOARD=srf06/cc13xx cc26xx-web-demo.bin**   and press **Enter.**

69. Copy and upload the file CC26xx-web-demo.bin just generated on a pen-drive; to perform follow the previous steps (Steps 47-54)

70. Power the second CC1310 (containing the bin file) and connect it to the raspberry.

71. Open the command prompt and restart the 6lbr, by typing:

   "**sudo service 6lbr restart**"   and press **Enter.**

72. Open Mozilla Firefox browser on your PC and type in the search bar **http://[bbbb::100]**.

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73. 6lbr main screen will be open, go on the "sensors" item menu to read the sensor just generated (Picture 8)


74. Great! Now you can operate with the sensor through the 6lbr

   a. In the sensor main screen, click on "**web**" to open a hyperlink with all the characteristics of the device: sensor temperature, sensor battery and neighbor nodes. See Picture 9.

75. Close the "**web**" page and return to the page of the sensor to interact with the sensor, (Picture 8)

76. In the table, click on the word "**coap**". In the screen just opened (Picture 10) you can control the sensors through the network.
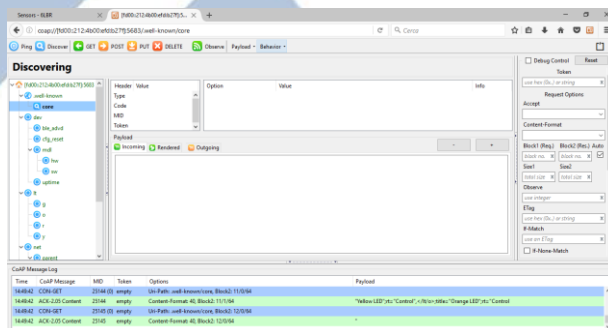
Please note, If the Coap doesn't work, you must install Copper CU, the additional plugin for Mozilla and restart the browser. You can download Copper CU from this link: https://addons.mozilla.org/it/firefox/addon/copper-270430/

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