

PLUTI (Prophet) installation on embedded computer



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1. Prophet installation on embedded computer

1.1 Introduction

This chapter explains step by step configuration of network and PLUTI in Linux embedded system. PLUTI is acronym for Prophet by Lulea University of Technology Implementation. The project PLUTI was recently renamed from previous project name Prophet. In this document both names can appear but they're describing the same implementation.

1.2 Prerequisites

1.2.1 Hardware

- Cambria GW2358-4 Network Platform
- Atheros wireless card
- USB storage device

1.2.2 Software

- OpenWRT installed on embedded machine (SEE DOCUMENTATION)
- Prophet compiled for XScale target system (SEE DOCUMENTATION) or use the existing build available on www.grasic.net

1.3 Network configuration

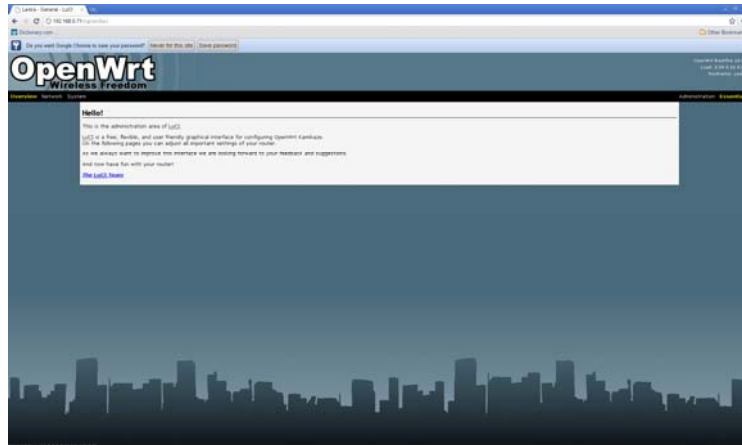
Before Prophet can communicate with the outer world, a network has to be configured. It's possible to configure network in web based interface or the console. The Web browser interface is more convenient and it's described later in this section. Two possible modes are available for wireless communication:

- Access point
- Ad-hoc

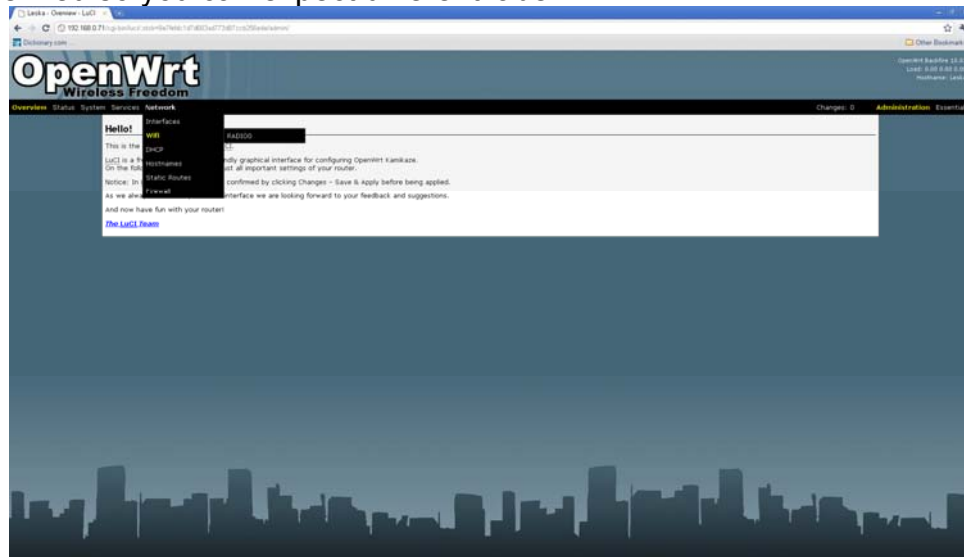
In this paper it's introduced only configuration the latter.

Network configuration in OpenWRT can generally be done over Web based interface (LuCI). It's available by default on the systems installed from the official image available on www.openwrt.si. Follow the next steps in order to configure the network:

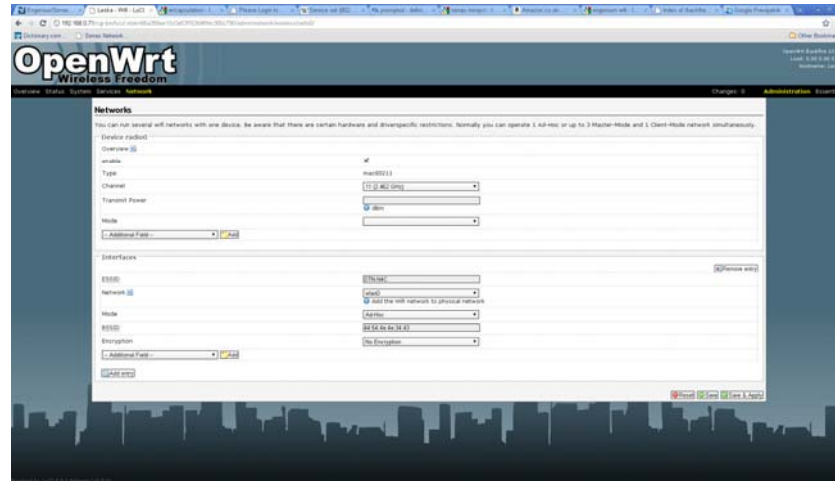
1. Connect embedded device into your local network or directly to your computer.
2. LuCI is accessible on the IP that was defined when the operating system was installed. Login with username *root* and enter password that you've chosen at installation.



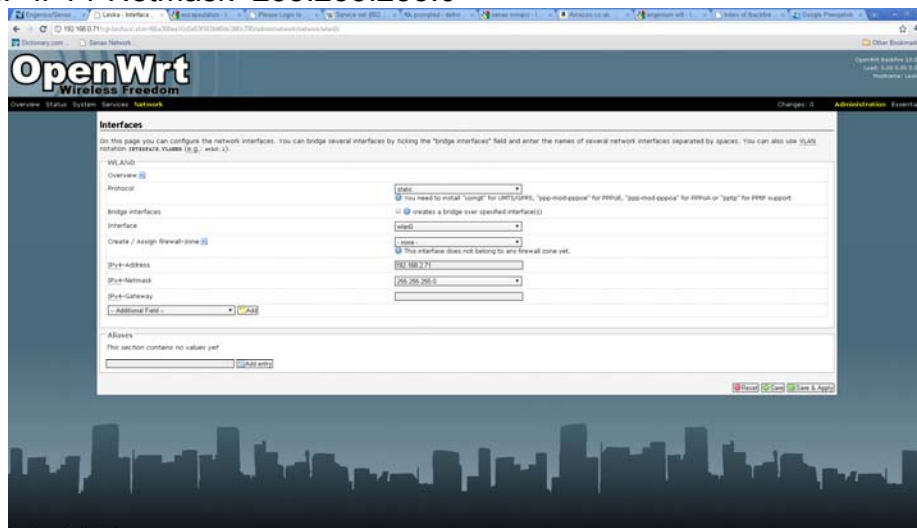
3. All Network configuration is available in the menu *administration* -> *Network*. Atheros wireless interface should be listed in the submenu *WiFi* labeled as RADIO0. Unfortunately the name is not uniformly defined so you can expect different label.



4. Click on the RADIO0 or whatever your interface is labeled. Set the following parameters:
 - a. Check the checkbox under label 'enable'
 - b. 'channel' to 11
 - c. 'ESSID' to DTN-N4C (or change the name to any other)
 - d. 'Network' to wlan0
 - e. 'BSSID' to 44:54:4e:4e:34:43



5. Apply changes with click on the button 'Save and Apply'
6. Now click on the menu *administration* -> *Network* -> *Interfaces* -> *wlan0* and set the following parameters:
 - a. Protocol=static
 - b. Interface=wlan0
 - c. IPv4-Address=192.168.2.71
 - d. IPv4-Netmask=255.255.255.0



7. Apply changes with click on the button 'Save and apply', and restart the machine

Now the network link with other devices should be established. The configuration you can verify on your local computer or remote machine. Login with SSH client on remote machine with the following steps:

1. Enter command ``ssh root@192.168.0.71`` and password when requested

```
n4c@localhost:~> ssh root@192.168.0.71
root@192.168.0.71's password:
```

2. Enter command ``ifconfig wlan0``, and check if wlan0 is properly configured

```
root@Leska:~# ifconfig wlan0
wlan0      Link encap:Ethernet  HWaddr 00:02:6F:59:69:9B
           inet addr:192.168.2.71  Bcast:192.168.2.255  Mask:255.255.255.0
           UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
           RX packets:937  errors:0  dropped:0  overruns:0  frame:0
```

```
TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
collisions:0 txqueuelen:1000
RX bytes:44039 (43.0 KiB) TX bytes:0 (0.0 B)
```

3. Now check wireless specific network configuration `iwconfig wlan0`

```
root@Leska:~# iwconfig wlan0
wlan0 IEEE 802.11abg ESSID:"DTN-N4C"
Mode:Ad-Hoc Frequency:2.462 GHz Cell: 44:54:4E:4E:34:43
Tx-Power=27 dBm
RTS thr:off Fragment thr:off
Encryption key:off
Power Management:off
```

Focus on ESSID, Cell(BSSID) and Mode. Check if the parameters match the configuration.

4. You can find the devices currently connected to your network with nmap command.

```
root@Leska:~# nmap 192.168.2.1-254
Nmap scan report for 192.168.2.71
Host is up (0.00062s latency).
Not shown: 997 closed ports
PORT      STATE SERVICE
22/tcp    open  ssh
53/tcp    open  domain
80/tcp    open  http
MAC Address: 00:02:6F:59:69:9B (Senao International Co.)

Nmap scan report for 192.168.2.84
Host is up (0.00012s latency).
Not shown: 999 closed ports
PORT      STATE SERVICE
22/tcp    open  ssh

Nmap done: 254 IP addresses (2 hosts up) scanned in 48.36 seconds
```

5. In order to test the connection you need another device in your network. (In this example we used a device with same HW specs and configured on IP=192.168.2.84)

```
root@Leska:~# ping 192.168.2.84
PING 192.168.2.84 (192.168.2.84): 56 data bytes
64 bytes from 192.168.2.84: seq=0 ttl=64 time=4.188 ms
64 bytes from 192.168.2.84: seq=1 ttl=64 time=0.409 ms
64 bytes from 192.168.2.84: seq=2 ttl=64 time=0.379 ms
64 bytes from 192.168.2.84: seq=3 ttl=64 time=0.376 ms
^C
--- 192.168.2.84 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 0.376/1.338/4.188 ms
```

Your output should be similar but not identical!

6. If you can't find or connect to another device, then check if your device can see it:

```
root@Leska:~# iwlist wlan0 scanning
```

This will find all wireless devices near you.

1.4 Prophet

1.4.1 Installation on OpenWrt

1.4.1.1 Installation from package

You can obtain Prophet installation packages for various architectures from www.grasic.net or compile it from source (DOCUMENT LINK!!!). In our example we require an openWRT package for XScale(IXP family) processor:

```
prophet_7.0.131-1_ixp4xx.ipk
```

Login to remote machine and install the package:

```
root@Leska:~# ssh root@192.168.0.71
root@Leska:~# wget www.grasic.net/prophet_7.0.131-1_ixp4xx.ipk
root@Leska:~# opkg install prophet_7.0.131-1_ixp4xx.ipk
```

If you don't have access to the internet you need to transfer the package with different method (USB storage device).

1.4.1.2 Mount points

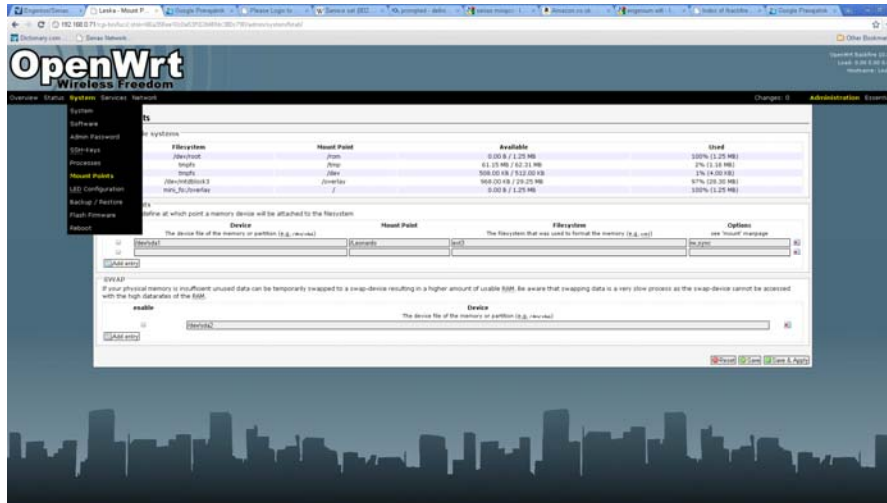
Embedded devices usually have small amount of storage capacity, but it's possible to increase it with extern storage device attached to one of the available interface (USB).

We'll use a 2GB USB pen drive for storing Prophet bundles. When you attach the pen to USB interface you need to check if it has been successfully recognized and assigned by the kernel. You can do this if you login to your remote machine and run the command:

```
root@Leska:~# dmesg | tail
usb-storage: device scan complete
sd 0:0:0:0: [sda] Write Protect is off
sd 0:0:0:0: [sda] Mode Sense: 23 00 00 00
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] Assuming drive cache: write through
sda: sda1
sd 0:0:0:0: [sda] Assuming drive cache: write through
sd 0:0:0:0: [sda] Attached SCSI removable disk
FAT: bogus number of reserved sectors
VFS: Can't find a valid FAT filesystem on dev sda1.
root@Leska:~#
root@Leska:~#
root@Leska:~# ls -la /dev/sda*
brw-rw---- 1 root root 8, 0 Feb 7 12:46 /dev/sda
brw-rw---- 1 root root 8, 1 Feb 7 12:46 /dev/sda1
root@Leska:~#
root@Leska:~# mkdir /Leonardo && mount /dev/sda1 /Leonardo
```

If the procedure passed without errors then you can define mount points in LuCI interface. Otherwise, the pen wasn't recognized, and you probably need to install additional device or file system drivers (DOCUMENTATION!!!!!!).

LuCI interface offers a convenient way of configuring mount points. It's available in the menu *Administration->System->Mount points*. You can add a new entry for newly attached device (/dev/sda1) and define the mount point to /Leonardo.



1.4.1.3 Prophet configuration

Prophet default configuration file path is /etc/prophet/prophet.ini. You can copy or move the configuration to any other location you desire. It's important to run prophet from the same directory as the configuration file.

Create default locations for Prophet Configuration and related files

```
root@Leska:~# mkdir /Leonardo
root@Leska:~# cp -rf /etc/prophet/prophet.ini /Leonardo
root@Leska:~# mkdir -p /Leonardo/dftp
root@Leska:~# mkdir -p /Leonardo/list
root@Leska:~# mkdir -p /Leonardo/storage
root@Leska:~# mkdir -p /Leonardo/log
```

Open the configuration file with a text editor, such as 'vim' and change the parameters as follows:

```
root@Leska:~# vim /Leonardo/prophet.ini

# A unique number identifying this node.
NODEID=71
# A unique name identifying this node, should be the same as local_eid in
# DTN-configuration but without the "dtn://" prefix.
NODENAME=leska.si.n4c.eu

# The IP number of this node.
NODEIP=192.168.2.71

# IP number of any secondary network interface on the same host. If there is no secondary
# interface, just set it to the same
NODEIP2=192.168.0.71

# The broadcast address of this node. Should be as narrow as possible, ie rather use
# 192.168.10.255 than 255.255.255.255
NODEBROADCAST=192.168.2.255

# The hostname where PROPHET should connect to DTN. Usually the same as NODEIP1.
DTNHOSTNAME=192.168.2.71

#DFTP Sync folder
DFTPPATH=/Leonardo/dftp

# The directory PROPHET will use for storing bundles. It will be created on
# startup if it does not already exist.
STORAGEPATH=/Leonardo/storage/

# The directory PROPHET will use for logging. It will be created on startup if
# it does not already exist.
LOGPATH=/Leonardo/log/
```

```
# The directory PROPHET will use for storing the node list, bundle list etc. It
# will be created on startup if it does not already exist.
MSGPATH=/Leonardo/list/
```

For other parameters see the prophet documentation.

1.4.1.4 Running prophet

The last step in the procedure is running Prophet. The only rule that needs to be applied here is that you run Prophet from the directory where prophet.ini resides. If the location of prophet.ini is /Leonardo, then you should run Prophet with the following command:

```
root@Leska:~# cd /Leonardo && prophet &
```

If you want to automatically run Prophet on every boot then you need to invoke the following commands:

```
root@Leska:~# echo "cd /Leonardo && prophet &" > /etc/init.d/prophet
root@Leska:~# chmod a+x /etc/init.d/S96prophet

root@Leska:~# reboot
```