

4th Generation District Heating setup documentation

December 11, 2017

1 Introduction

This document details the setup of the DH system using beagle bone black border router and mulle devices. The mulle devices are coded using the code produced at the LTU-EISLAB repository¹ and hence to reuse the same code, one should get access to the repository before getting started with setting the DH system. The steps detailed in this document points to the code developed for the valve and temperature sensor using the basic code available at the LTU-EISLAB repository. At the moment of this writing the setup is as follows (as shown in Figure 1): The Border router is connected to the PC via a mini USB cable which provide Ethernet over USB. The temp sensor T_OUT is the outside sensor and temp sensor T_IN is the inside sensor. The Valve is denoted by VLV through out the document.

2 Steps to connect to border router when it is connected on LAN

1. ssh to 130.240.234.49 ip address using username: debian and password: temppwd
2. power on the mulle devices and type 'curl -g http://[fdfd::1]' in the ssh window and it shows the list of devices connected to the border router.

3 Steps to connect border router to the PC

1. Power up the Ubuntu VM, connect the border router to the PC via mini USB cable.
2. Type 'ifconfig' in Ubuntu terminal and wait till the VM detects 192.168.7.* network.
3. Now open another terminal and ssh into the border router. ssh debian@192.168.7.2
4. type the password 'temppwd' shown there and connect to border router as shown in Figure 2
5. give ls and make sure the service registry, authorization and orchestration modules are present on it
6. give the command 'sudo bash ~/route/routing.sh'
7. now run the routing script on the ubuntu, in ubuntu terminal type the commands 'cd con-tiki/DHfiles' and then 'sudo bash routing.sh'
8. now the routing modules work and the beagle bone is able to redirect traffic to the ubuntu
9. to verify this, open firefox browser in the ubuntu and type http://[fdfd::1]
10. At this movement, the neighbors and routes show an empty list as shown in Figure 3, it will pop up once the devices are connected

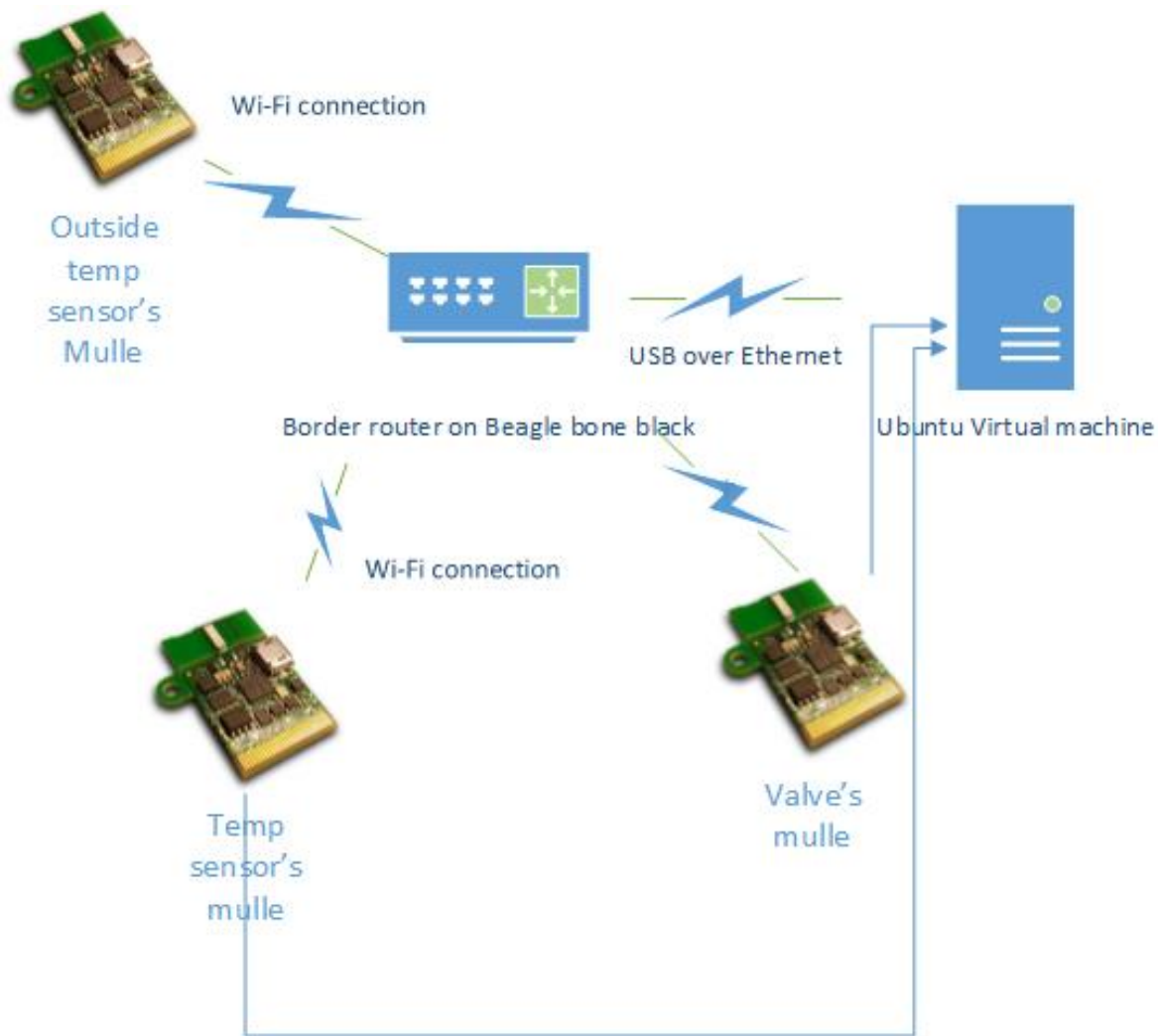


Figure 1: DH setup

¹ contact Jens, Eliasson for access to repository

4 Steps to configure and connect devices

1. place the mulle on the EISTEC programmer and connect to the PC via USB.
2. Follow the steps in <https://github.com/eistec/mulle/wiki/Contiki-introduction> to flash the mulle
3. in the ubuntu terminal goto folder structure 'cd contiki/DHfiles/jacnil/Arrowhead_DH_Assignment/temperature_syst' and give the commands 'export MULLE_SERIAL = xxx' then 'export PROGRAMMER_SERIAL = yyy' and then 'make', the xxx and yyy represent the corresponding mulle serial number present on the mulle and the programmer numbers respectively (for valve mulle goto folder structure contiki/DHfiles/jacnil/Arrowhead_DH_Assignment/valve_actuation_system)

```
ltu@ubuntu:~$ ssh debian@192.168.7.2
Debian GNU/Linux 7

BeagleBoard.org Debian Image 2015-03-01

Support/FAQ: http://elinux.org/Beagleboard:BeagleBoneBlack\_Debian
default username:password is [debian:tempwd]
debian@192.168.7.2's password: █
```

Figure 2: ssh connection to border router

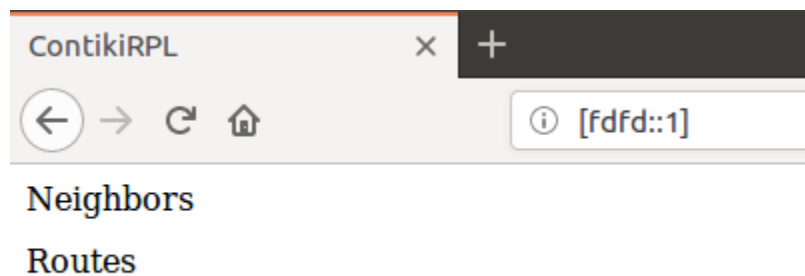


Figure 3: neighbors and routes of border router

4. if everything goes fine you should be able to see these devices in the border router list as shown below in Figure 4
5. now run the dh application in the ubuntu terminal and it should be able to record the information from sensors as shown in Figure 5

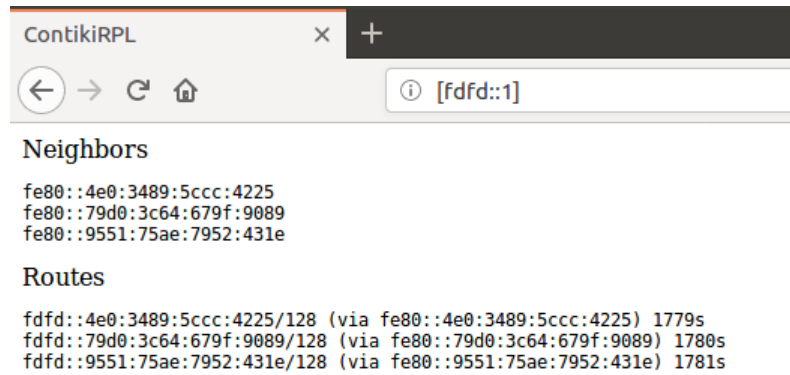


Figure 4: neighbors and routes of border router

```
ltu@ubuntu: ~/contiki/DHfiles/Arrowhead_DH_assignment
ltu@ubuntu:~/contiki/DHfiles/Arrowhead_DH_assignment$ python3 DH_application.py
-----
Temperatures:
    Outside:      27.0
    Pipe:         100.7
    Requested:    25

Actuation: -1 %

-----
Temperatures:
    Outside:      27.0
    Pipe:         79.9
    Requested:    25

Actuation: -2 %
```

Figure 5: dh application taking the readings