

**SUMMER COURSE IOT**

**PROJECT DOCUMENTATION**

**SMART TRASH POOL SYSTEM(STPS)**

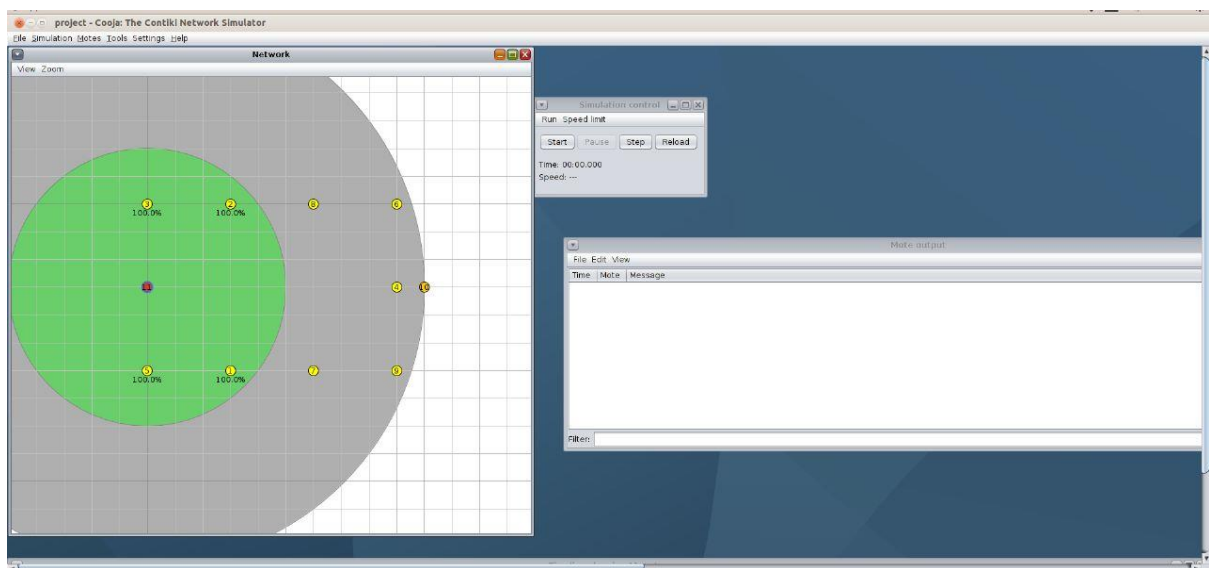
SI.NO	Name	SRN	Section
1	CHINMAYA R	PES2UG21CS144	C
2	CHANDANA DONGRE	PES2UG21CS134	C

Open the Cooja simulation and create the motes according the coordinates required

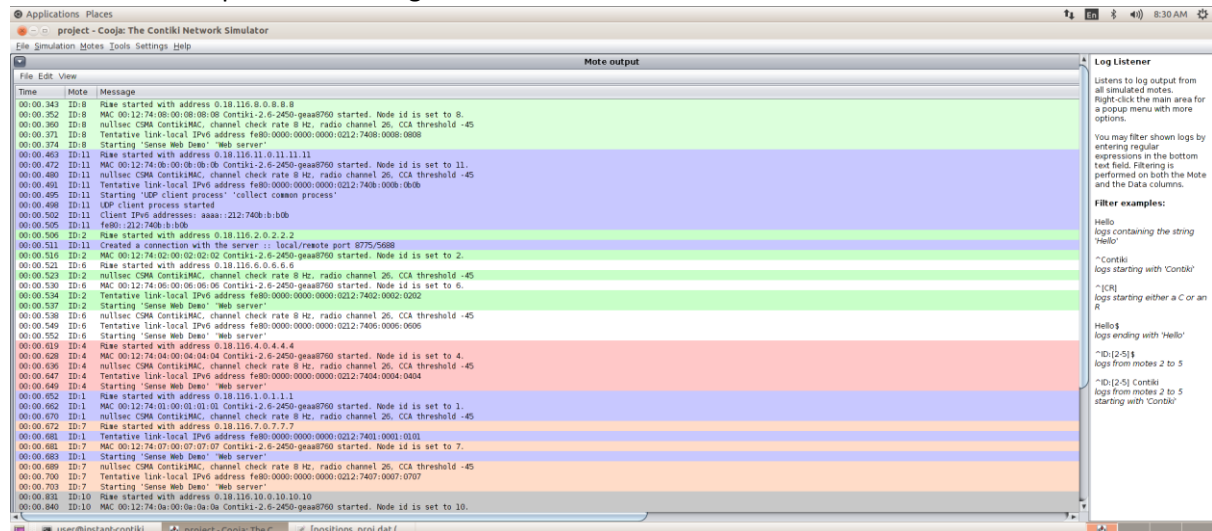
In this model we use the following key:

1. Dust bins using 9 sky-websense Mote (sky 1-9)
- 2.Vehicle using 1 mobile sender (sky 11)
3. Border-router (sky 10)

After generating motes needed start the Simulation.



This the mote output after starting the simulation:



Edit the skywebsense.c file to add mass parameter. Changed code shown below:

```
static int
get_mass(void){
    int res = (rand() % 2 + 1);
    int weight = res * 9.8;
    return weight;
}

/*-----*/
static const char *TOP = "<html><head><title>Contiki Web Sense</title></head><body>\n";
static const char *BOTTOM = "</body></html>\n";
/*-----*/
/* Only one single request at time */
static char buf[256];
static int blen;
#define ADD(...) do { \
    blen += snprintf(&buf[blen], sizeof(buf) - blen, __VA_ARGS__); \
} while(0)

static
PT_THREAD(send_values(struct httpd_state *s))
{
    PSOCK_BEGIN(&s->sout);

    SEND_STRING(&s->sout, TOP);

    if(strncmp(s->filename, "/index", 6) == 0 ||
       s->filename[1] == '\\0') {
        /* Default page: show latest sensor values as text (does not
           require Internet connection to Google for charts). */
        blen = 0;
        int temp = get_mass();
        ADD("<h1>Current readings</h1>\n"
            "Weight %d Kg",
            temp);
        if(temp>15){
            ADD("<br>Alert!!! Bin's about to fill");
        }
    }
}
```

Make connect the border router in Contiki/examples/ipv6/border-router directory using command make connect-router-cooja and open the serial socket SERVER tool and start on the listening port 60001. It configures and gives the server IPv6 addresses as shown below:

```

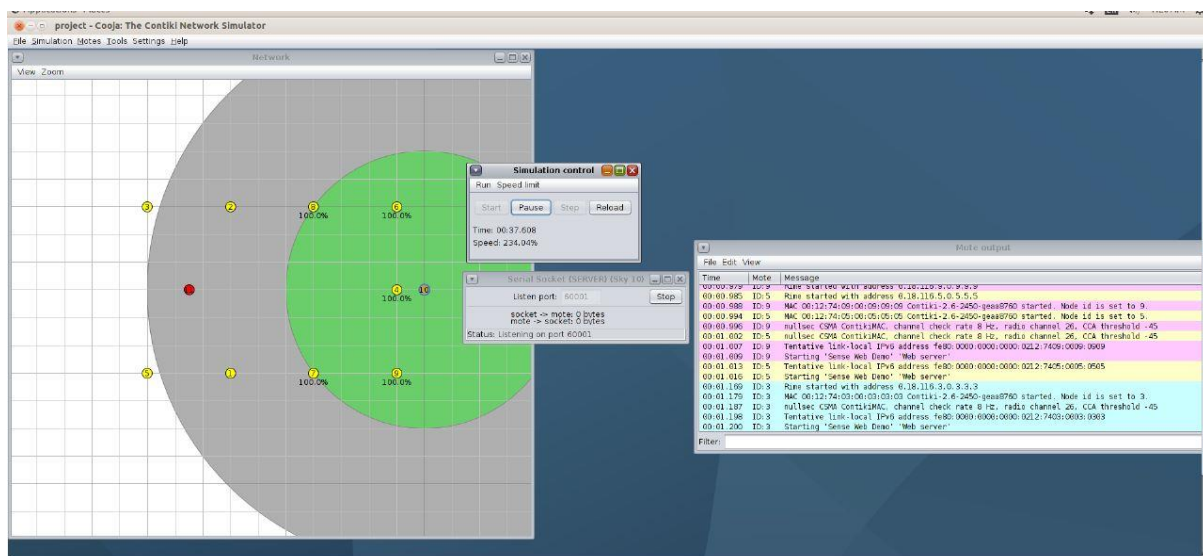
user@instant-contiki:~/contiki/examples/ipv6/rpl-border-router$ make connect-router-cooja
TARGET not defined, using target 'native'
sudo ../../tools/tunslip6 -a 127.0.0.1 aaaa::1/64
[sudo] password for user:
slip connected to `127.0.0.1:60001'
opened tun device `/dev/tun0'
ifconfig tun0 inet 'hostname' up
ifconfig tun0 add aaaa::1/64
ifconfig tun0 add fe80::0:0:0:1/64
ifconfig tun0

tun0      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          inet addr:127.0.1.1  P-t-P:127.0.1.1  Mask:255.255.255.255
          inet6 addr: fe80::1/64 Scope:Link
          inet6 addr: aaaa::1/64 Scope:Global
          UP POINTOPOINT RUNNING NOARP MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:500
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

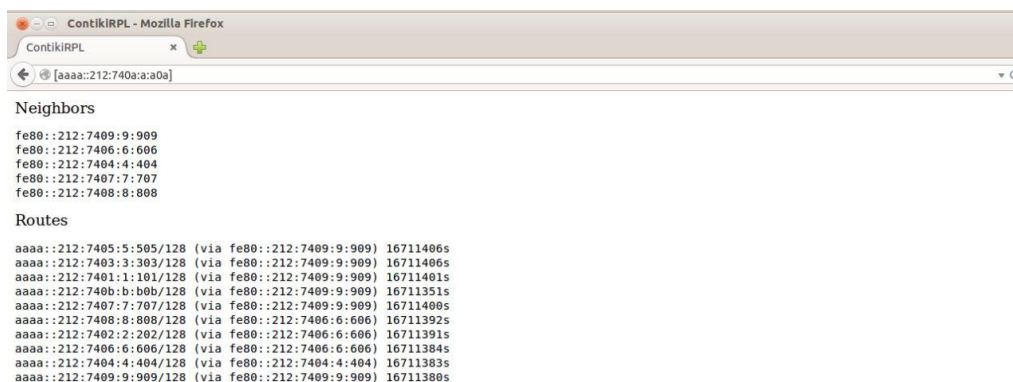
*** Address:aaaa::1 => aaaa:0000:0000:0000
Got configuration message of type P
Setting prefix aaaa::
Server IPv6 addresses:
aaaa::212:740a:a:a0a
fe80::212:740a:a:a0a

```

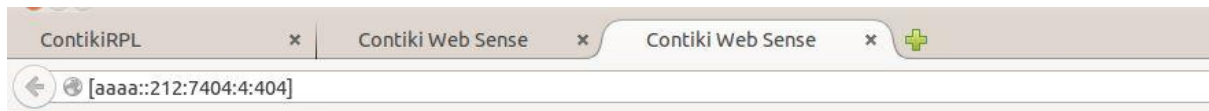
Switch on the server port 60001



Using the server IPv6 addresses type the ip after the route has been determined to get the readings. We get the output on web page (ContikiRPL) and also get the result of each sky-websense(Contiki Web Sense) Mote as shown below:



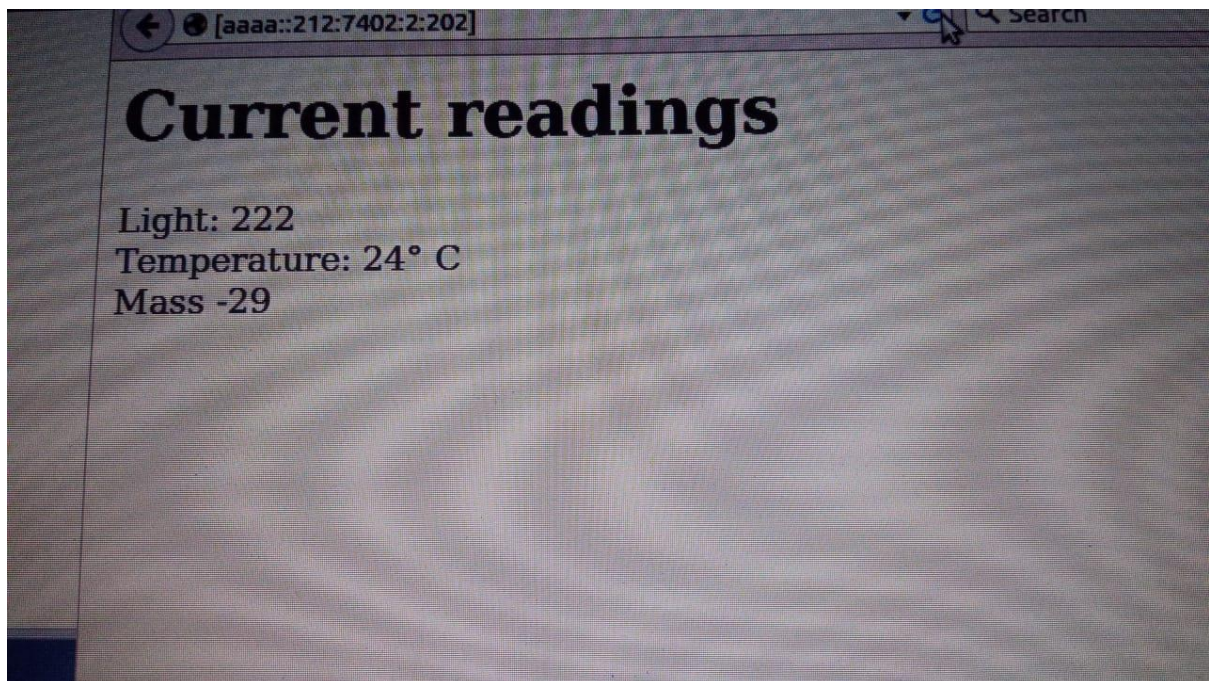




## Current readings

Weight 19 Kg

Alert!!! Bin's about to fill



Design a mobility model arrange the coordinates as required and save the positions\_proj.dat file

```
user@instant-contiki: ~/contiki/tools/cooja
user@instant-contiki:~/contiki/examples/ipv6/rpl-border-router$ cd
user@instant-contiki:~$ cd bonnmotion/bin
user@instant-contiki:~/bonnmotion/bin$ ./bm -f test ManhattanGrid -n 11 -d 200 -x 40 -y 40 -u 3 -v 2
BonnMotion 3.0.1

OS: Linux 3.13.0-62-generic
Java: Oracle Corporation 1.7.0_79

Starting ManhattanGrid ...
Next RNG-Seed =1734243913510000407 | #Randoms = 11965
ManhattanGrid done.
Runtime: 0 sec
user@instant-contiki:~/bonnmotion/bin$ ./bm WiseML -f test -L 1
BonnMotion 3.0.1

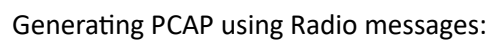
OS: Linux 3.13.0-62-generic
Java: Oracle Corporation 1.7.0_79

Starting WiseML ...
randomSeed (String):1690090225756
randomSeed (Long):1690090225756
WiseML done.
Runtime: 0 sec
user@instant-contiki:~/bonnmotion/bin$ ./wml2dat test.wml positions_proj.dat
```

One Mobile sender:

```
sky-websense.c x positions_proj.dat x
0 0 30 60
1 0 30 0
2 0 0 0
3 0 90 30
4 0 0 60
5 0 90 0
6 0 60 60
7 0 60 0
8 0 90 60
9 0 100 30
10 0 0 30
0 1 30 60
1 1 30 0
2 1 0 0
3 1 90 30
4 1 0 60
5 1 90 0
6 1 60 60
7 1 60 0
8 1 90 60
9 1 100 30
10 1 15 30
0 2 30 60
1 2 30 0
2 2 0 0
3 2 90 30
4 2 0 60
5 2 90 0
6 2 60 60
7 2 60 0
8 2 90 60
9 2 100 30
10 2 15 30
0 3 30 60
1 3 30 0
2 3 0 0
3 3 90 30
4 3 0 60
5 3 90 0
6 3 60 60
7 3 60 0
8 3 0 60
```

After starting the simulation mote 11 move according to their mobility model



Open radio messages choose the 6lopan analyser and run the simulation and after 15 minutes stop the simulation and we can open the pcap file to start the analysis of the packets along with the protocols used

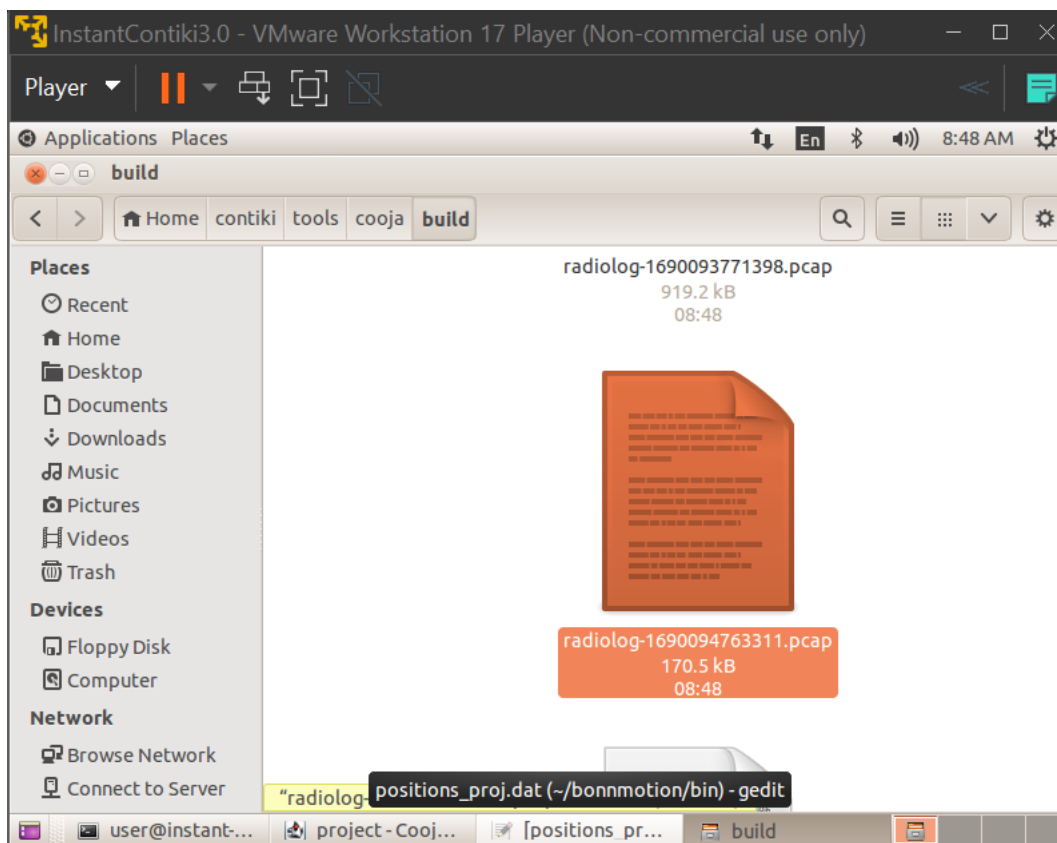
Applications Places

project - Cooja: The Contiki Network Simulator

File Simulation Notes Tools Settings Help

Radio messages: showing 366/770 packets

No.	Time	From	To	Data
156	24:02.077	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
157	24:02.080	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
158	24:02.080	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
159	24:02.083	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
160	24:02.083	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
161	24:02.087	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
162	24:02.087	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
163	24:02.090	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
164	24:02.090	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
165	24:02.093	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
166	24:02.094	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
167	24:02.097	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
168	24:02.097	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
169	24:02.100	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
170	24:02.100	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
171	24:02.104	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
172	24:02.104	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
173	24:02.107	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
174	24:02.107	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
175	24:02.110	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
176	24:02.111	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
177	24:02.114	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
178	24:02.114	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
179	24:02.117	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
180	24:02.117	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
181	24:02.121	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
182	24:02.121	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
183	24:02.124	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
184	24:02.124	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
185	24:02.127	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
186	24:02.128	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000
187	24:02.131	5	11	64: 15. 4 D 00:12:74:05:00:05:05:05 0xFFFF IPv6 ICMPv6 RPL DIS 0000
188	24:02.131	9	-	64: 15. 4 D 00:12:74:09:00:09:09:09 0xFFFF IPv6 ICMPv6 RPL DIS 0000



Initial the wireshark looks like this:



Applications Places

radiolog-1690094763311.pcap [Wireshark 1.7.2 (SVN Rev 42506 from /trunk)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
2	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
3	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
4	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
5	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
6	0.024000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
7	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
8	0.024000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
9	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
10	0.025000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
11	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
12	0.025000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
13	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)

Frame 1: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)

- IEEE 802.15.4 Data, Dst: Broadcast, Src: NtLab\_02:00:02:02:02
- 6LoWPAN
- Internet Protocol Version 6, Src: fe80::212:7402:2:202 (fe80::212:7402:2:202), Dst: ff02::1a (ff02::1a)
- Internet Control Message Protocol v6

```

3000  41 d8 87 cd ab ff ff 02 02 00 00 02 74 12 00 41  A.....t..A
3010  60 00 00 00 00 06 3a 40 fe 80 00 00 00 00 00 00  .....@.....
3020  02 12 74 02 00 02 02 02 ff 02 00 00 00 00 00 00  ..t.....
3030  00 00 00 00 00 00 00 1a 9b 00 ef 08 00 00 dd d6  .....

```

File: /home/user/contiki/tools/c... Packets: 4056 Displayed: 4056 Marked: 0 Load time: 0:00.078

Using the filter of the icmpv6 protocol to filter out the packets:

radiolog-1690094763311.pcap [Wireshark 1.7.2 (SVN Rev 42506 from /trunk)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: icmpv6 Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
2	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
3	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
4	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
5	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
6	0.024000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
7	0.024000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
8	0.024000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
9	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
10	0.025000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
11	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
12	0.025000	fe80::212:7406:6:606	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)
13	0.025000	fe80::212:7402:2:202	ff02::1a	ICMPv6	64	RPL Control (DODAG Information Solicitation)

Frame 1: 64 bytes on wire (512 bits), 64 bytes captured (512 bits)

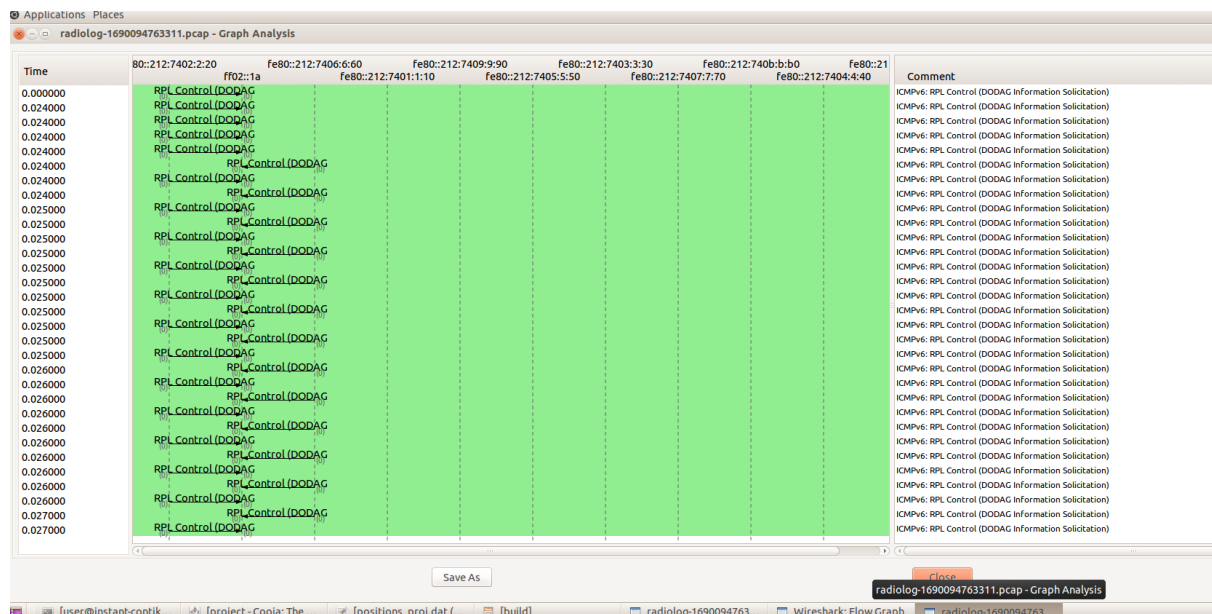
WTAP\_ENCAP: 104

Arrival Time: Jul 23, 2023 08:46:03.312000000 CEST

[Time shift for this packet: 0.000000000 seconds]

In Wireshark we can check the flow graph for DODAG using statistics option:





Now we analyse the same PCAP file in foren6 which allows more interactive form of analysis and is easy to understand. The details are available at a glance in the different tabs you can select any packet and the data is available in the other tab. You can also choose the time from timeline and select the red mote to see the warnings or lost packet from that particular mote

Forend: A 6LoWPAN Diagnosis Tool

File Layout Data Window Help

Start Stop Manage Sources Toggle node movement Clear Toggle node info Link/Unlink Dialogs

Packet Informations Informations

Data

- Frame 881: 102 bytes on wire (816 bits), 100 bytes captured (800 bits) on interface 0
- IEEE 802.15.4 Data, Dst: Wt1ab\_0a:00:0a:0a:0a, Src: Wt1ab\_0a:00:0a:0a:0a
- 6LoWPAN
- Internet Protocol Version 6, Src: fe80::212:7406:6:606 (fe80::212:7406:6:606)
- Internet Control Message Protocol v6

Filter:

Type	Version	Message
Packet 132	Type: UDP	src:12740a00000a0a0a dst:12740a00000a0a0a
Packet 133	Type: RPL DIO	src:12740700070707 dst:12740700070707
Node 133	Node updated,	wpan id = 1274070007
Packet 134	Type: RPL DIO	src:12740b000b0b0b dst:12740b000b0b0b
Node 134	Node updated,	wpan id = 12740b000b
Packet 135	Type: RPL DIO	src:12740600060606 dst:12740600060606
Node 135	Node updated,	wpan id = 1274060006

Filter:

Type	Version	Message
Packet 133	Type: RPL DIO	src:12740700070707 dst:12740900090909 frame: 879
Node 133	Node updated,	wpan id = 12740700070707
Packet 134	Type: RPL DIO	src:12740b000b0b0b dst:12740400040404 frame: 880
Node 134	Node updated,	wpan id = 12740b000b0b0b
Packet 135	Type: RPL DIO	src:12740a000a0a0a dst:12740a000a0a0a frame: 881
Node 135	Node updated,	wpan id = 12740a000a0a0a

Informations Informations

Name data

- 802.15.4
  - MAC Address
- IPv6
  - Link-Local IP
  - Global IP
- RPL configuration
  - Instance ID
    - DODAG ID
    - Version
    - Mode of ...
  - Prefix
    - On-link
    - Autoconf
    - Router...
    - Valid li...
    - Prefer...
  - Configura...
    - Use Au...
    - Path C...
    - DIO Int...

Overlay: Normal

Timeline: 135/136 83.098 sec