

RPL Simulation with COOJA in Contiki OS

1. RPL is a distance vector routing protocol for low power small devices and for lossy networks that use IPv6.
2. Destination Oriented Directed Acyclic Graph (DODAG) is built to route at a single terminus.
3. The network graph is assembled by using the OF (Objective Function) which explains how the routing metric is calculated.
4. Network optimization is done by the RPL instance which permits to build a logical routing topology over the present Wireless Sensor Network arrangement.
5. COOJA is capable of simulating wireless sensor network.
6. Here, we make use of Contiki OS based COOJA simulator to demonstrate working of RPL protocol.
7. We create a border router mote denoted by 1 (1,green) which would multicast DIO messages to other motes (2-17,yellow) to create a topology.
8. An RPL Instance is a set of one or more DODAGs that share a RPLInstanceID.
9. An RPL Node may belong to multiple RPL Instances (global or local), and it may act as router in some and as a leaf in others.
10. The network window in Figure 1 shows the arrangement of motes after setting up the server. 1 acts as border router (green) and rest of the motes (2-

17) are sources (yellow). All of the motes are within radio range of the border router.

11. Server is started at router mote by issuing command-

make connect-router-cooja

12. We start the simulation by clicking on **Start** in Simulation window. The network window looks like below when the simulation starts.

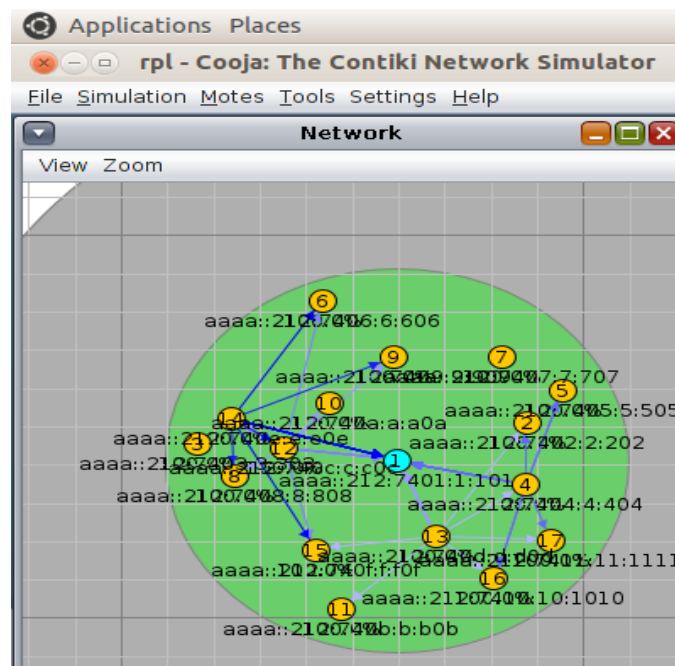


Figure 1:Network window

13. The timeline window is used to observe the power consumption and network traffic in WSN.

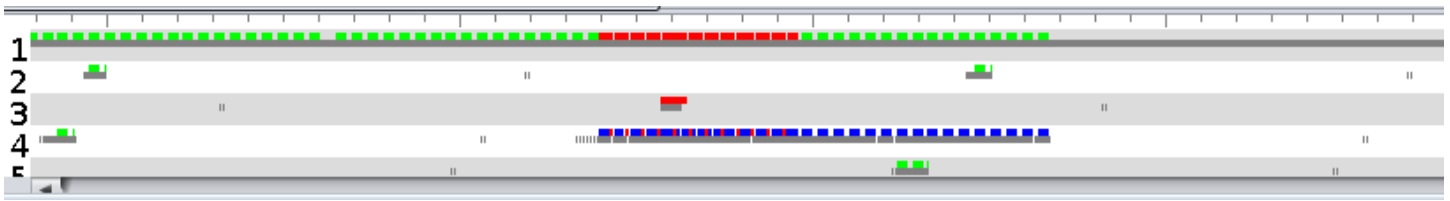


Figure 2:Timeline window

14. Radio transmissions is represented by blue, reception by green and interference by red color.
15. The mote output shows messages associated with setting up of motes, ipv6 address, information like channel rate and radio channel.

Mote output		
File Edit View		
Time	Mote	Message
00:00.346	ID:8	Rime started with address 0.18.116.8.0.8.8.8
00:00.354	ID:8	MAC 00:12:74:08:00:08:08:08 Contiki 2.7 started. Node id is set to 8.
00:00.360	ID:8	CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:00.371	ID:8	Tentative link-local IPv6 address fe80:0000:0000:0000:0212:7408:0008:0808
00:00.374	ID:8	Starting 'Sense Web Demo' 'Web server'
00:00.464	ID:11	Rime started with address 0.18.116.11.0.11.11.11
00:00.472	ID:11	MAC 00:12:74:0b:00:0b:0b:0b Contiki 2.7 started. Node id is set to 11.
00:00.478	ID:11	CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:00.489	ID:11	Tentative link-local IPv6 address fe80:0000:0000:0000:0212:740b:000b:0b0b
00:00.492	ID:11	Starting 'Sense Web Demo' 'Web server'
00:00.509	ID:2	Rime started with address 0.18.116.2.0.2.2.2
00:00.517	ID:2	MAC 00:12:74:02:00:02:02:02 Contiki 2.7 started. Node id is set to 2.
00:00.523	ID:6	Rime started with address 0.18.116.6.0.6.6.6
00:00.524	ID:2	CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:00.531	ID:6	MAC 00:12:74:06:00:06:06:06 Contiki 2.7 started. Node id is set to 6.
00:00.534	ID:2	Tentative link-local IPv6 address fe80:0000:0000:0000:0212:7402:0002:0202
00:00.537	ID:2	Starting 'Sense Web Demo' 'Web server'
00:00.538	ID:6	CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:00.549	ID:6	Tentative link-local IPv6 address fe80:0000:0000:0000:0212:7406:0006:0606
00:00.552	ID:6	Starting 'Sense Web Demo' 'Web server'
00:00.621	ID:4	Rime started with address 0.18.116.4.0.4.4.4
00:00.629	ID:4	MAC 00:12:74:04:00:04:04:04 Contiki 2.7 started. Node id is set to 4.
00:00.636	ID:4	CSMA ContikiMAC, channel check rate 8 Hz, radio channel 26
00:00.647	ID:4	Tentative link-local IPv6 address fe80:0000:0000:0000:0212:7404:0004:0404
00:00.649	ID:4	Starting 'Sense Web Demo' 'Web server'
00:00.659	ID:1	Rime started with address 0.18.116.1.0.1.1.1
00:00.667	ID:1	MAC 00:12:74:01:00:01:01:01 Contiki 2.7 started. Node id is set to 1.

Figure 3:Mote output window

16. We can also check for control or data packets in radio message window.

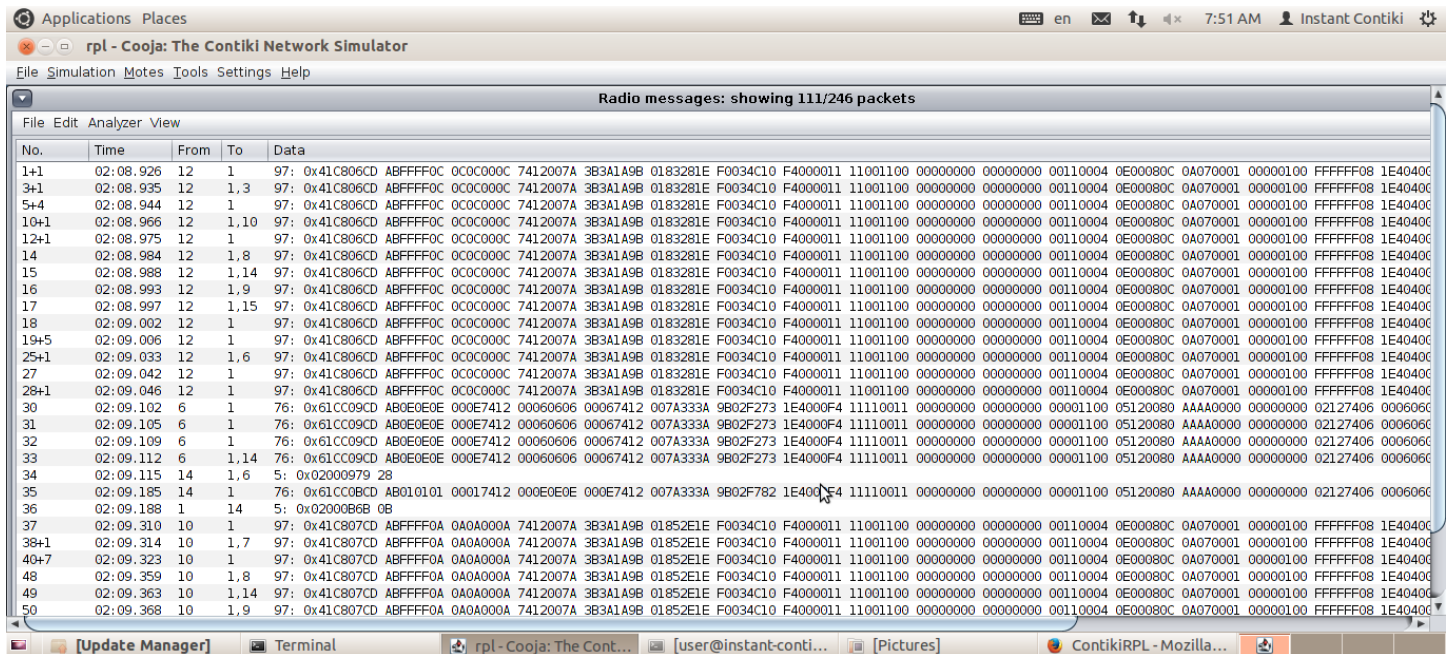


Figure 4:Radio messages

17. We can open the browser and insert border router address and check out its neighbors and routes to other motes as show in figure 5.

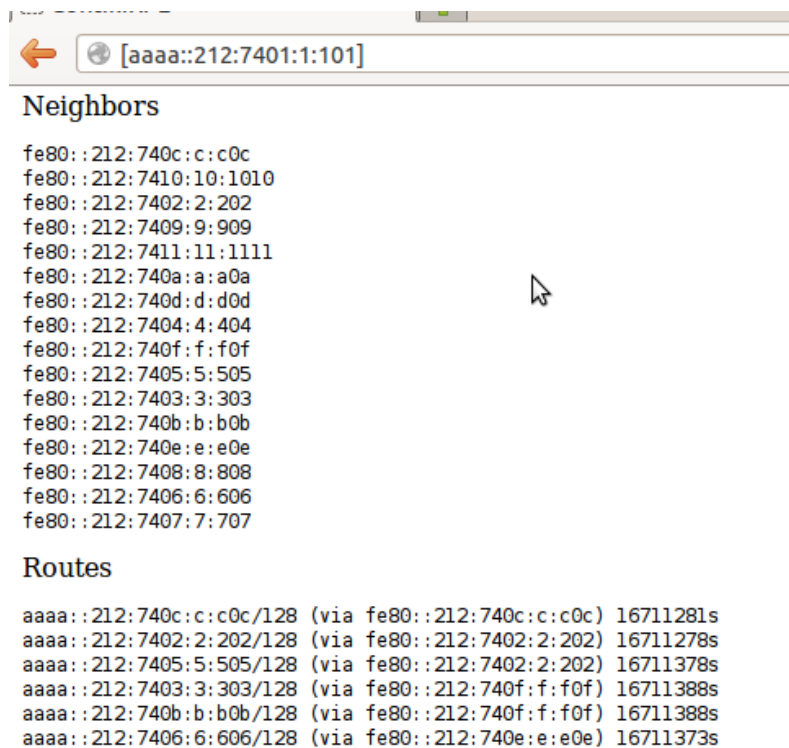


Figure 5