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# Cooja Simulator Step by Step Manual

By

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# Download and Install VMWare

- Go to [https://my.vmware.com/en/web/vmware/free#desktop\\_end\\_user\\_computing/vmware\\_workstation\\_player/12\\_0](https://my.vmware.com/en/web/vmware/free#desktop_end_user_computing/vmware_workstation_player/12_0)
- and download + install VMWare for Contiki OS and Cooja simulator to work

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## Download VMware Player

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- Go to  
<https://sourceforge.net/projects/contiki/files/Instant%20Contiki/>
- and download Contiki
- Unzip and open the folder

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 **The Contiki Operating System**

Status: **Beta** Brought to you by: [adamdunkels](#), [fros4943](#), [oliverschmidt](#)

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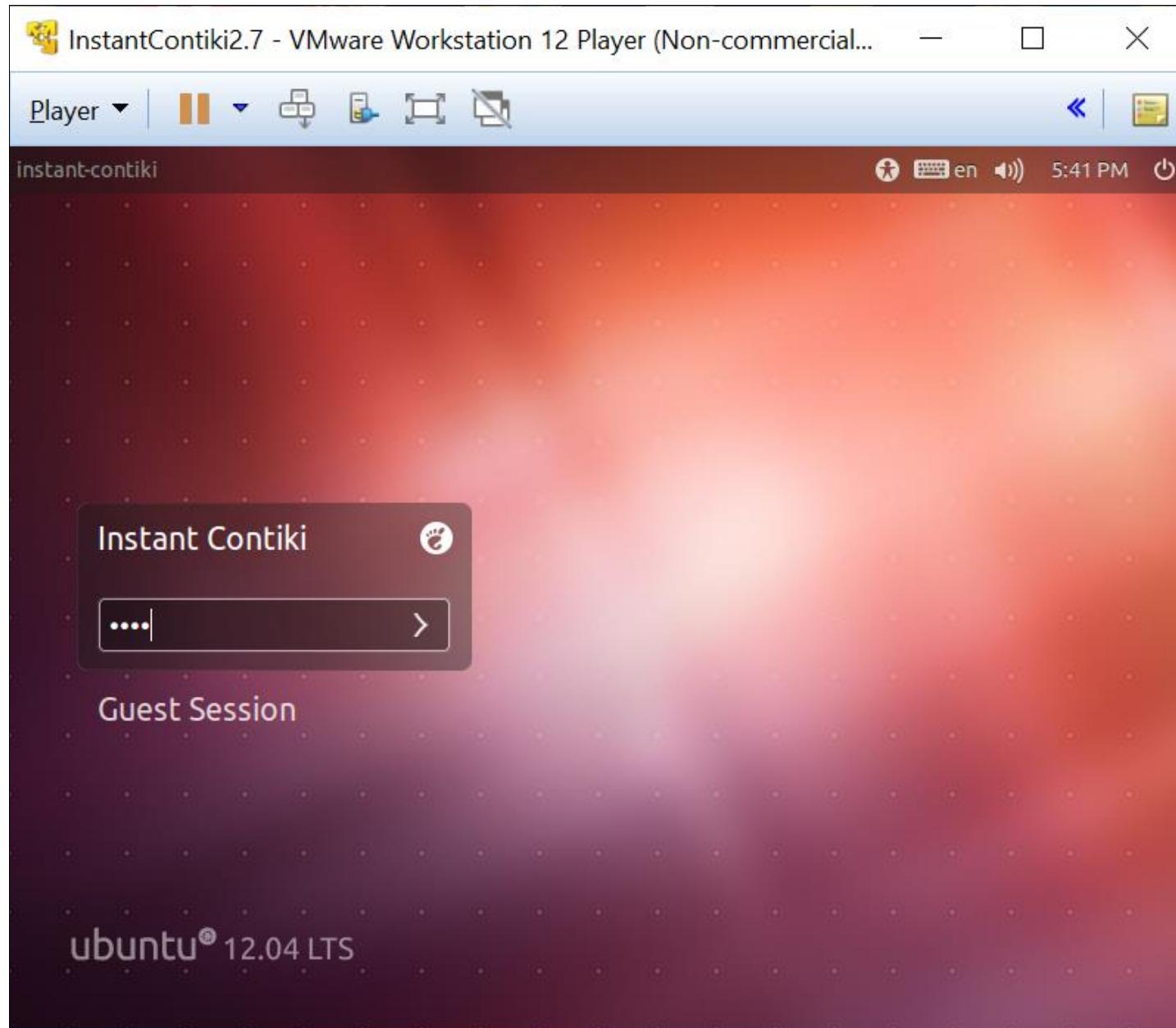


  
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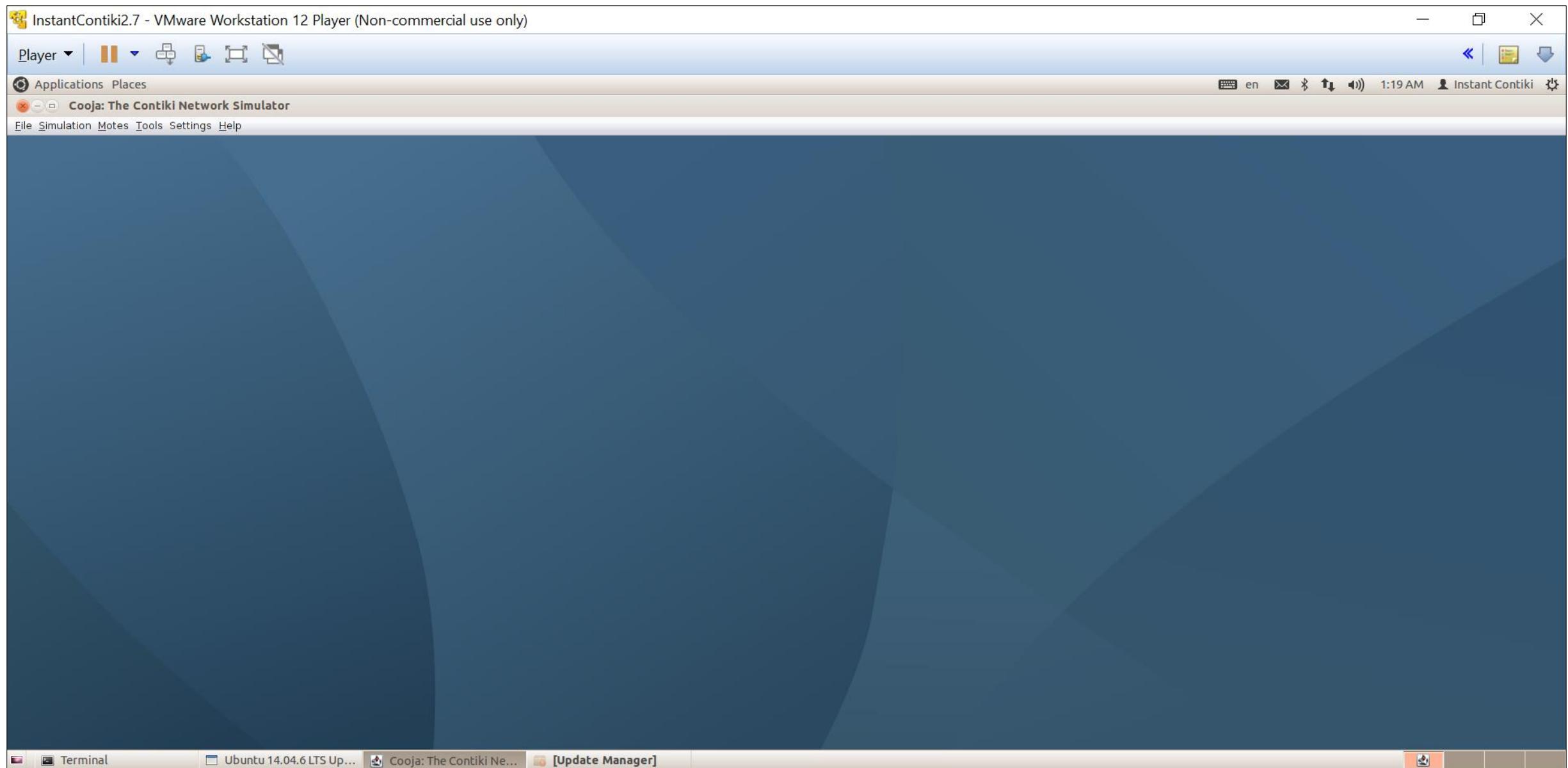
# Instant Contiki Log in

- Log into Contiki OS via VMWare workstation
- Use “**user**” as the password
- **user** = default password

# Instant Contiki Log in via VMWare Workstation



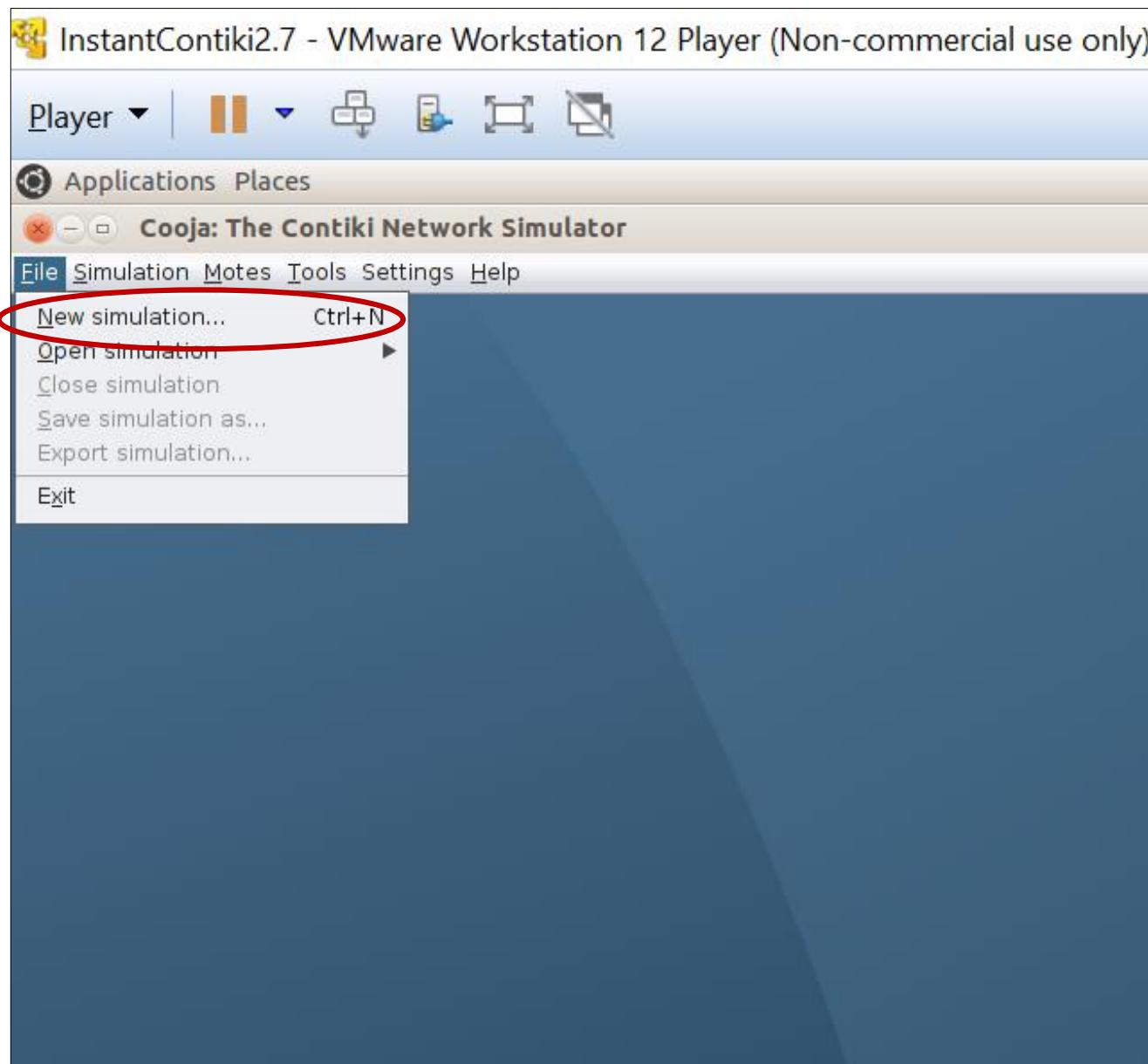
# Cooja Environment in VMWare Workstation



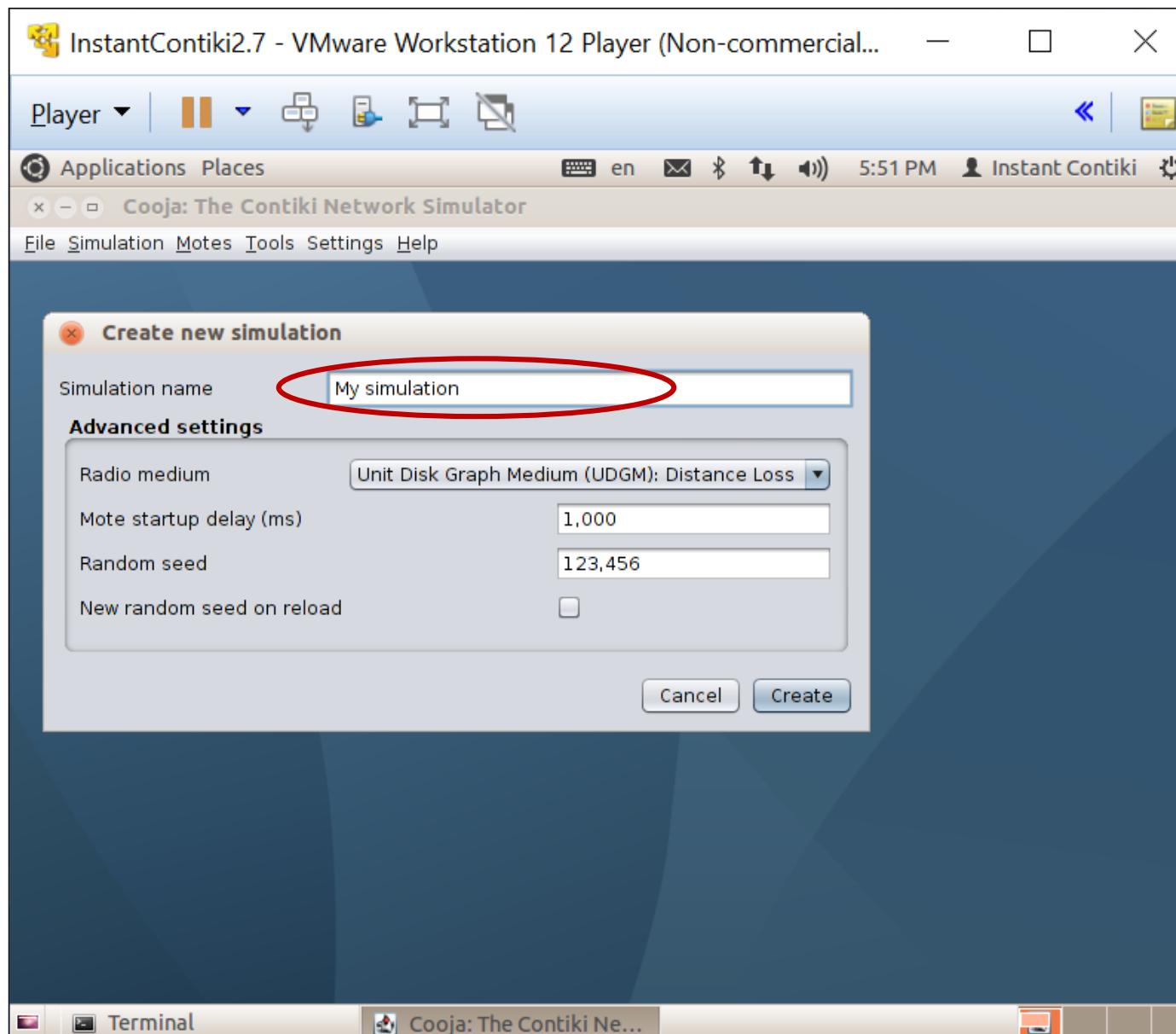
# Create New Simulation

- Go to **File**
- Select **Create New Simulation**

# Cooja Environment



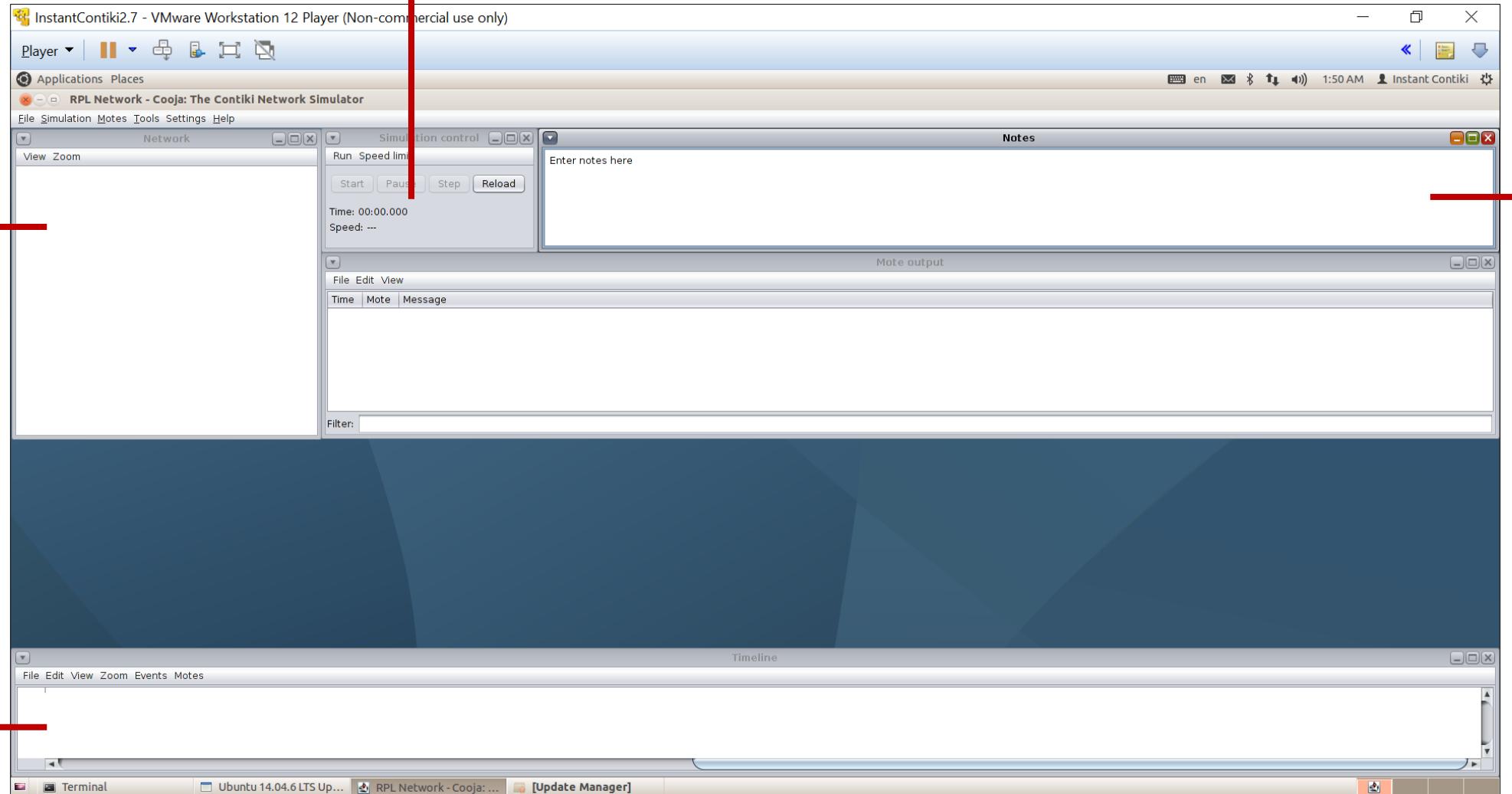
# Name your simulation



# Various Windows in the Cooja Environment

- Various windows will appear for simulation, such as network window, simulation control window, mote output and timeline

## Simulation Control Window



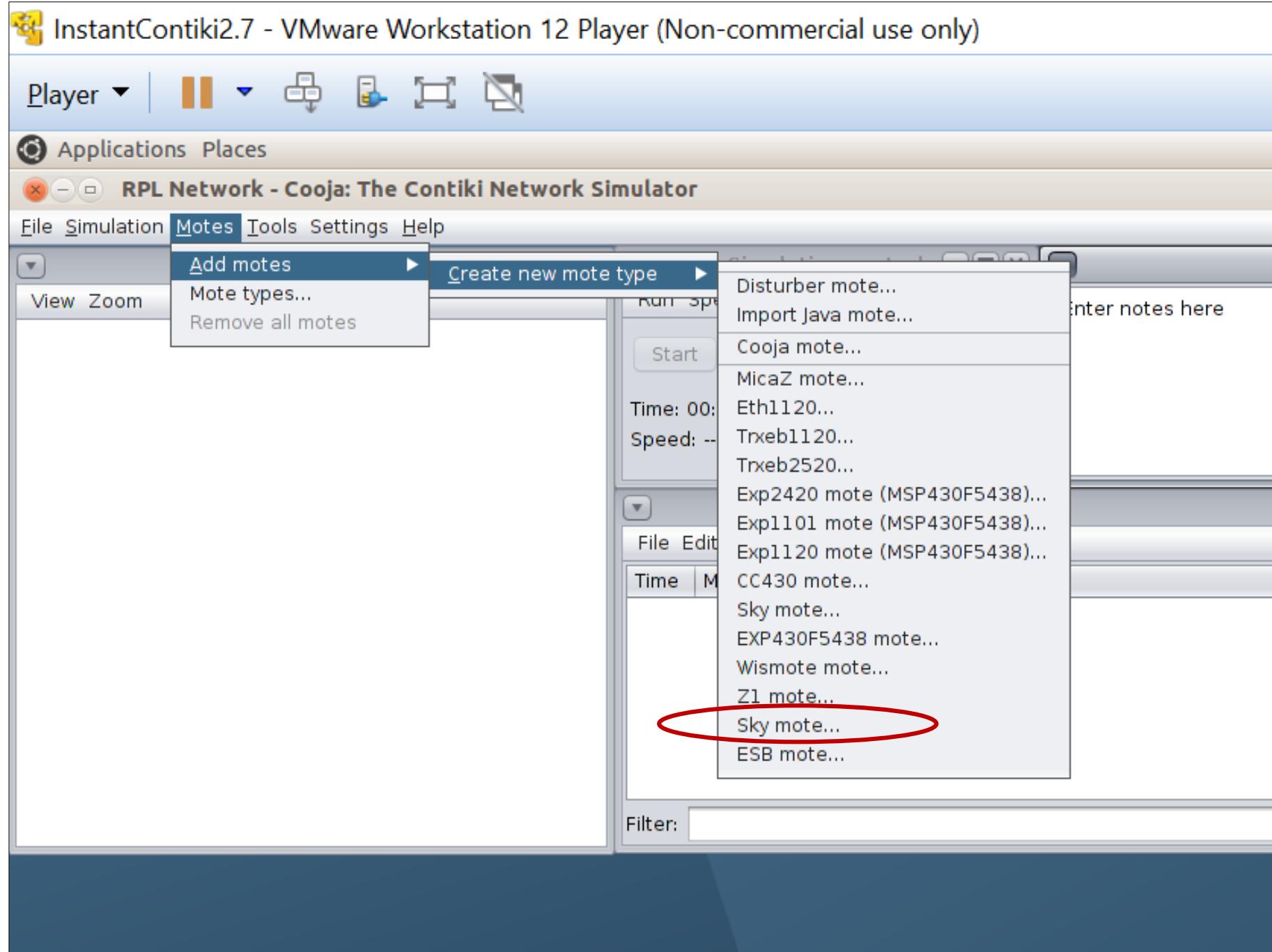
Simulation  
Window

Notes

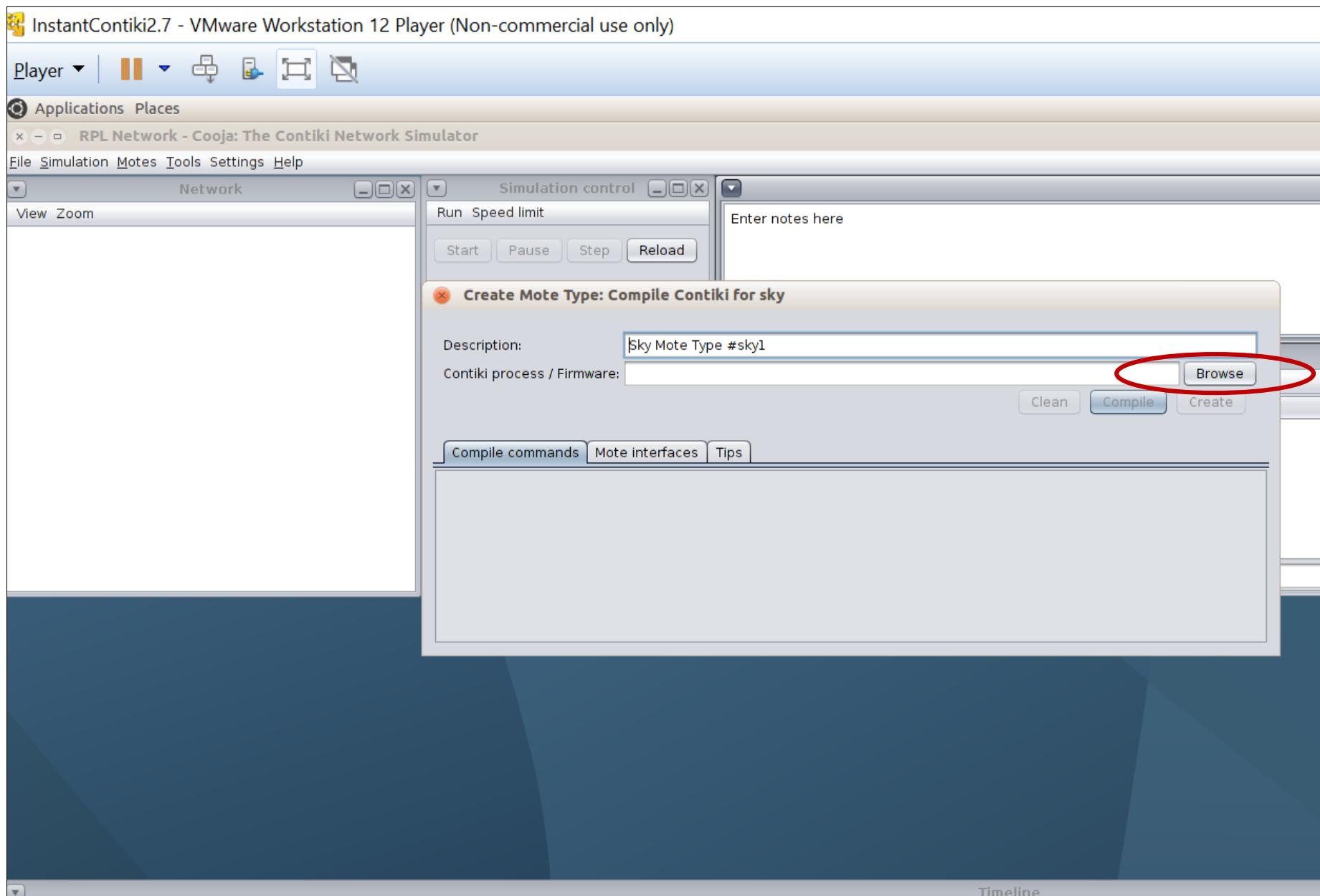
Timeline

# Getting Started with Simulation

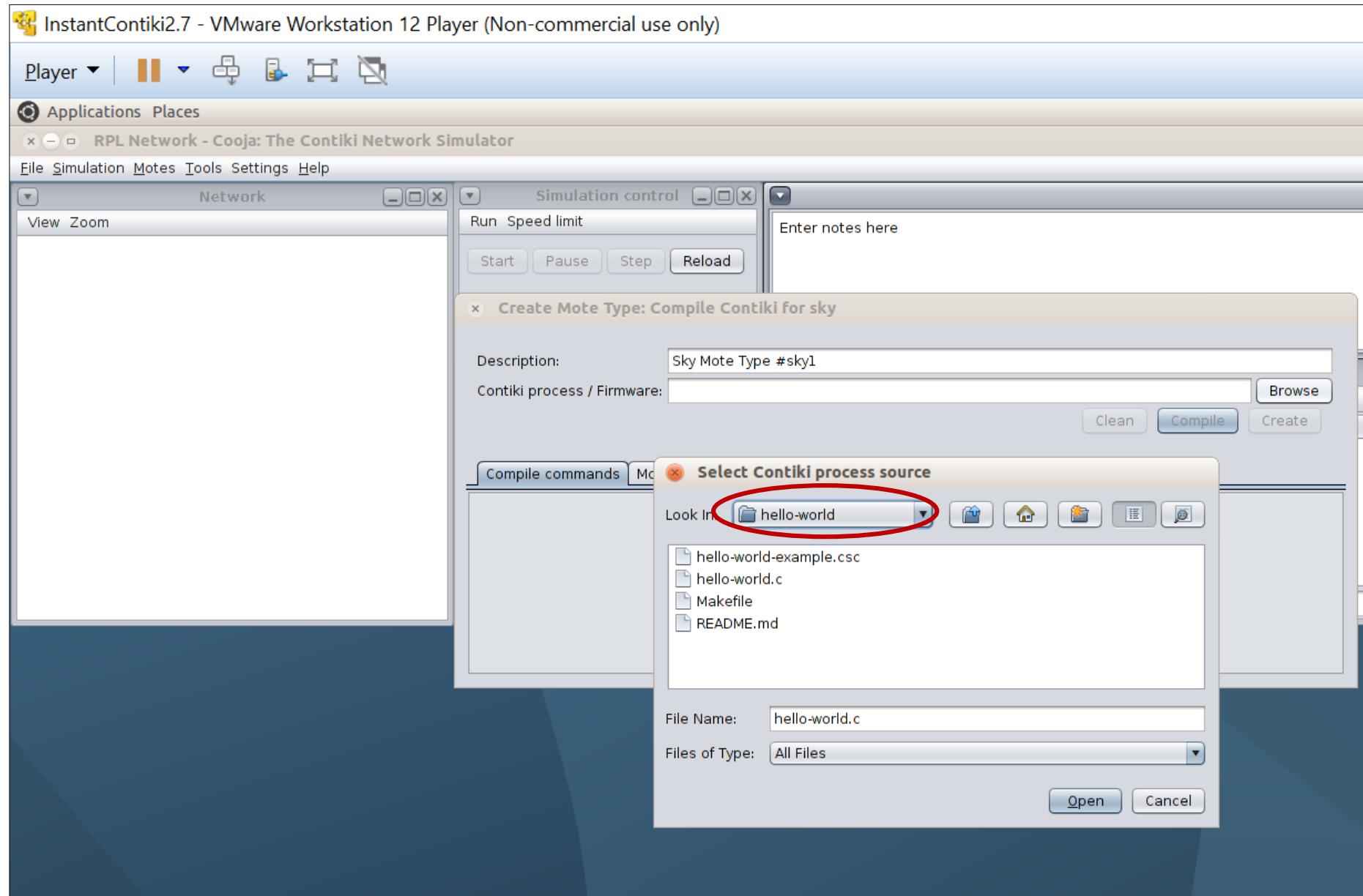
- Press on **Mote** dropdown menu
- Click **create new mote type**
- Choose **sky mote**



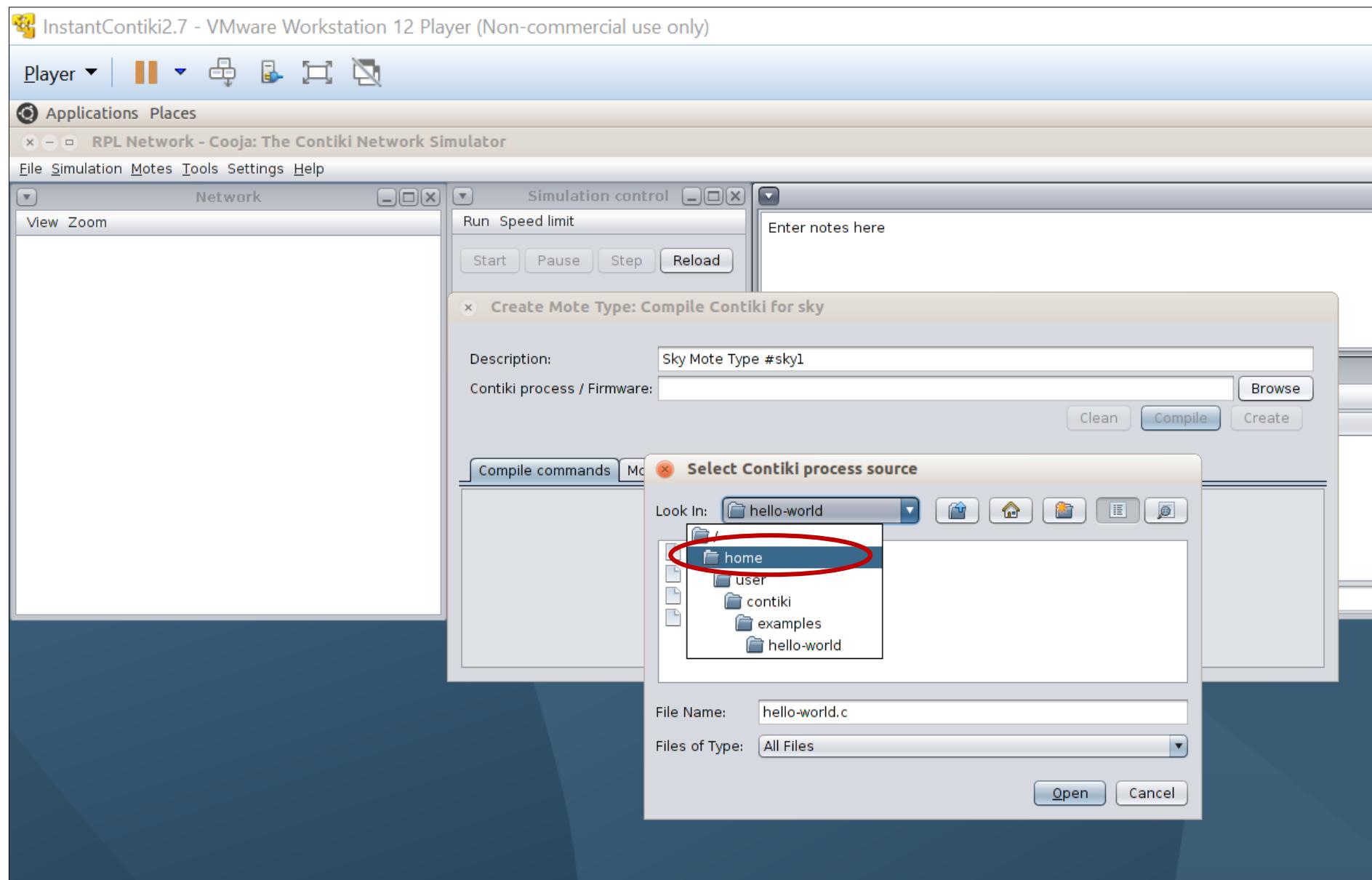
# Click on Browse



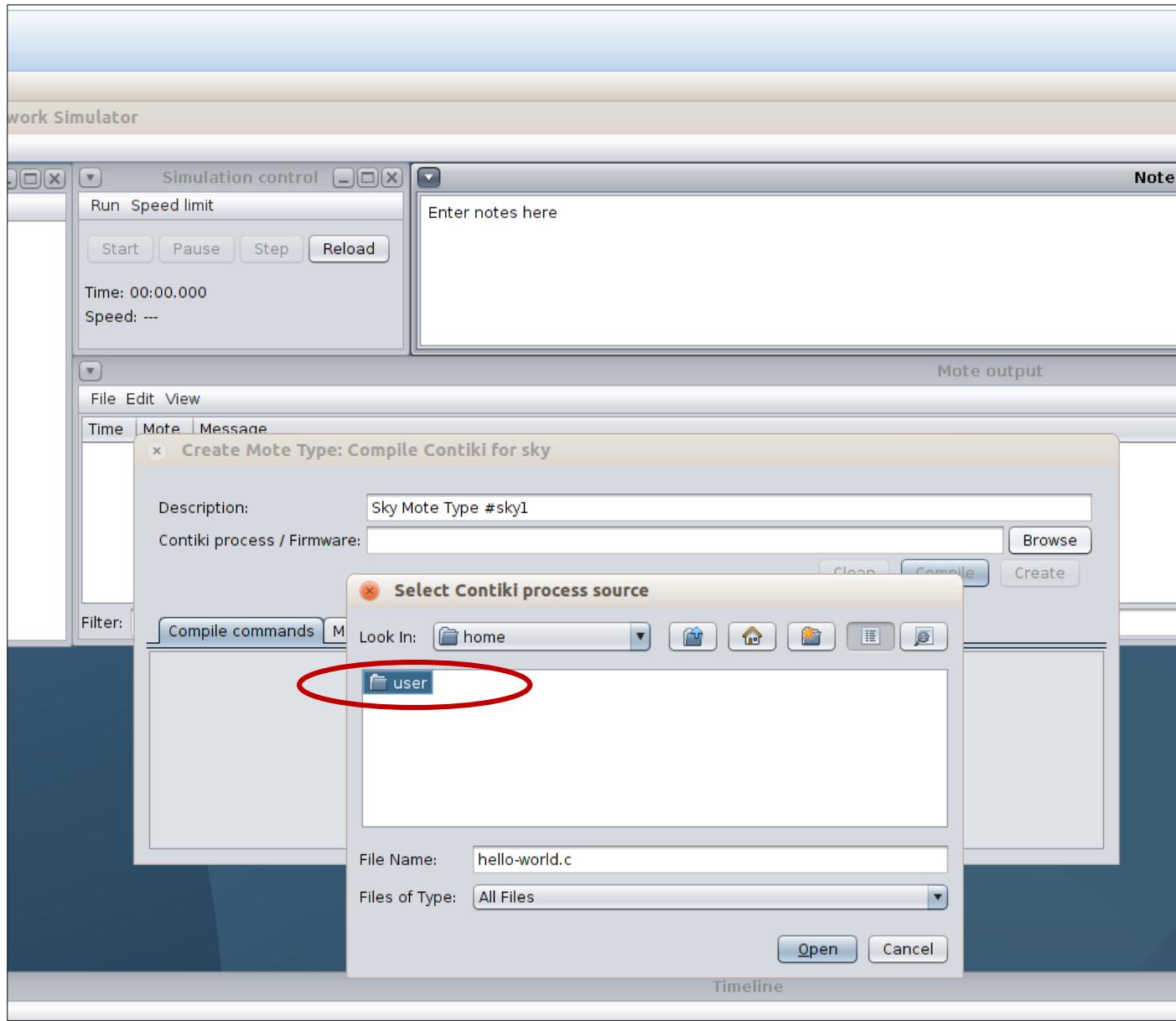
# Look in Dropdown menu for Home folder



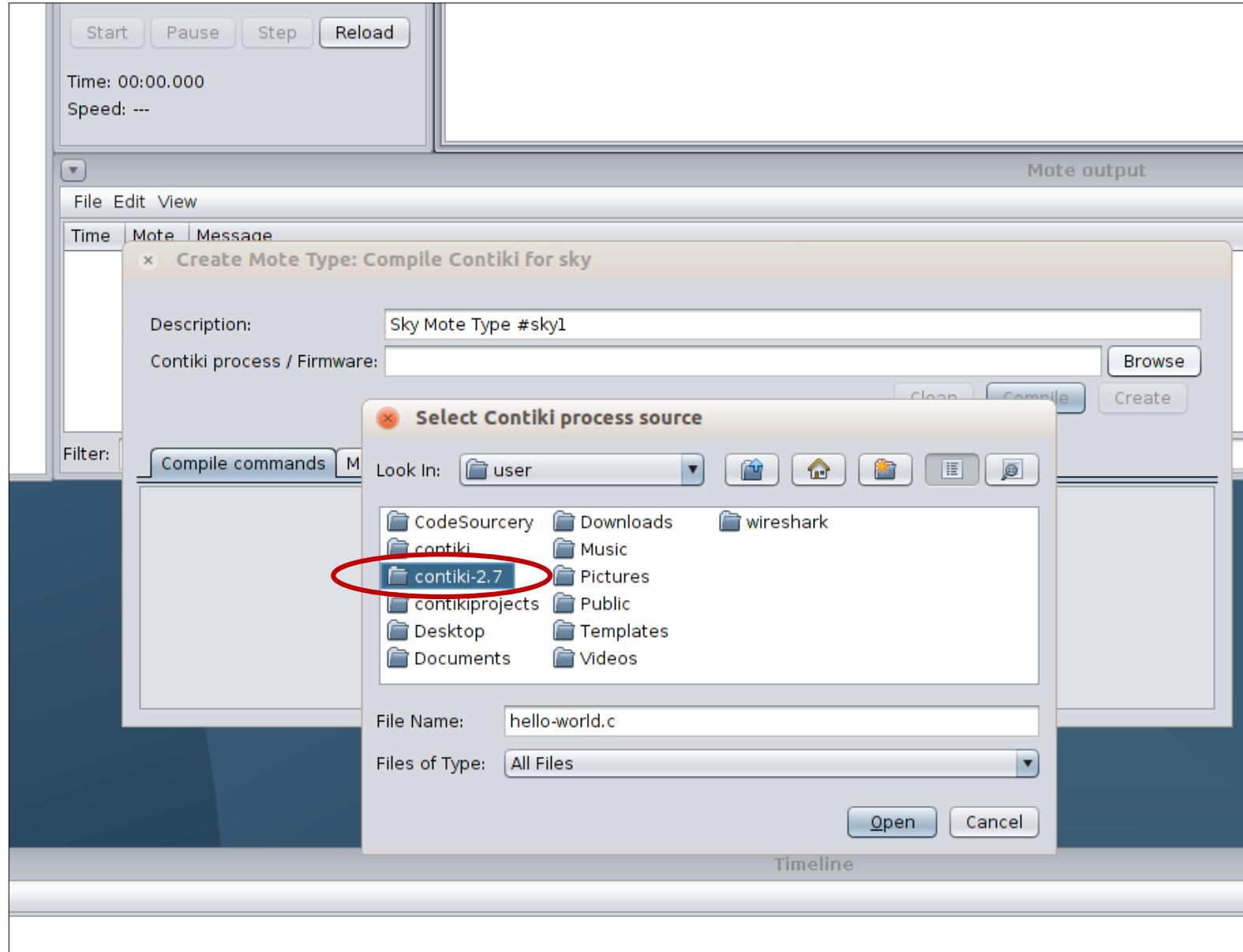
# Choose Home folder from the menu



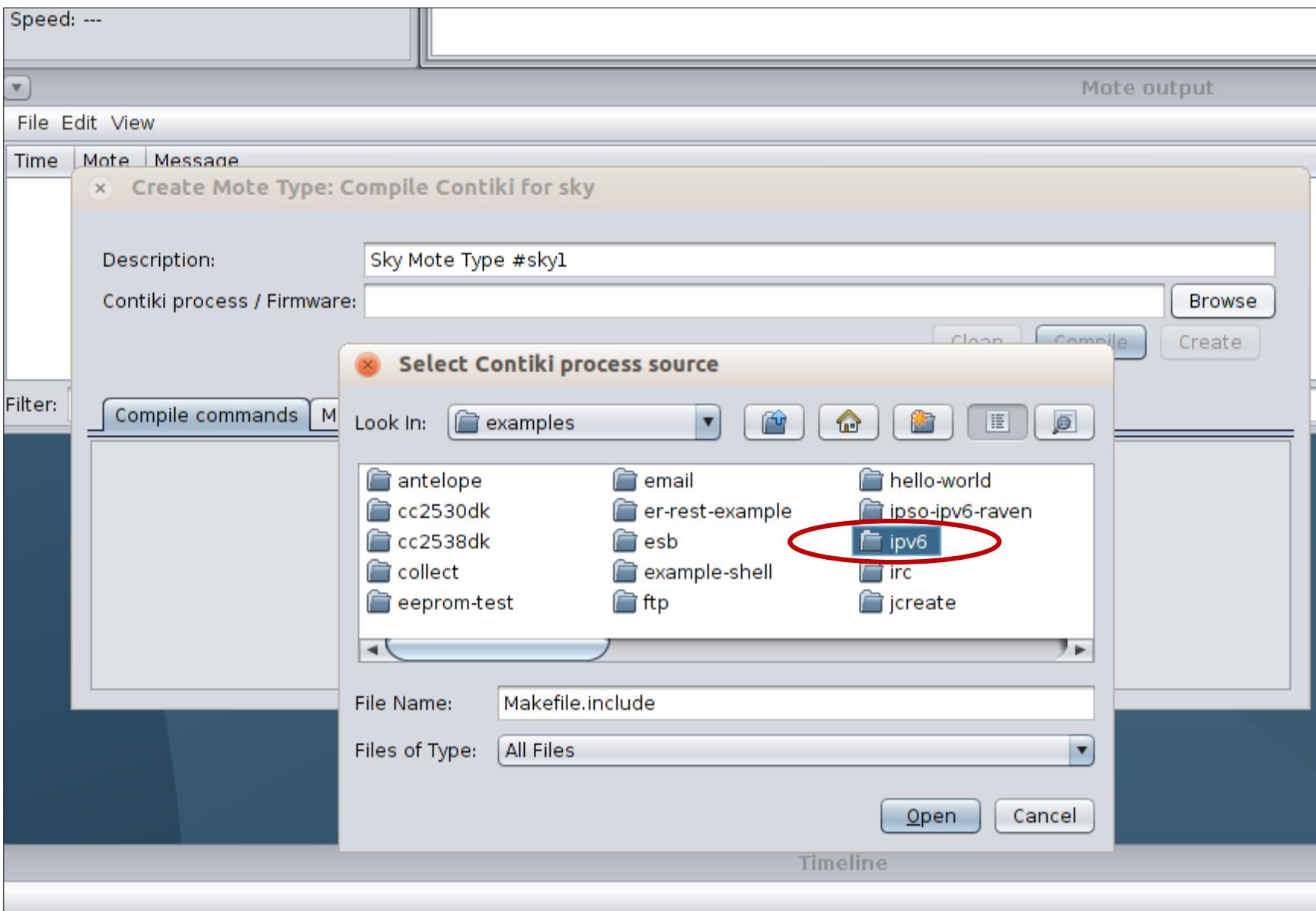
# Select User folder



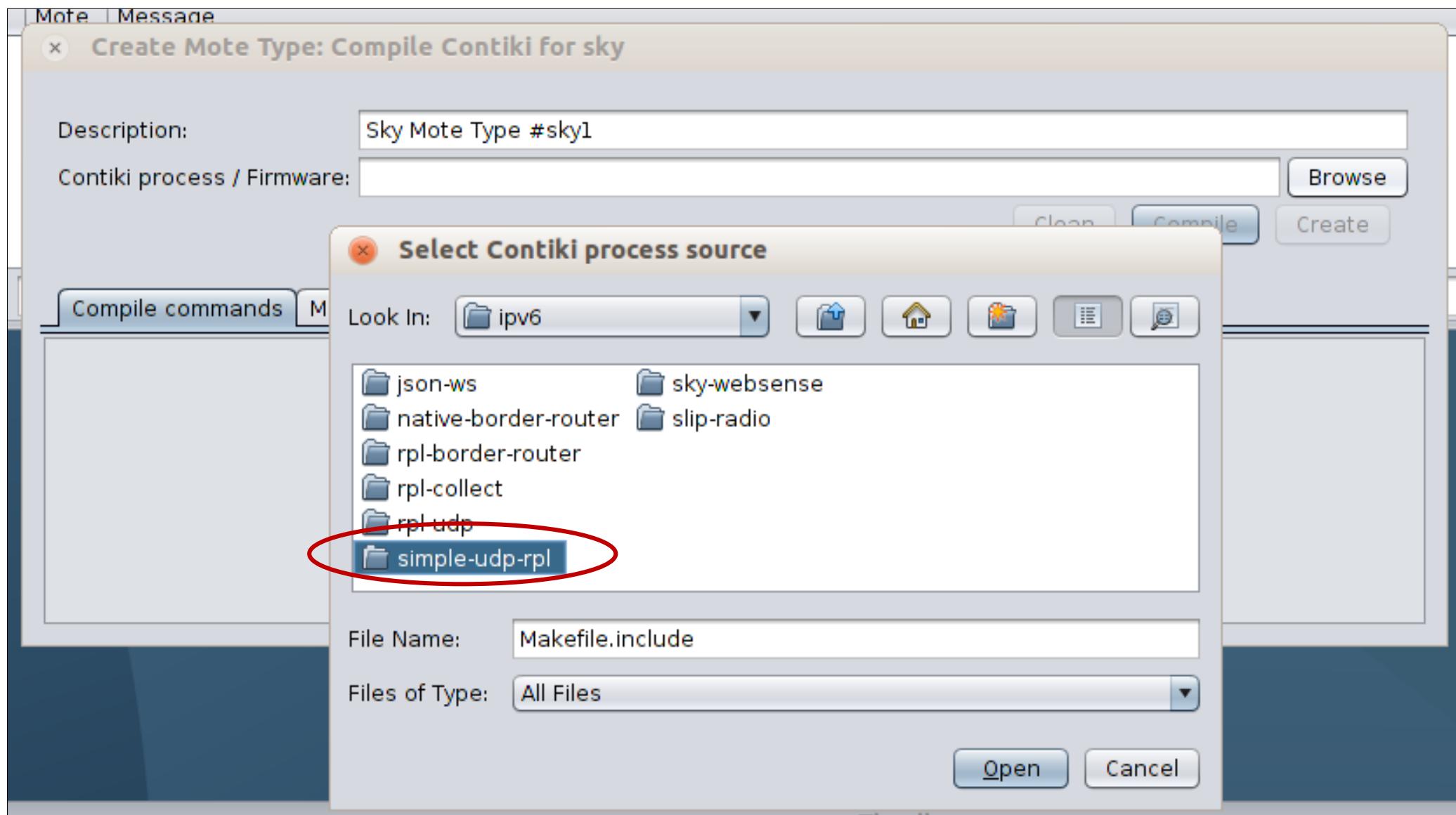
# Select Contiki 2.7 folder



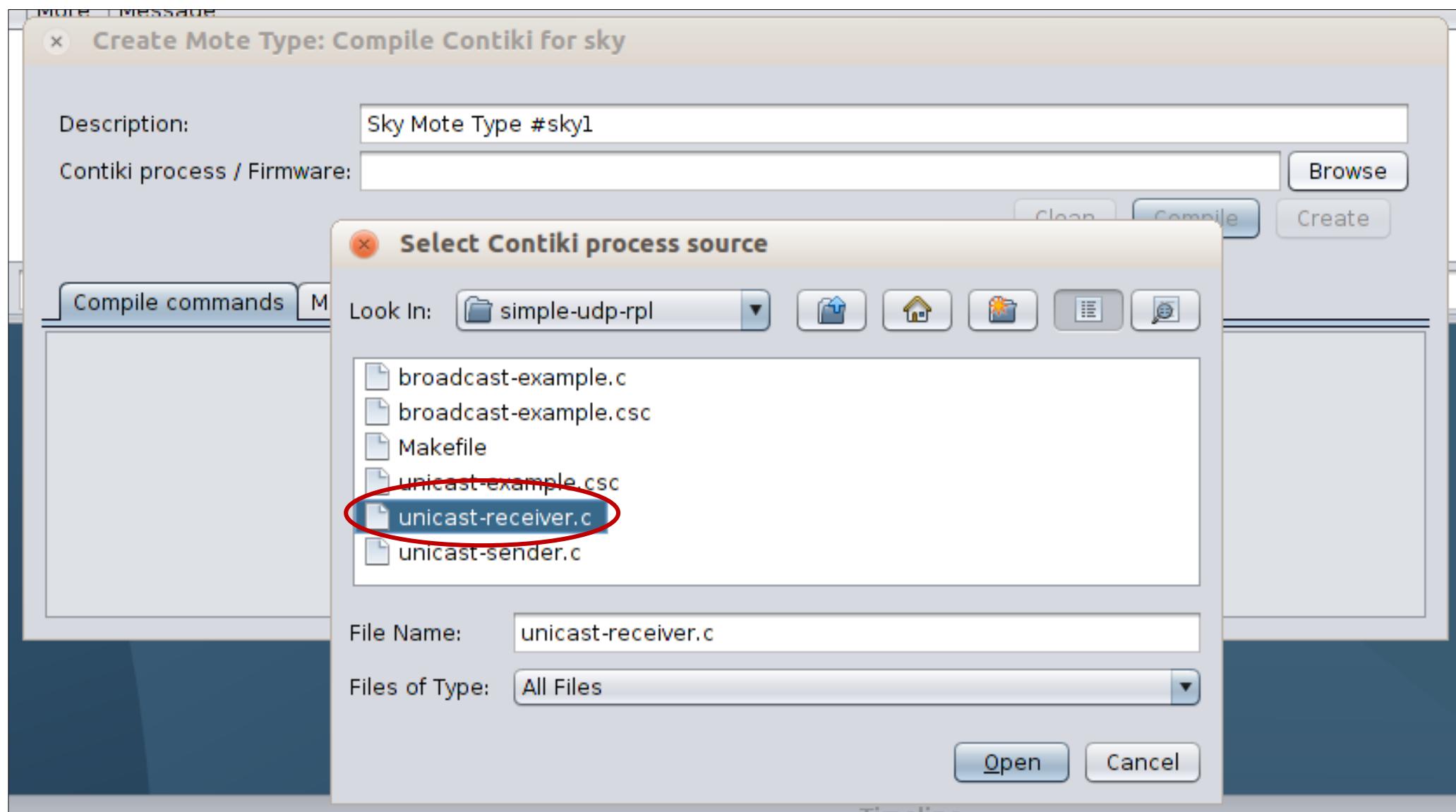
# Select IPv6 folder



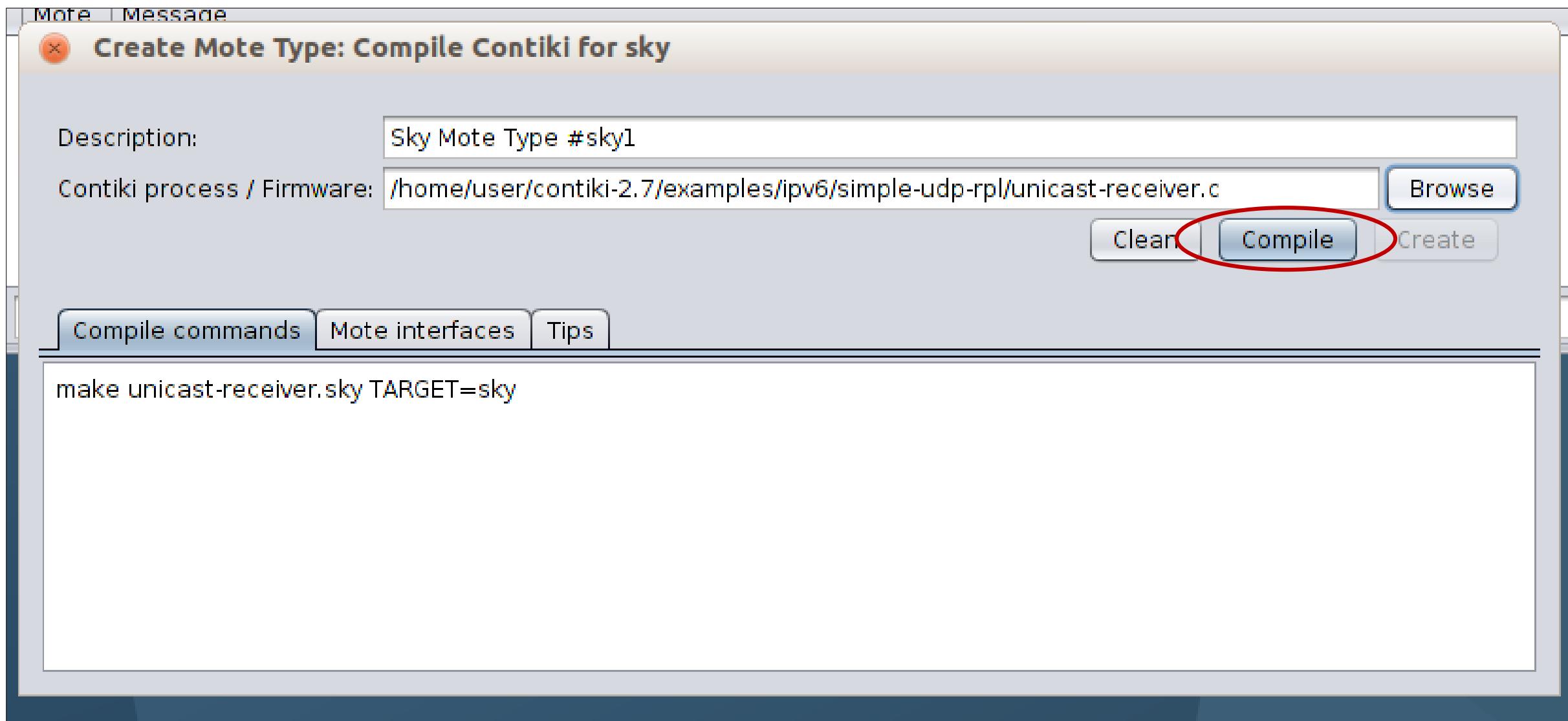
# Select simple-udp-rpl



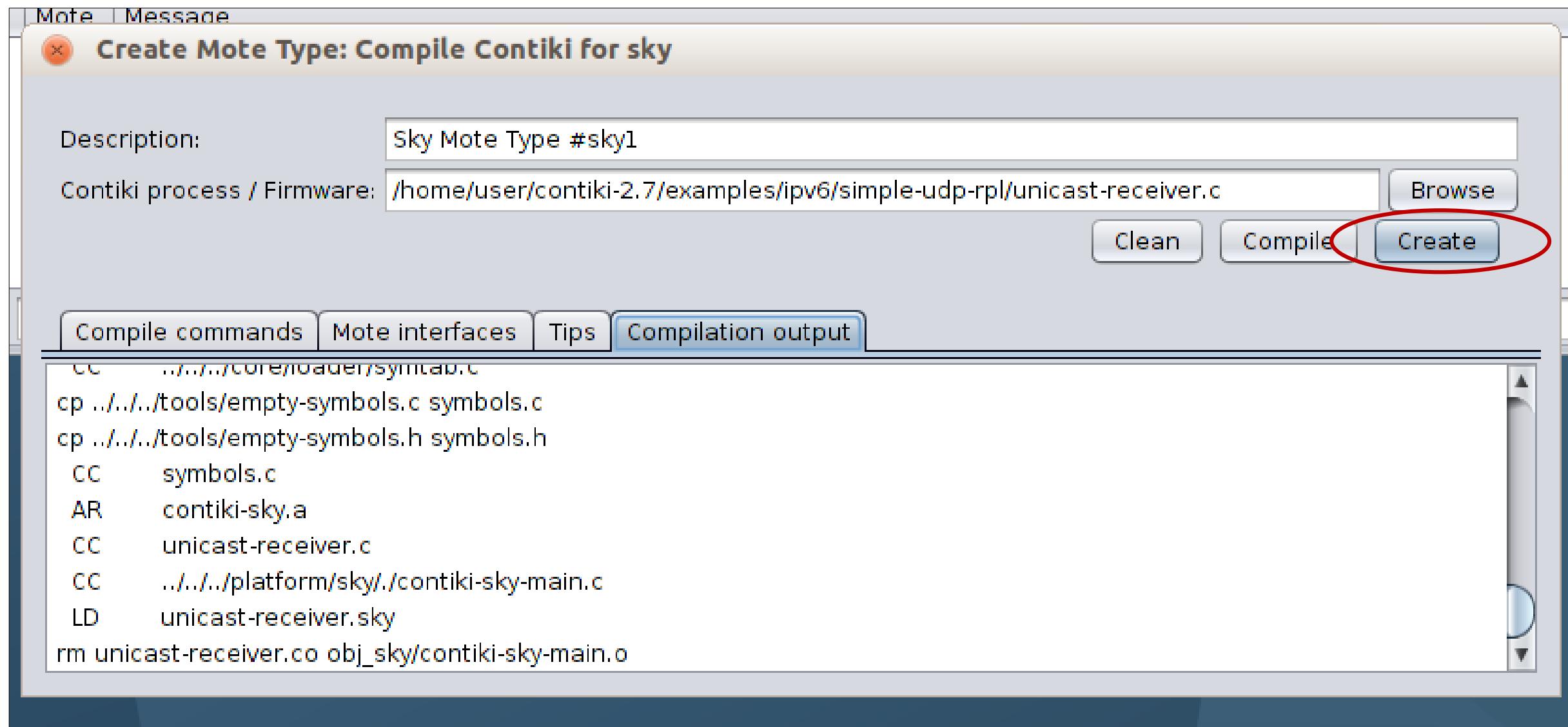
# Open unicast-receiver.c



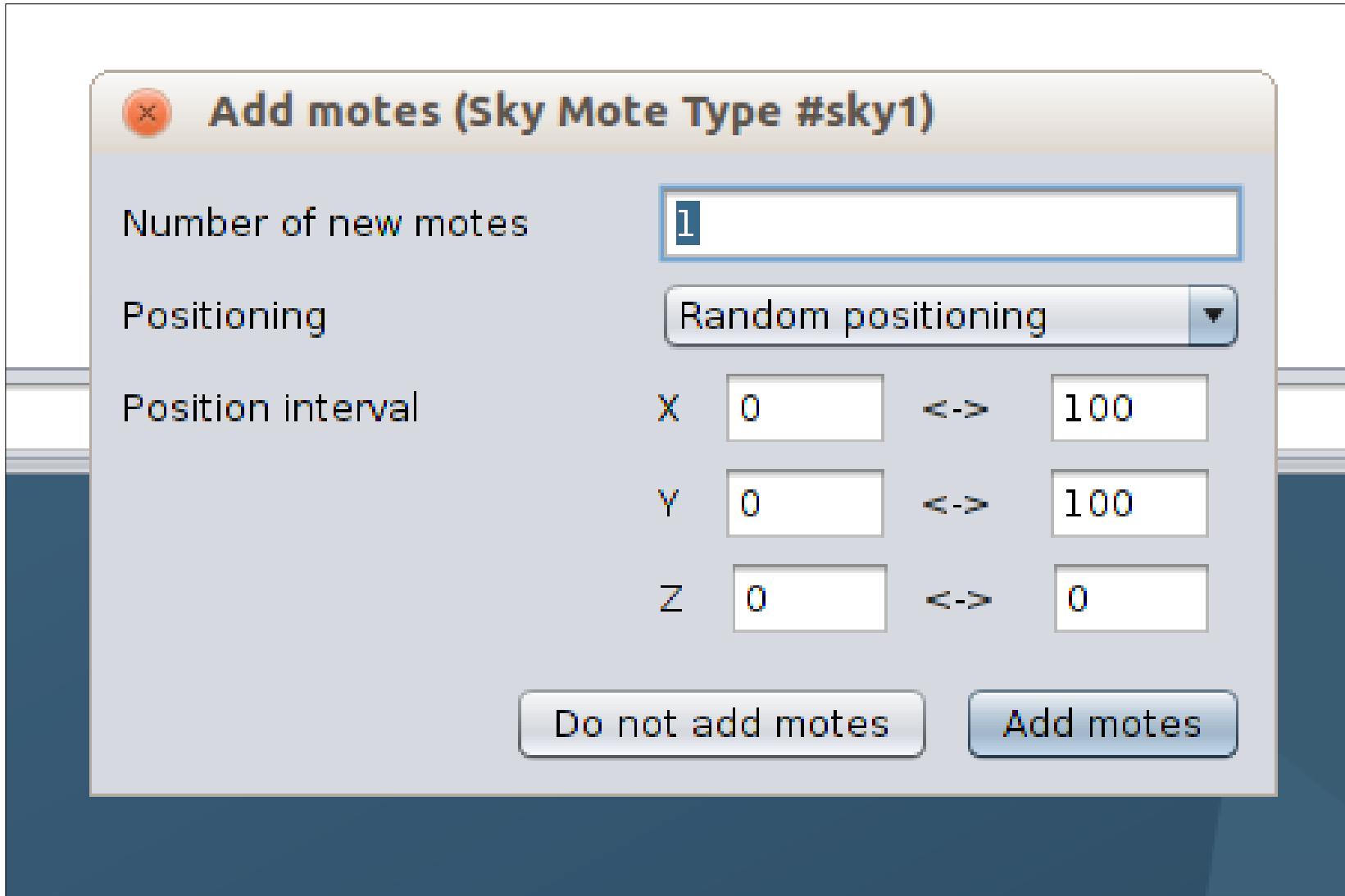
# Click on Compile



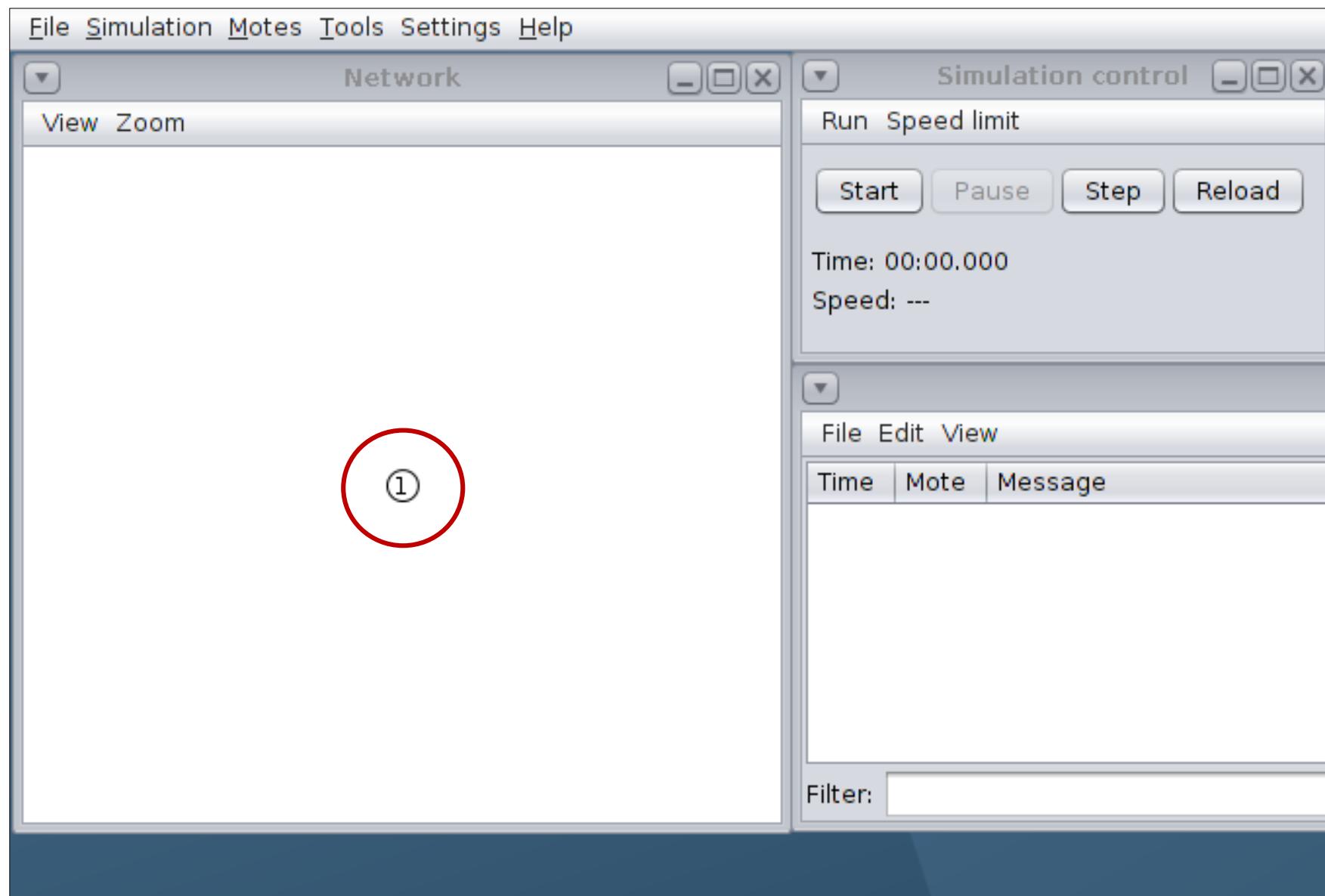
# Click on Create once it is compiled



Choose 1 sky mote and click on Add motes  
(one receiver is being used in this network for simple demonstration purposes)



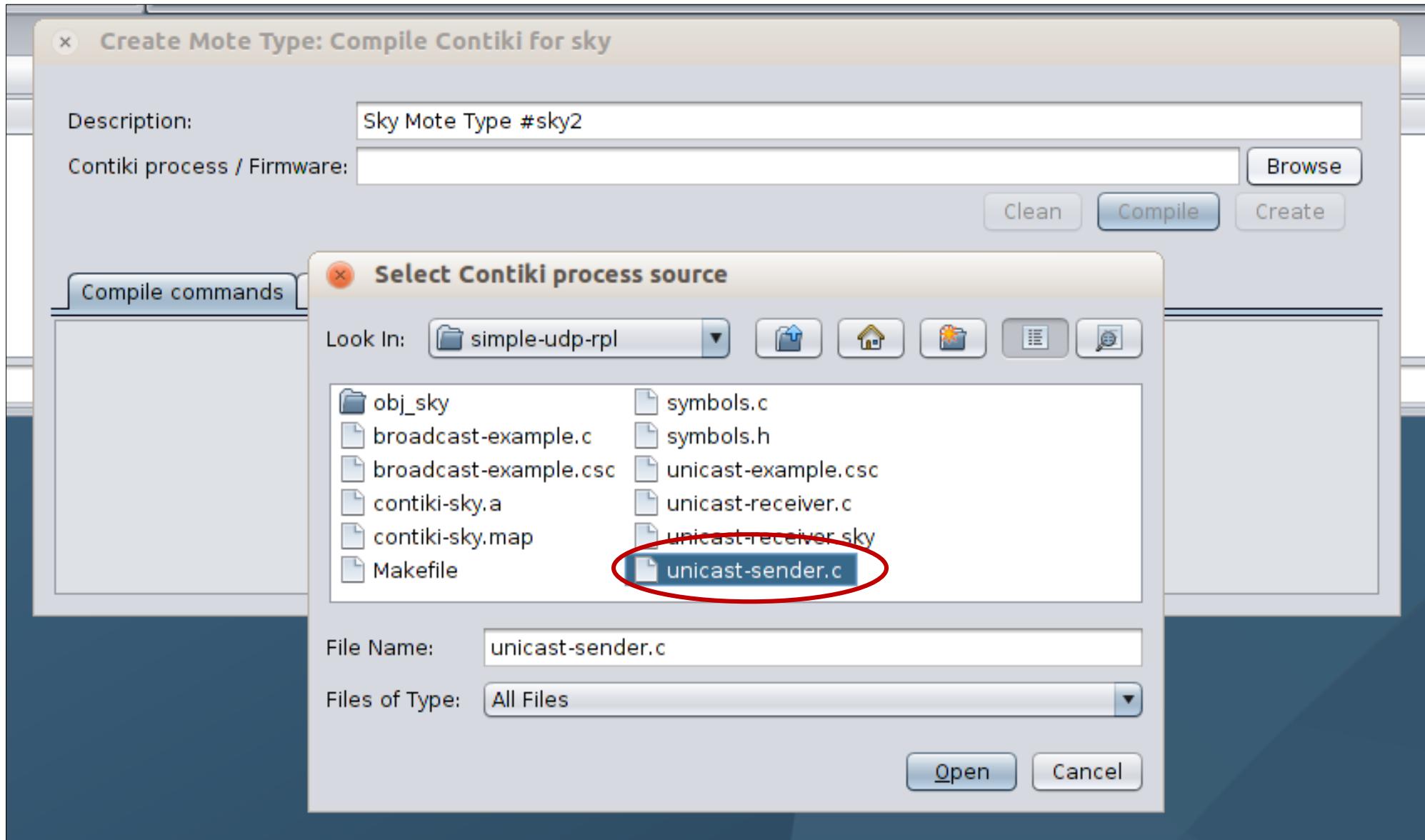
# 1 receiver sky mote has been added to the network



## Creating sender motes

- Repeat the process mentioned in **slides 18-22** to create sender motes and then open **unicast-sender.c** to add sender motes to the RPL network
- Select as many motes as you need
- 10 sender motes have been added to the network in this demonstration

# Open unicast-sender.c



# Compile and create sender motes

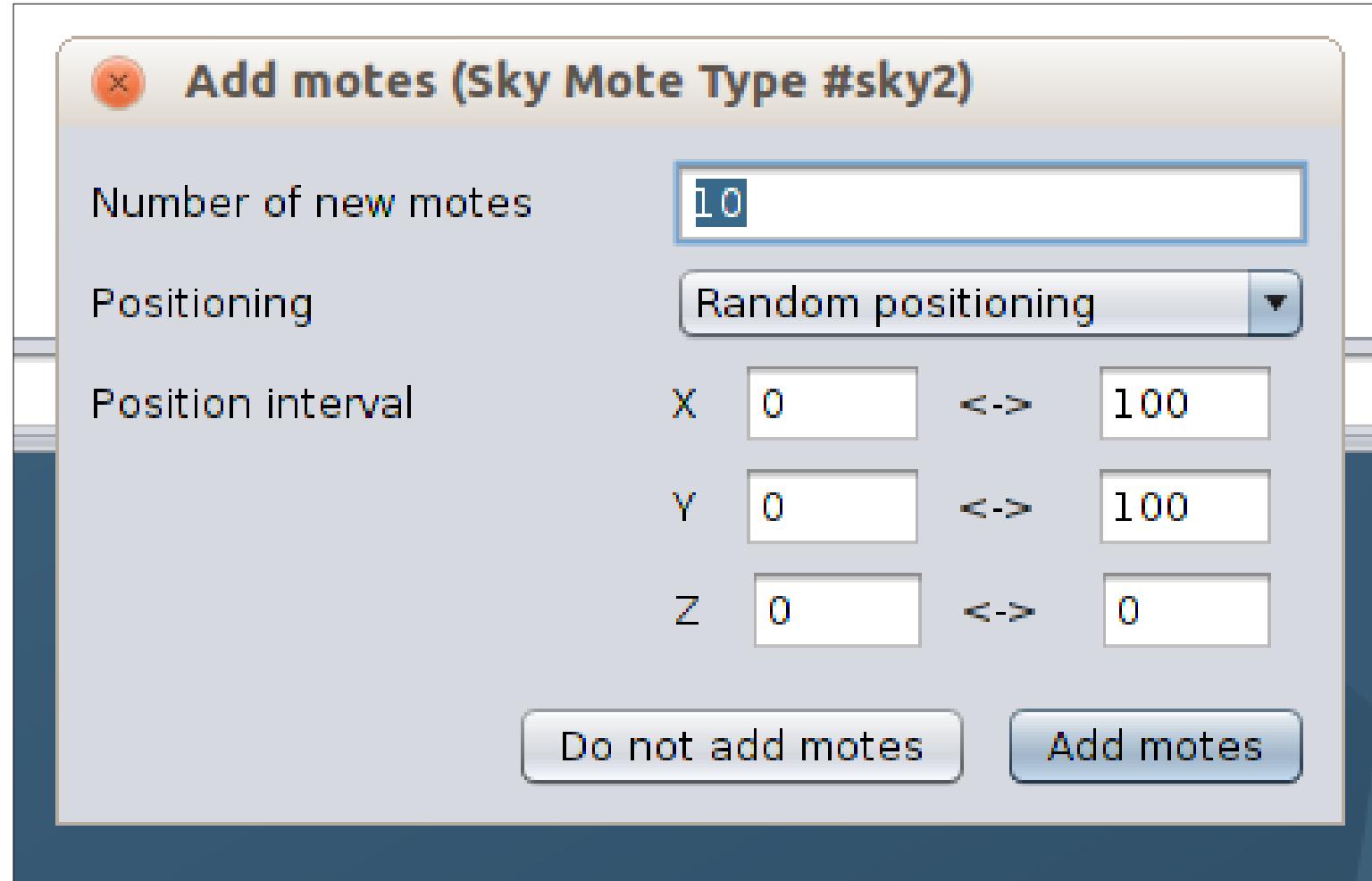
**Create Mote Type: Compile Contiki for sky**

Description: Sky Mote Type #sky2

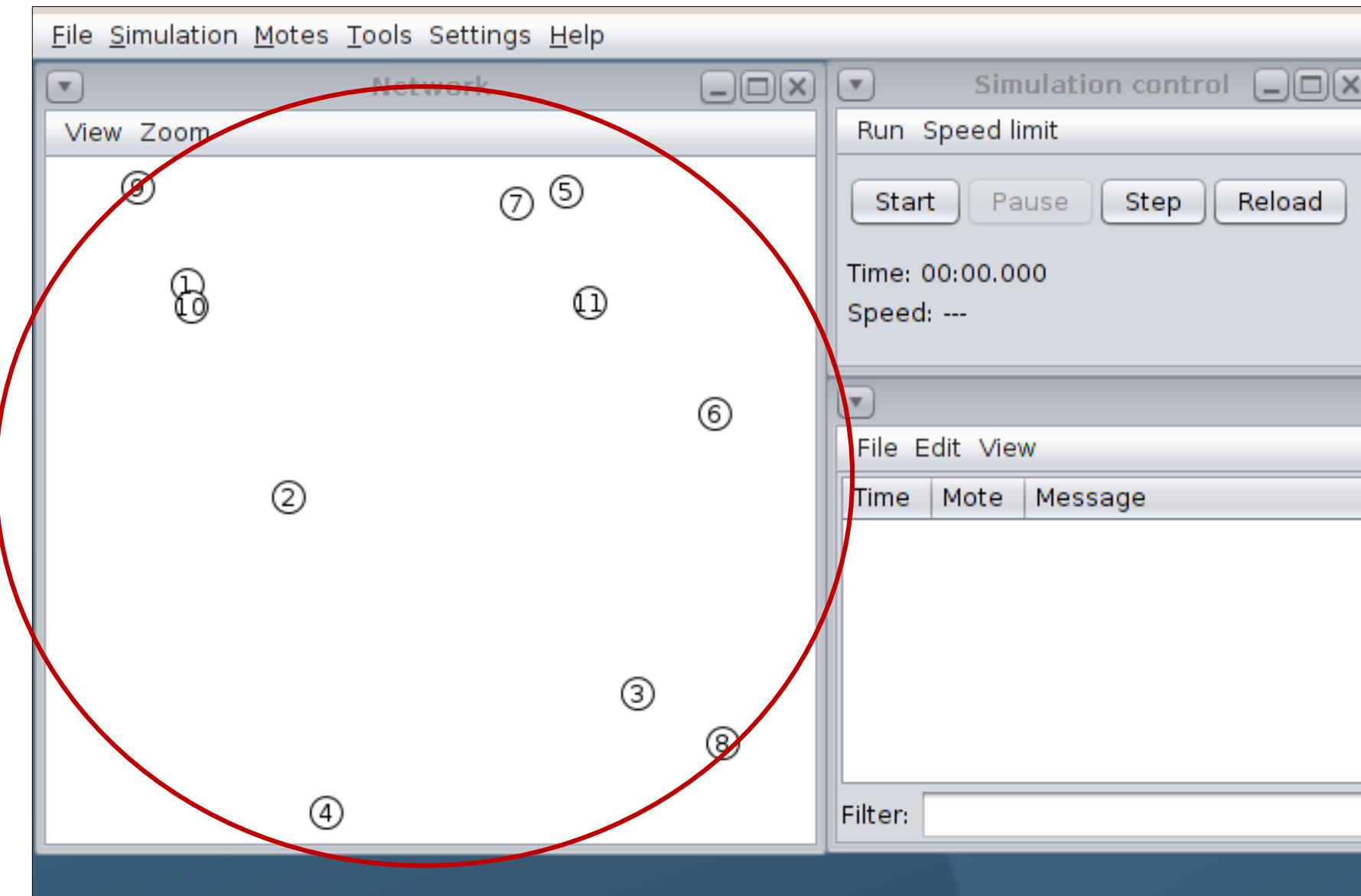
Contiki process / Firmware: </home/user/contiki-2.7/examples/ipv6/simple-udp-rpl/unicast-sender.c>

```
> make unicast-sender.sky TARGET=sky
CC      unicast-sender.c
CC      ../../platform/sky/.contiki-sky-main.c
LD      unicast-sender.sky
rm unicast-sender.co obj_sky/contiki-sky-main.o
```

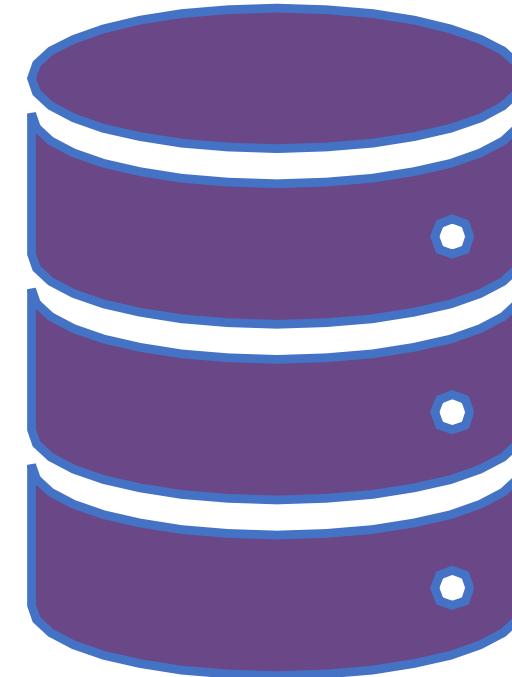
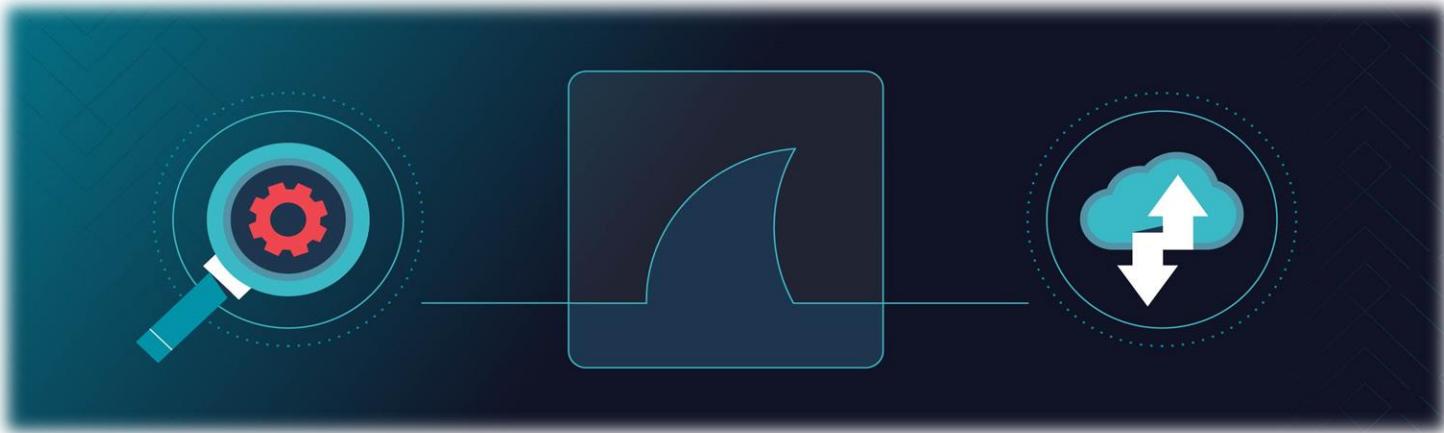
# 10 sender sky motes added here



# 1 receiver and 10 sender motes deployed in RPL network



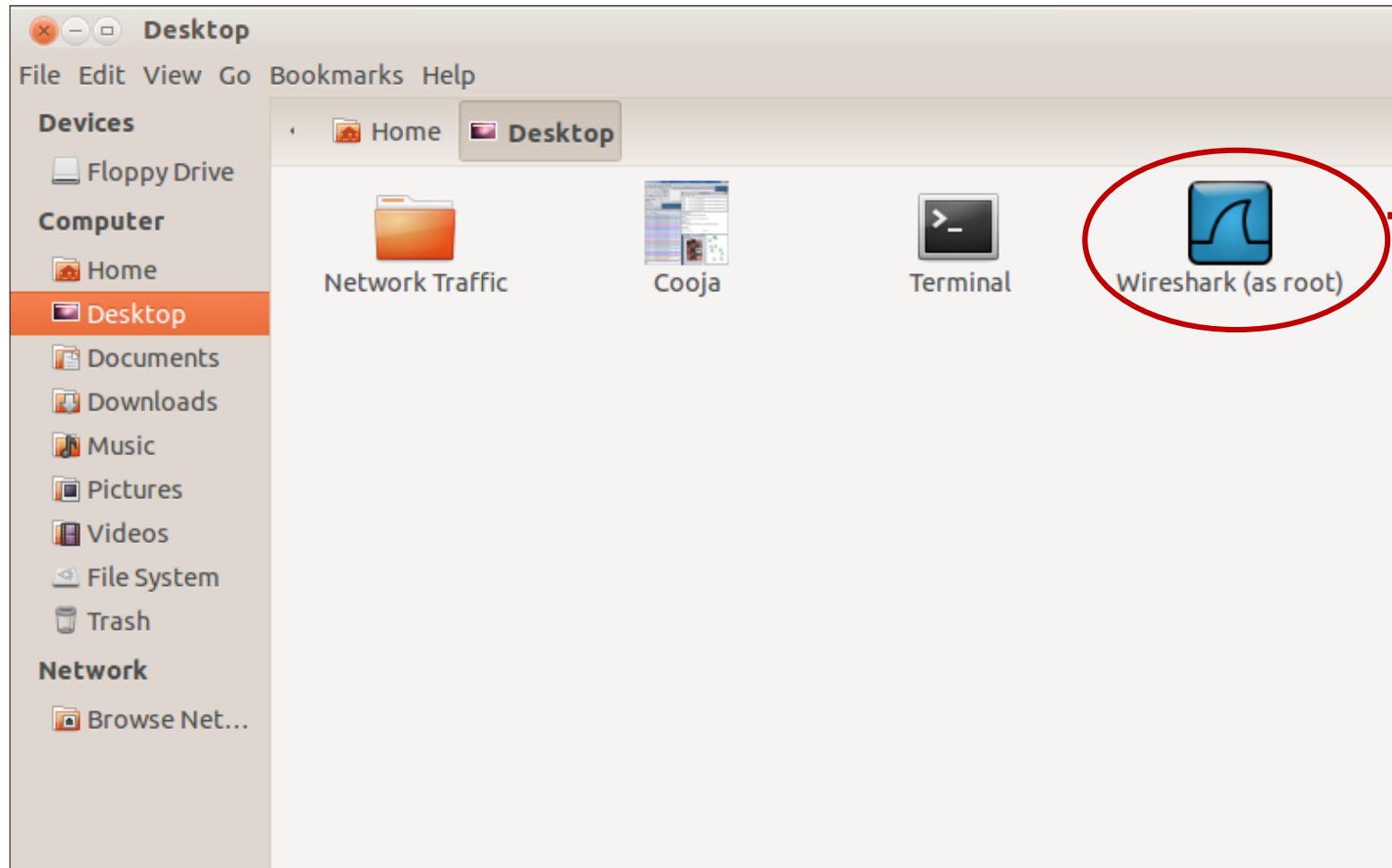
## Packet Storage and Analysis



# Steps

1. Install Wireshark packet analyzer
2. Save network traffic as PCAP file using Cooja Simulator
3. Locate stored PCAP file in Home directory of Instant Contiki OS
4. Open stored file via Wireshark
5. Export as CSV file for further use (CSV is a suitable dataset format for machine learning application)

# 1. Install Wireshark Packet Analyzer

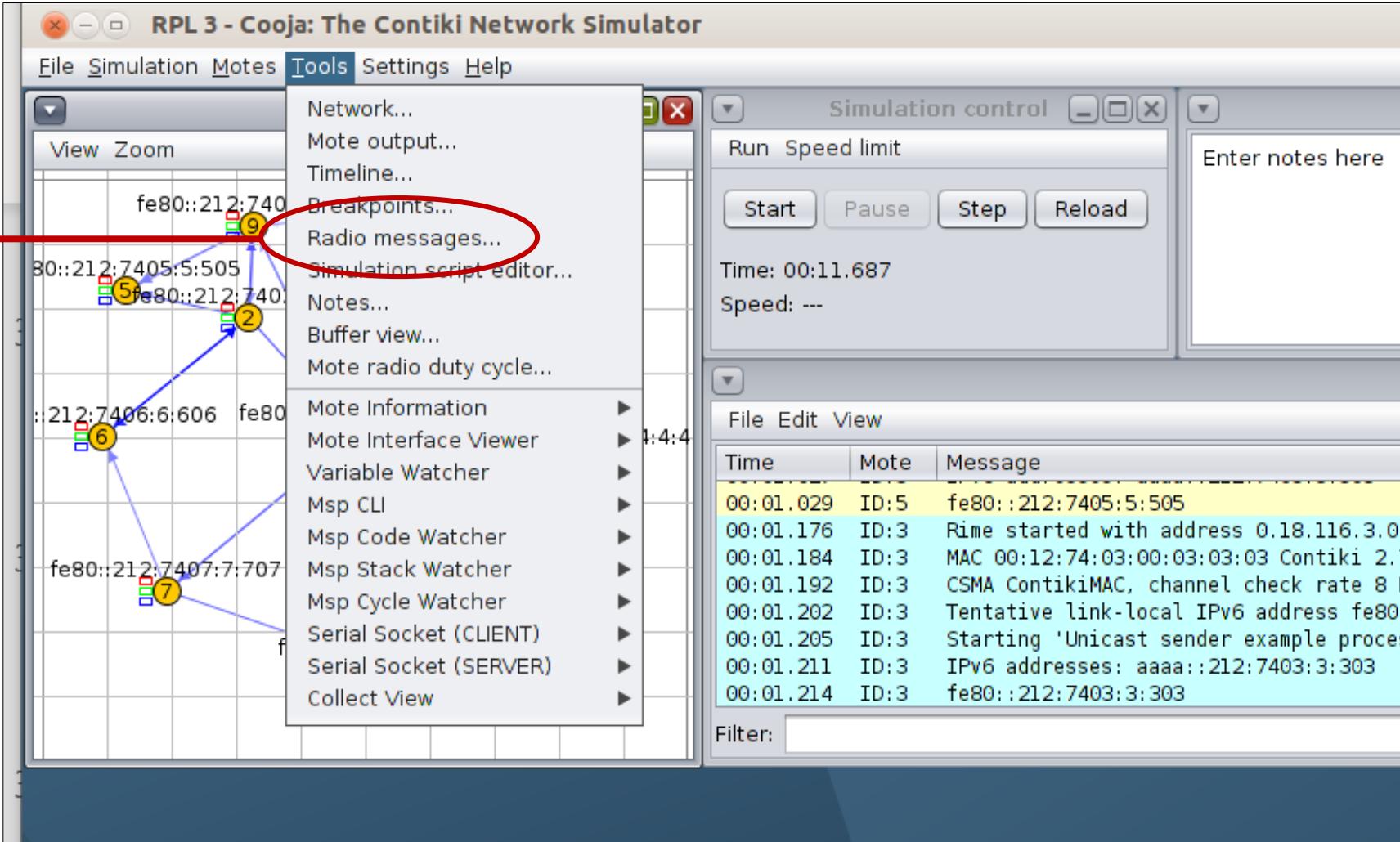


Wireshark packet analyzer

**Note:**  
Wireshark is a program for network traffic analysis and is a necessary tool to open PCAP files.

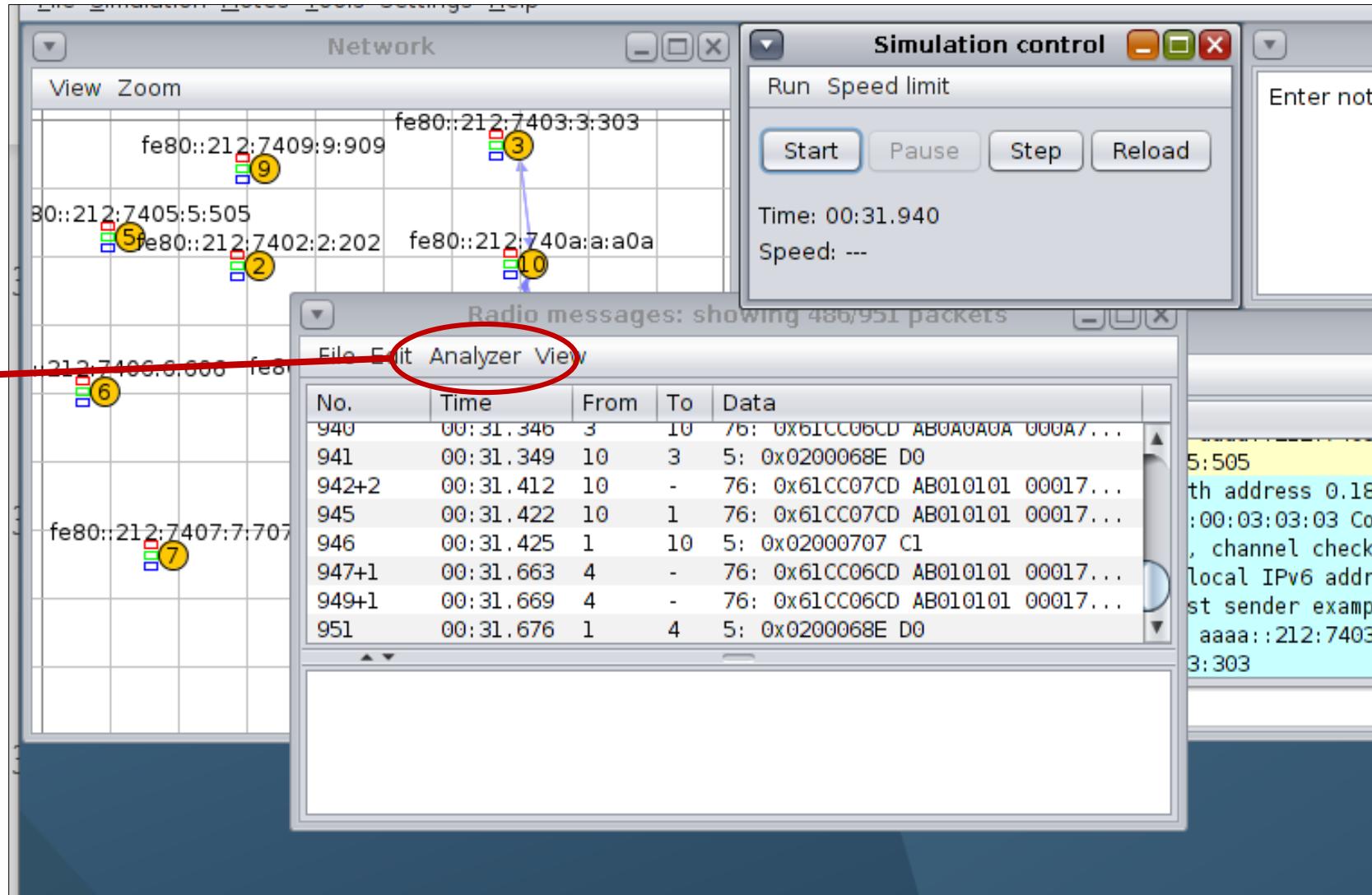
## 2. To store and analyze packets

Click on Radio  
Messages



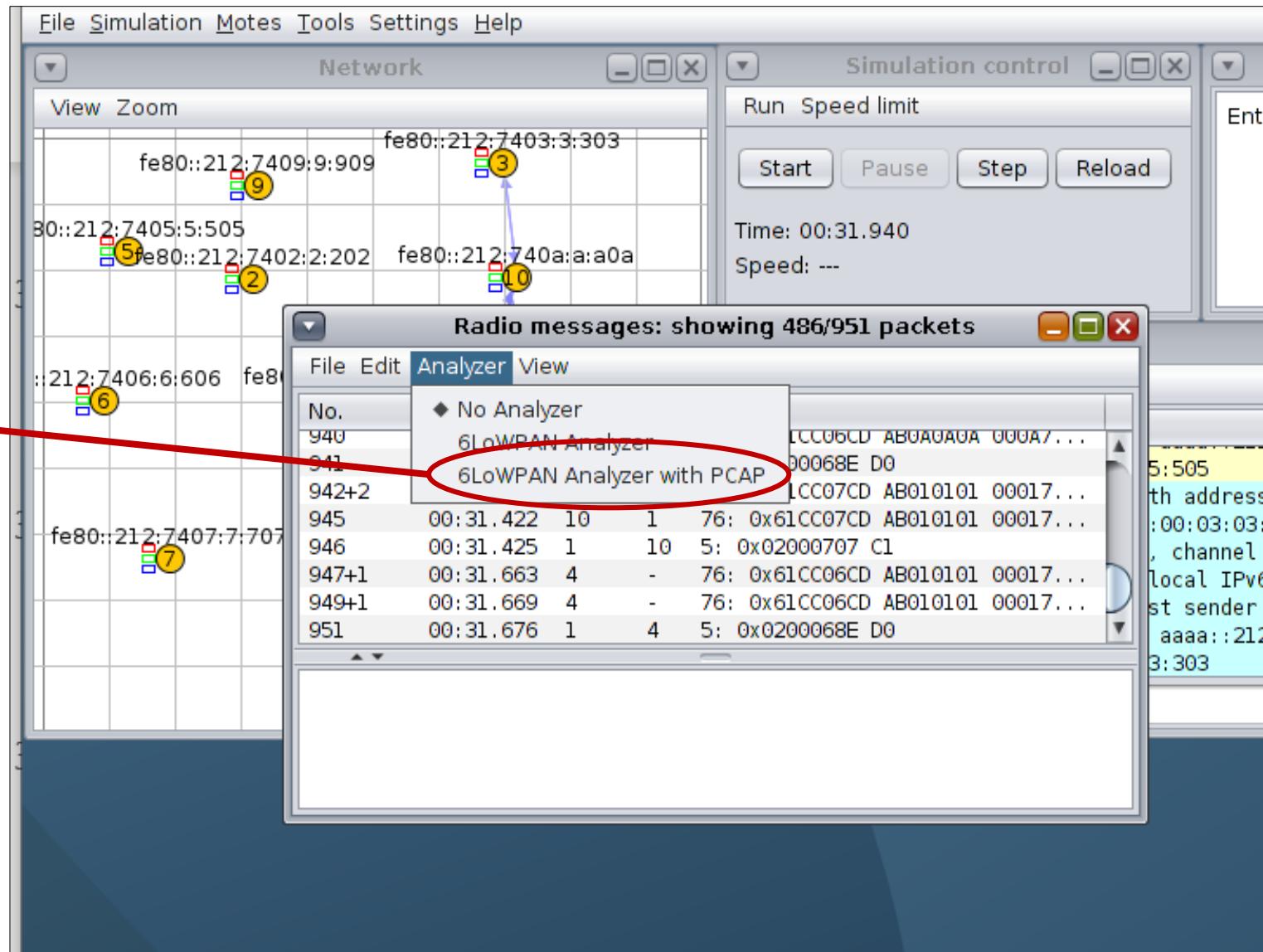
## 2. To store and analyze packets

Click on  
Analyzer



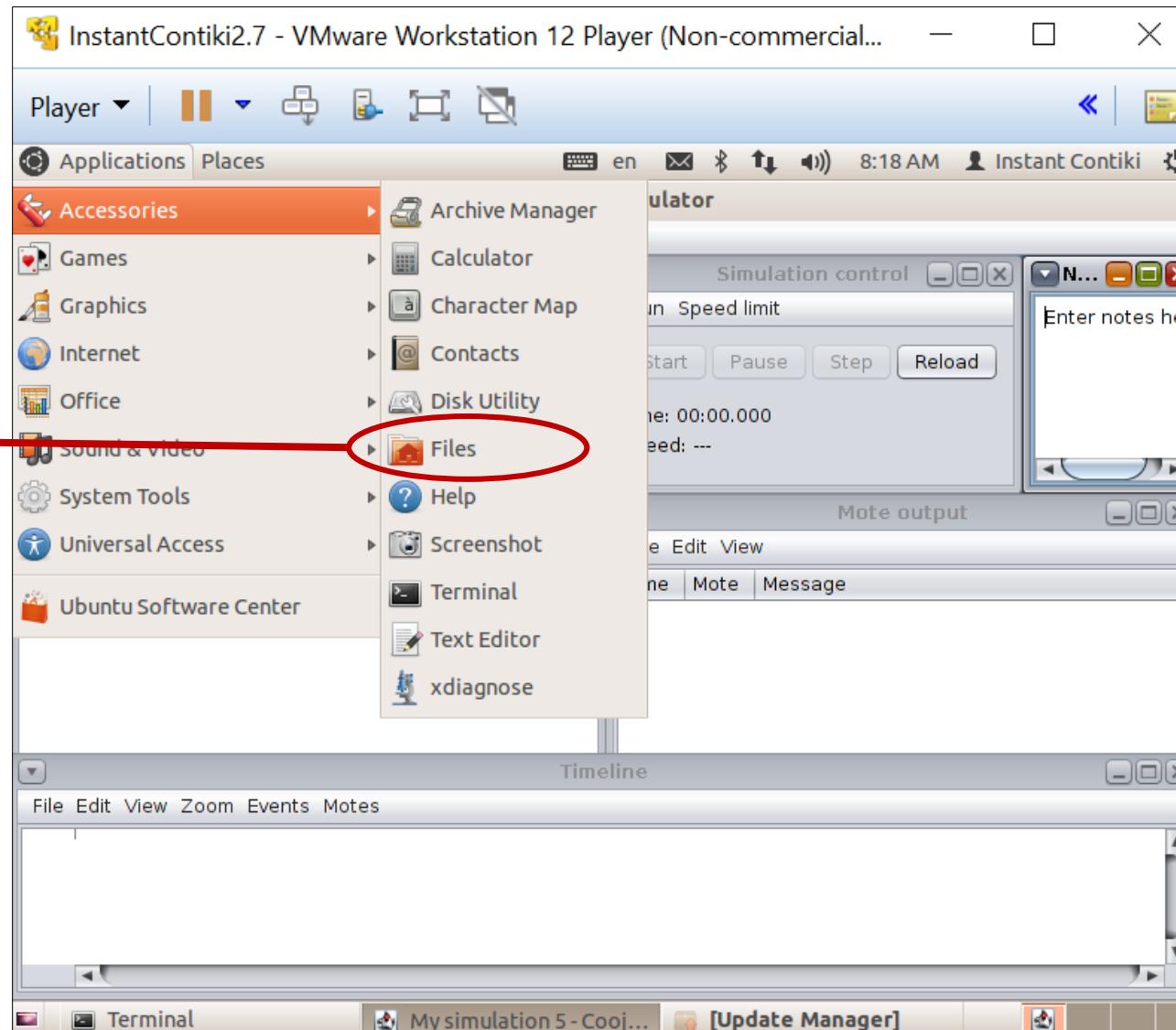
## 2. To store and analyze packets

Select 6LoWPAN Analyzer with PCAP



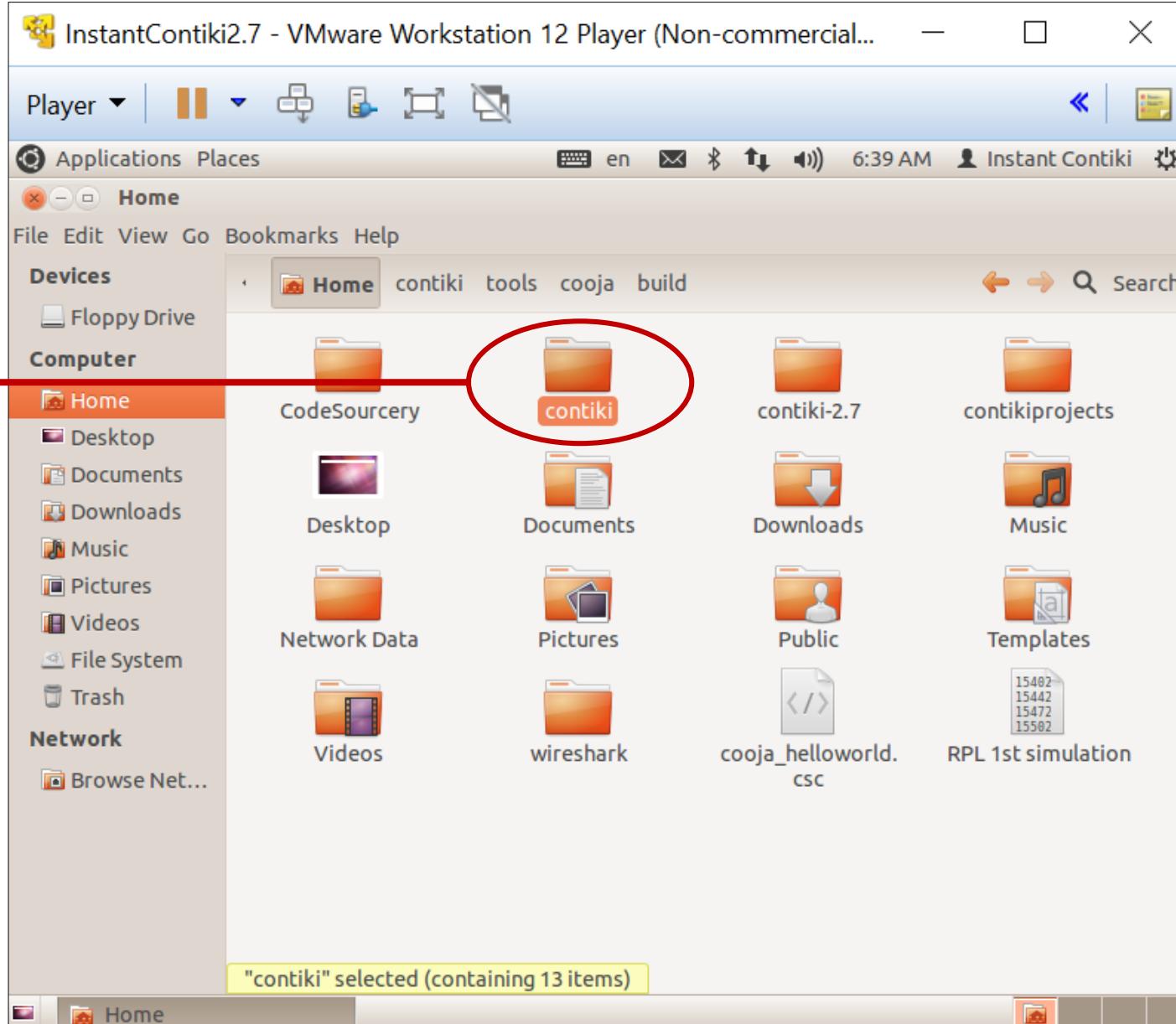
### 3. To see where PCAP files are saved

Go to Applications  
menu and open Files ←  
from Accessories

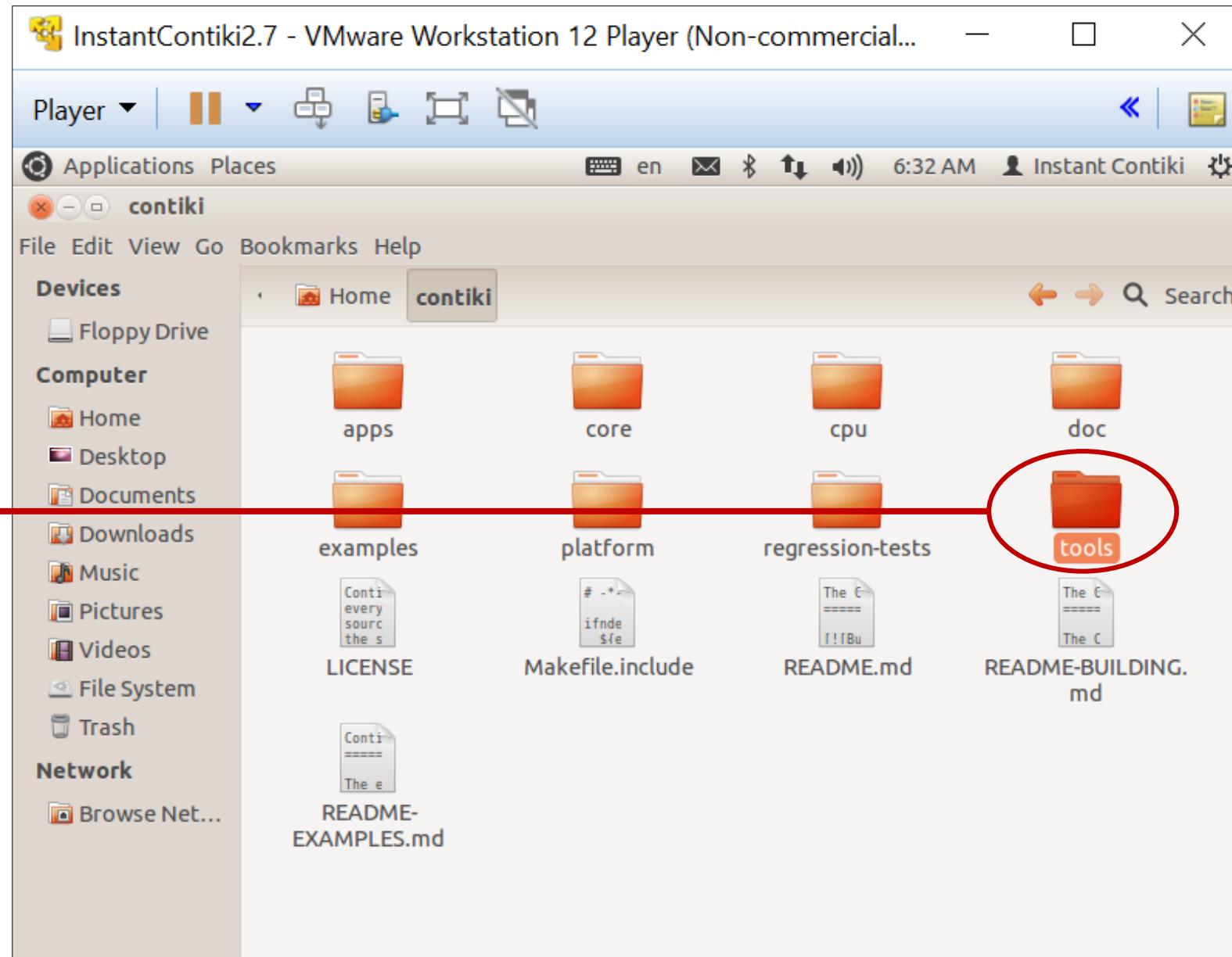


### 3. To see where PCAP files are saved

Open contiki folder ←

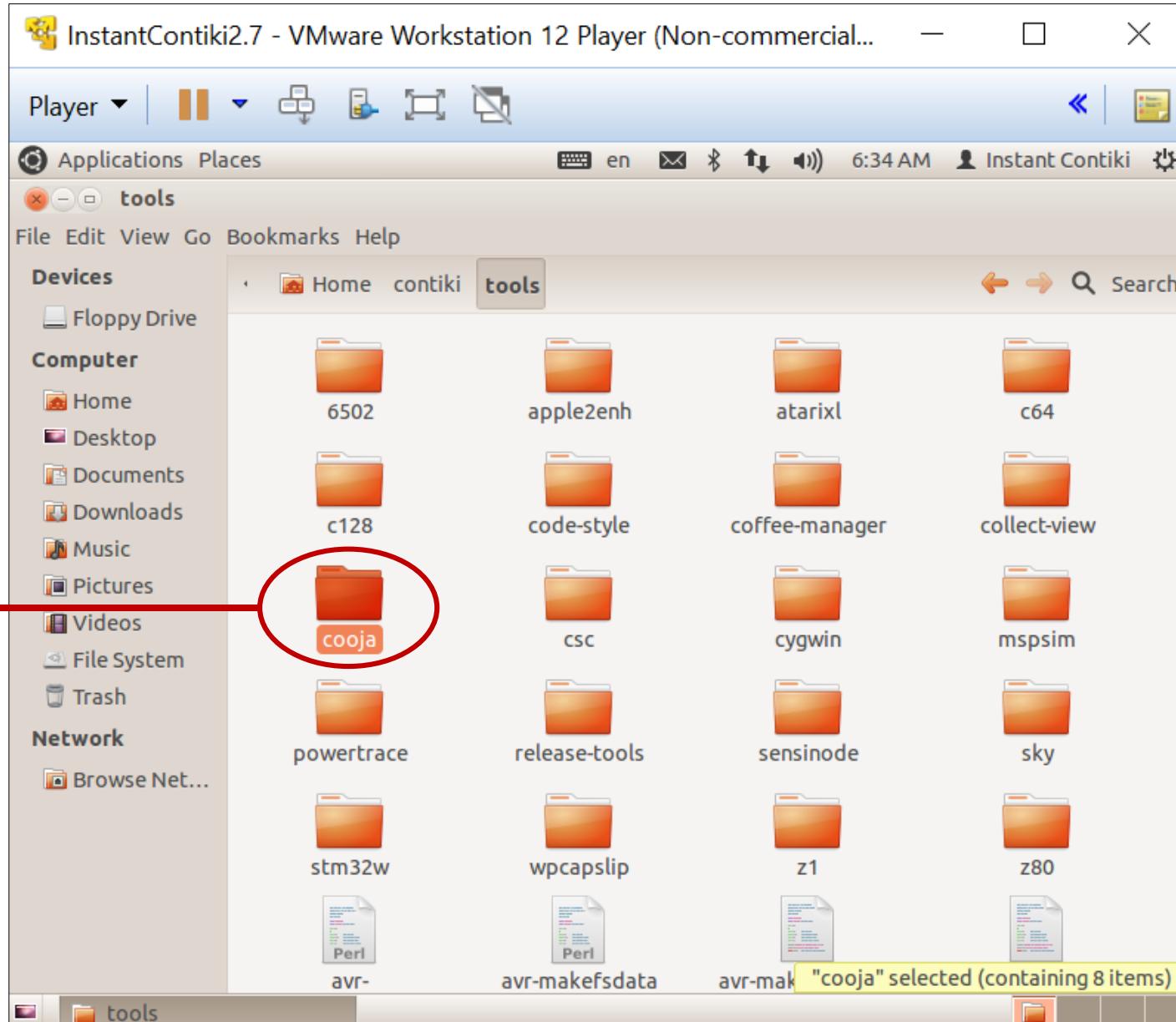


### 3. To see where PCAP files are saved



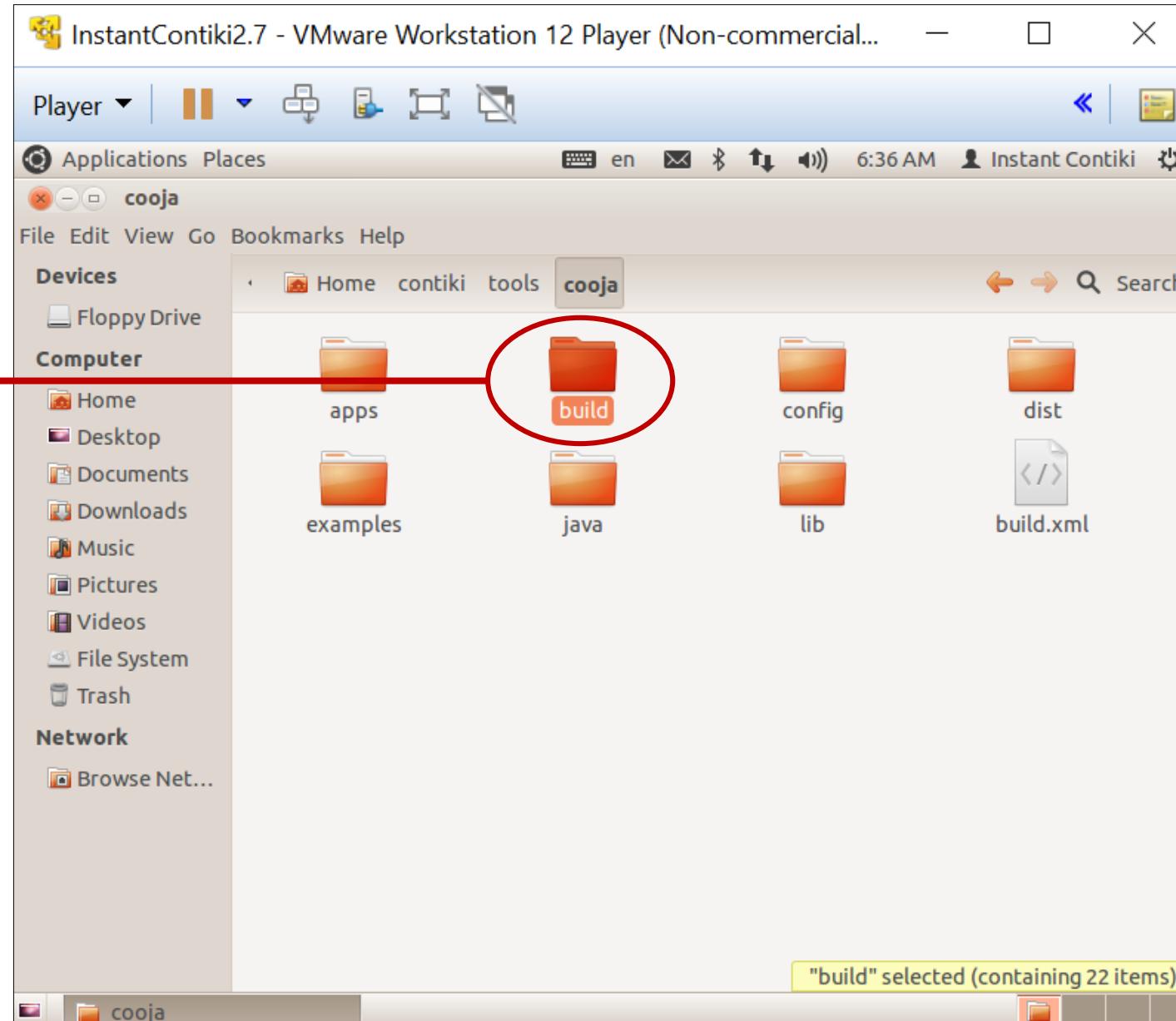
### 3. To see where PCAP files are saved

Open cooja folder

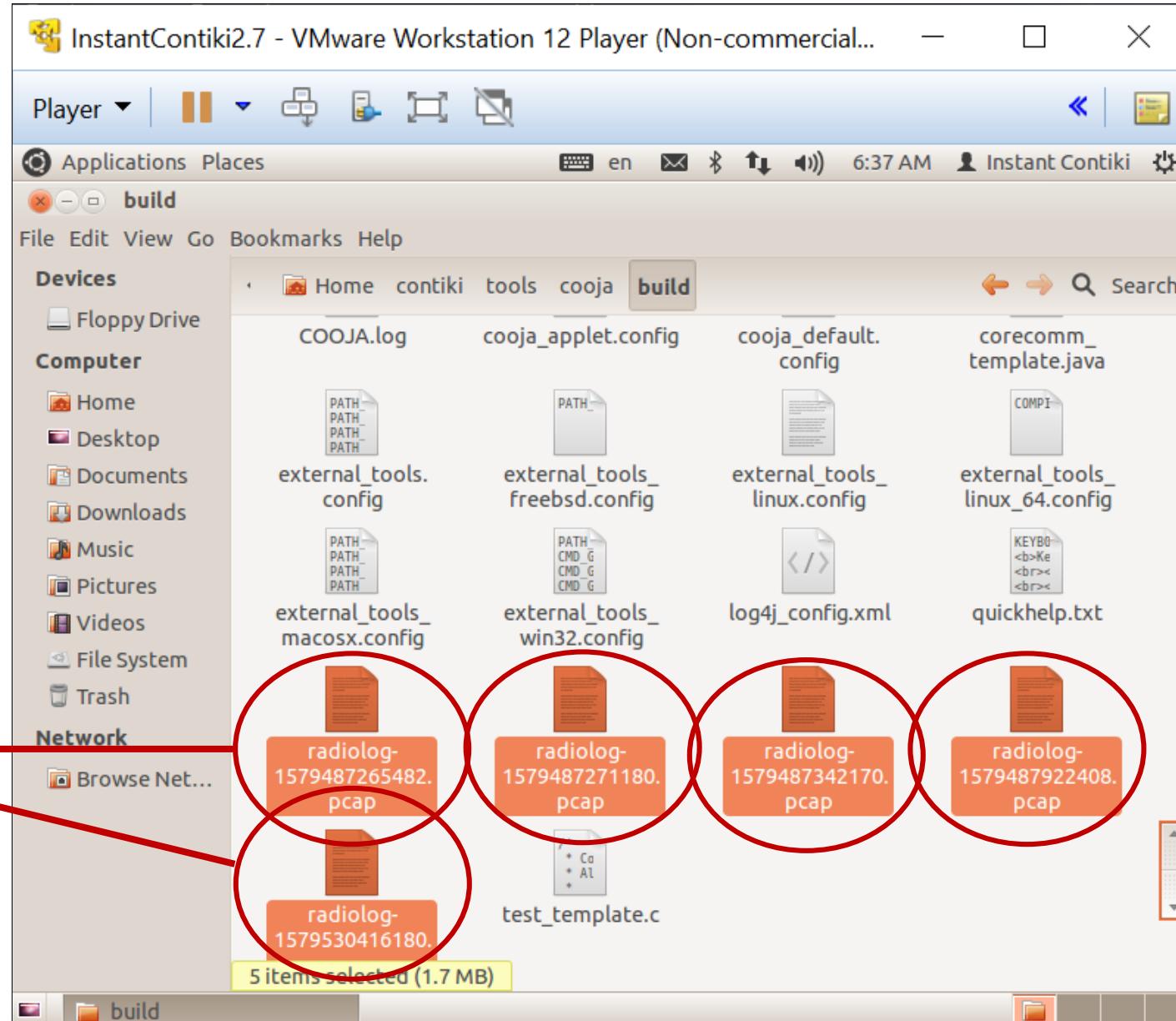


### 3. To see where PCAP files are saved

Open build folder



### 3. To see where PCAP files are saved

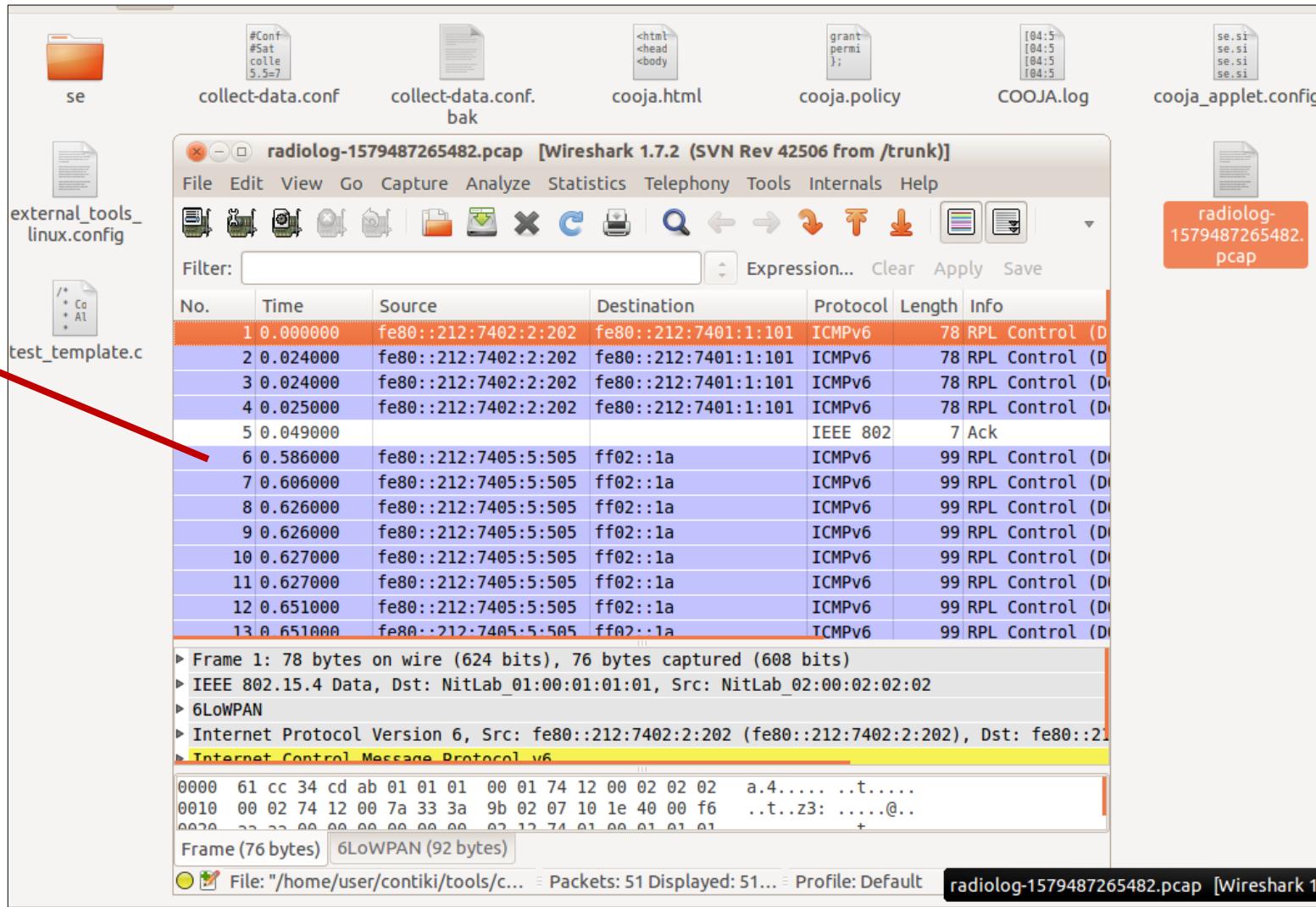


# 4. Open, analyze, and export PCAP files in CSV format using Wireshark program

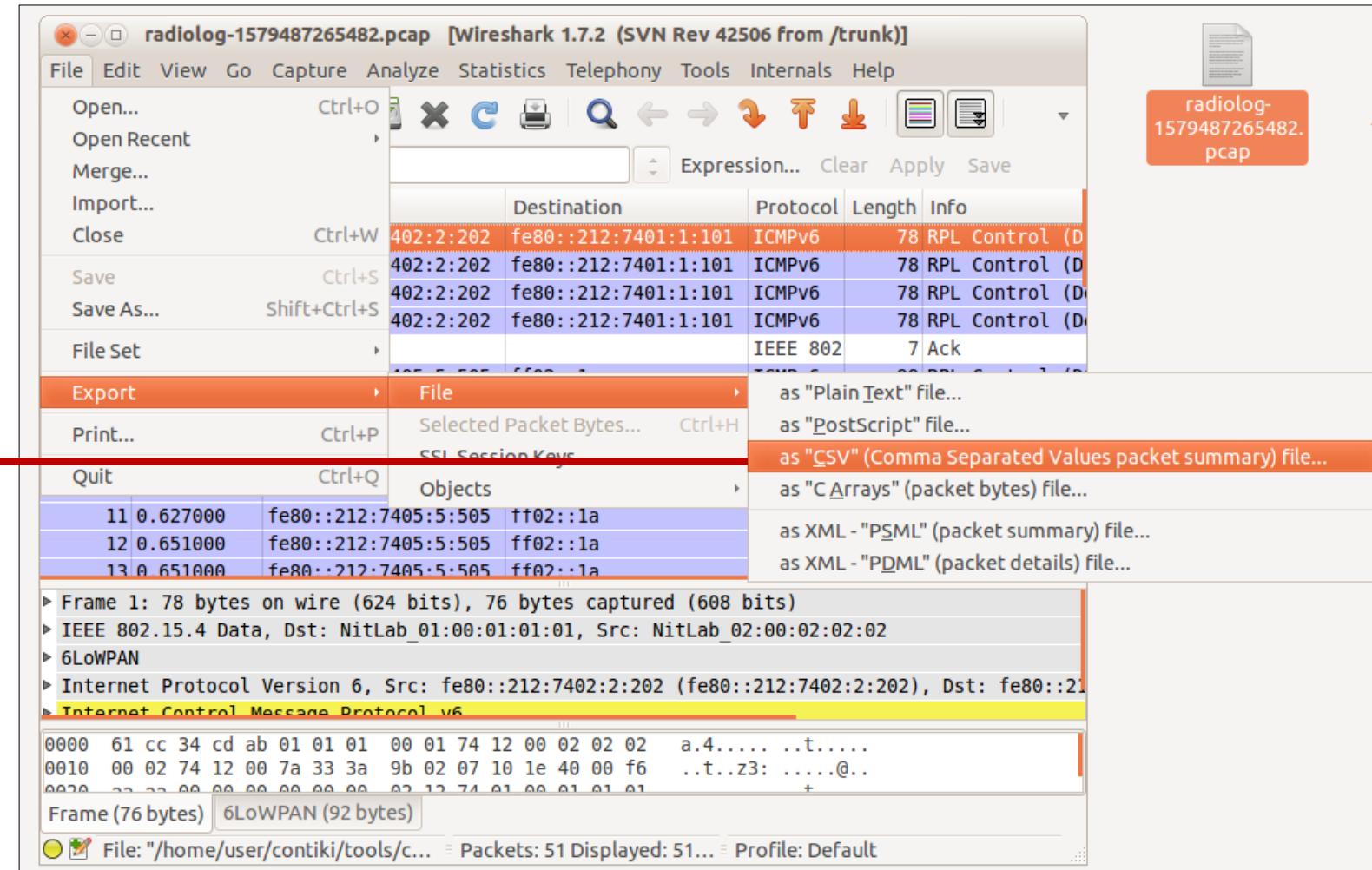
PCAP file has been opened via Wireshark packet analyzer.

## Note:

Wireshark is a program for network traffic analysis and is a necessary tool to open PCAP files.



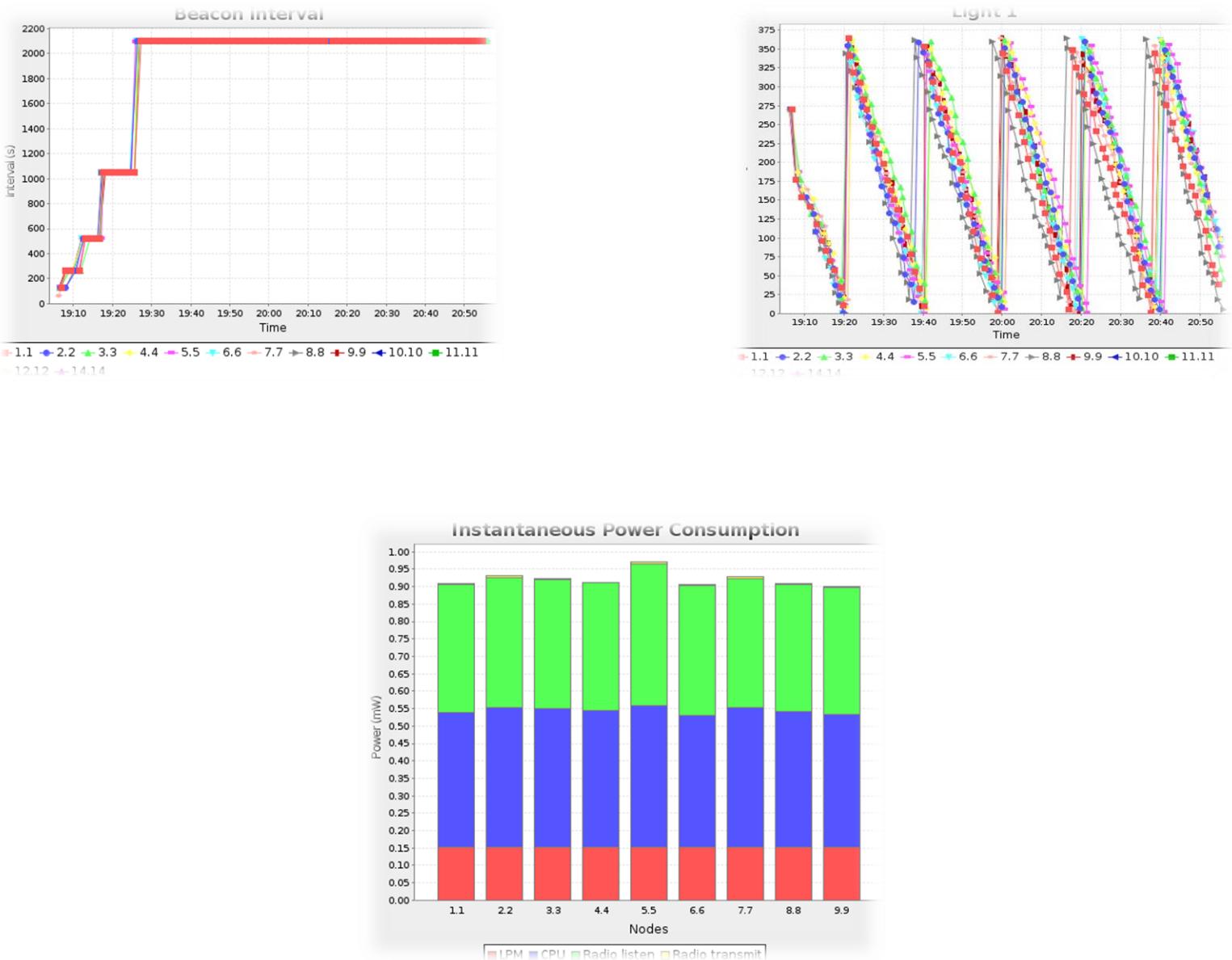
### 3. Open, analyze, and export PCAP files in CSV format using Wireshark program



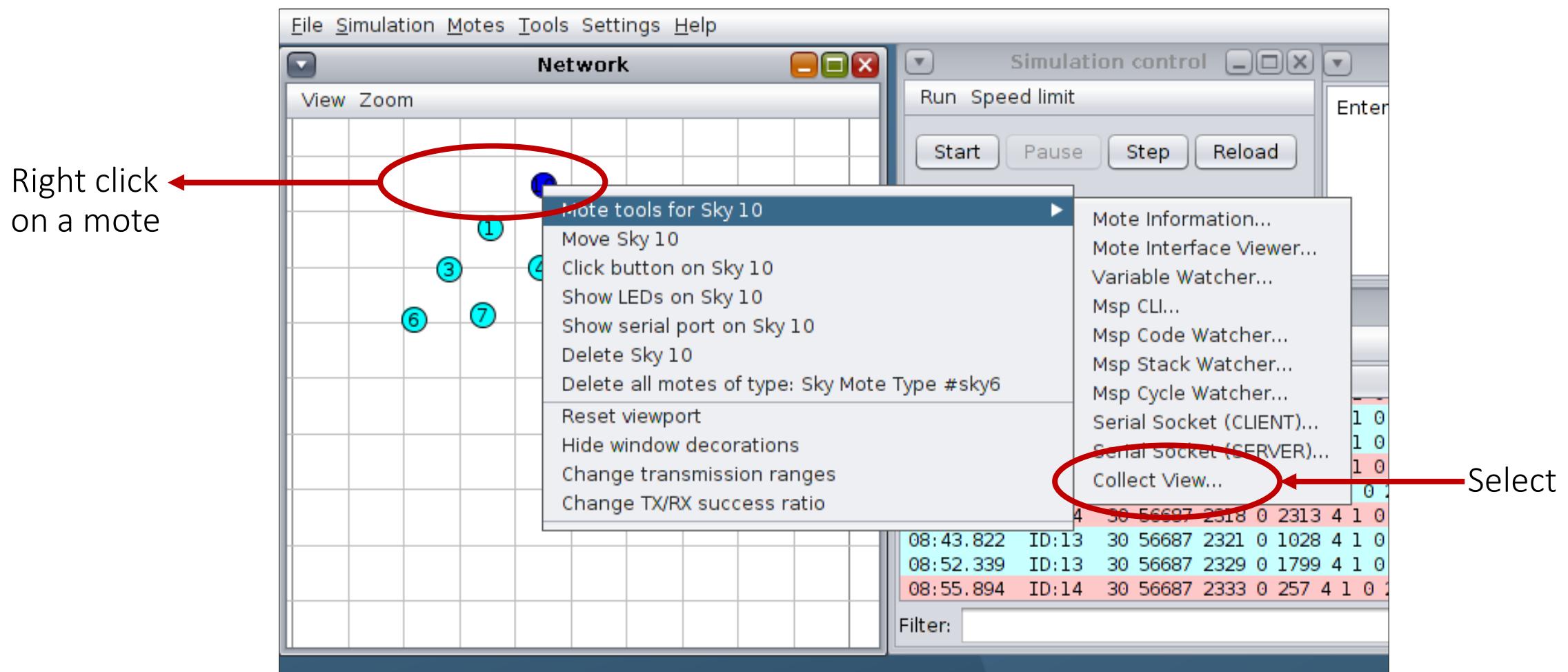
Go to File → Export  
→ File → as "CSV"

Note:  
PCAP files can be exported in other formats as well, such as plain text, xml, etc., as shown in the figure.

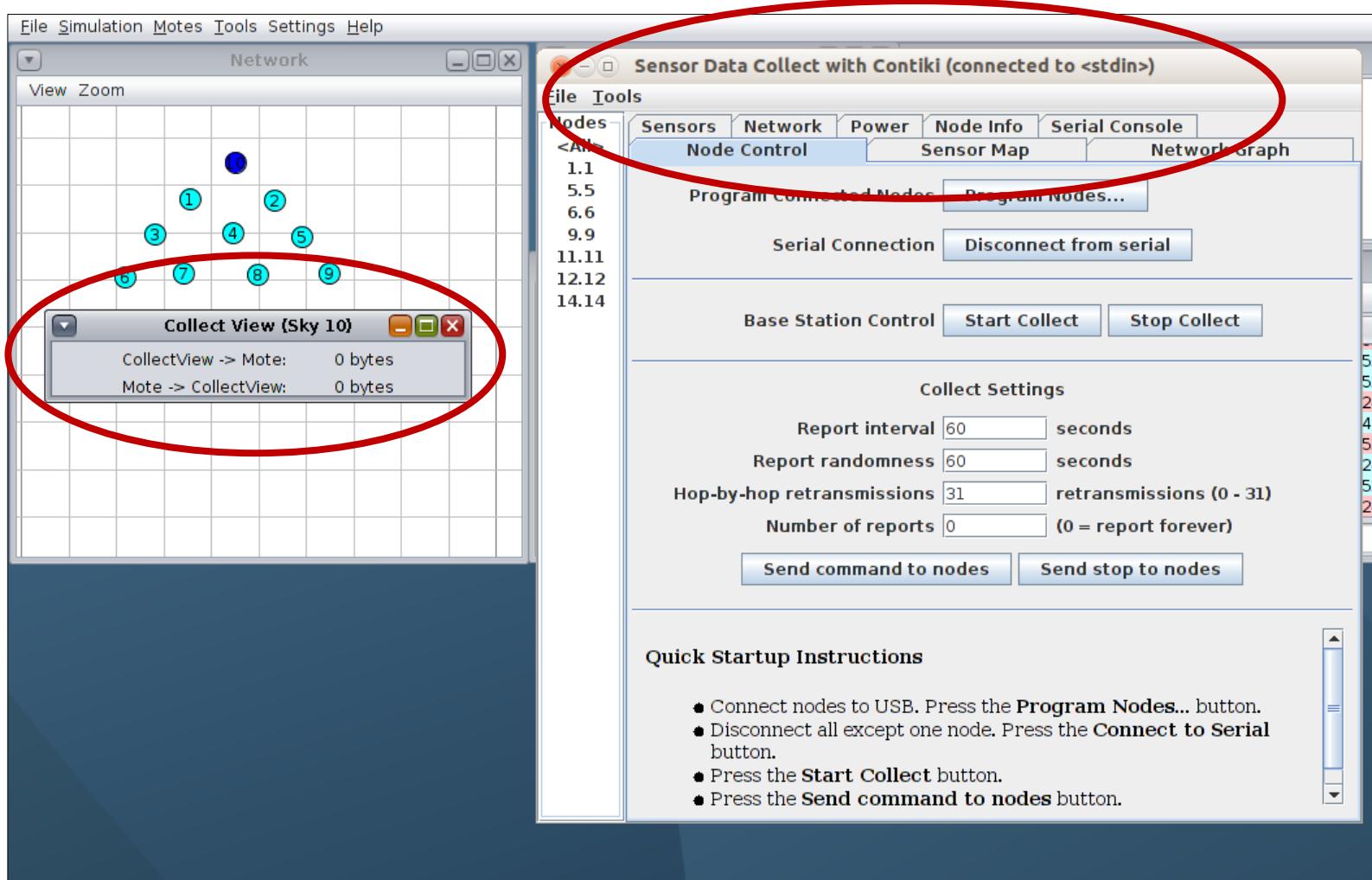
# RPL Collect, Metrics, Graphs and Plots



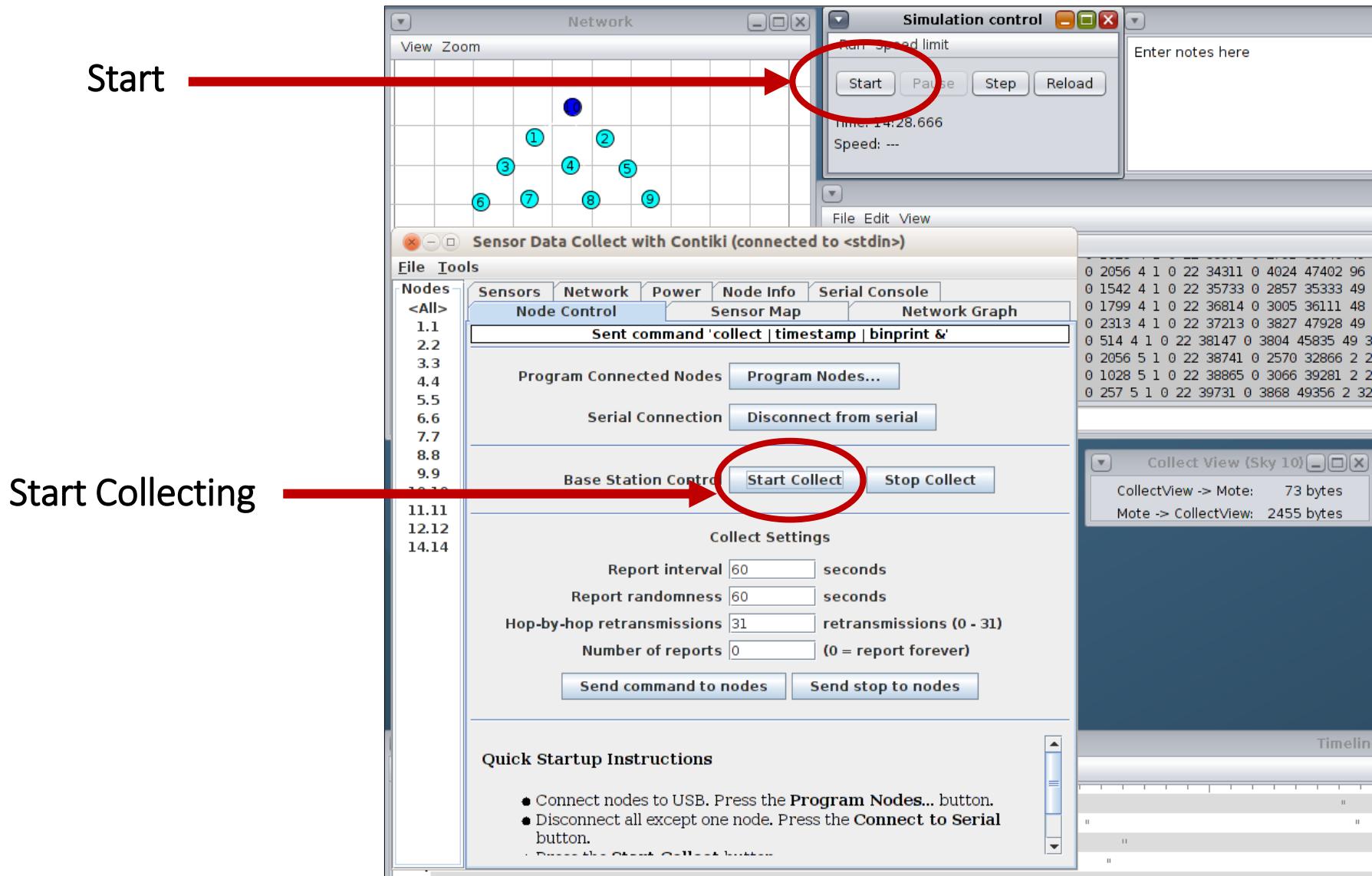
1. Right click on a mote and select **Collect View** from Mote tools menu  
(Collect View of Sink node (sky mote 10) is observed in this demonstration.)



2. Two windows will appear: Collect View (sky mote number) and Sensor Data Collect with Contiki

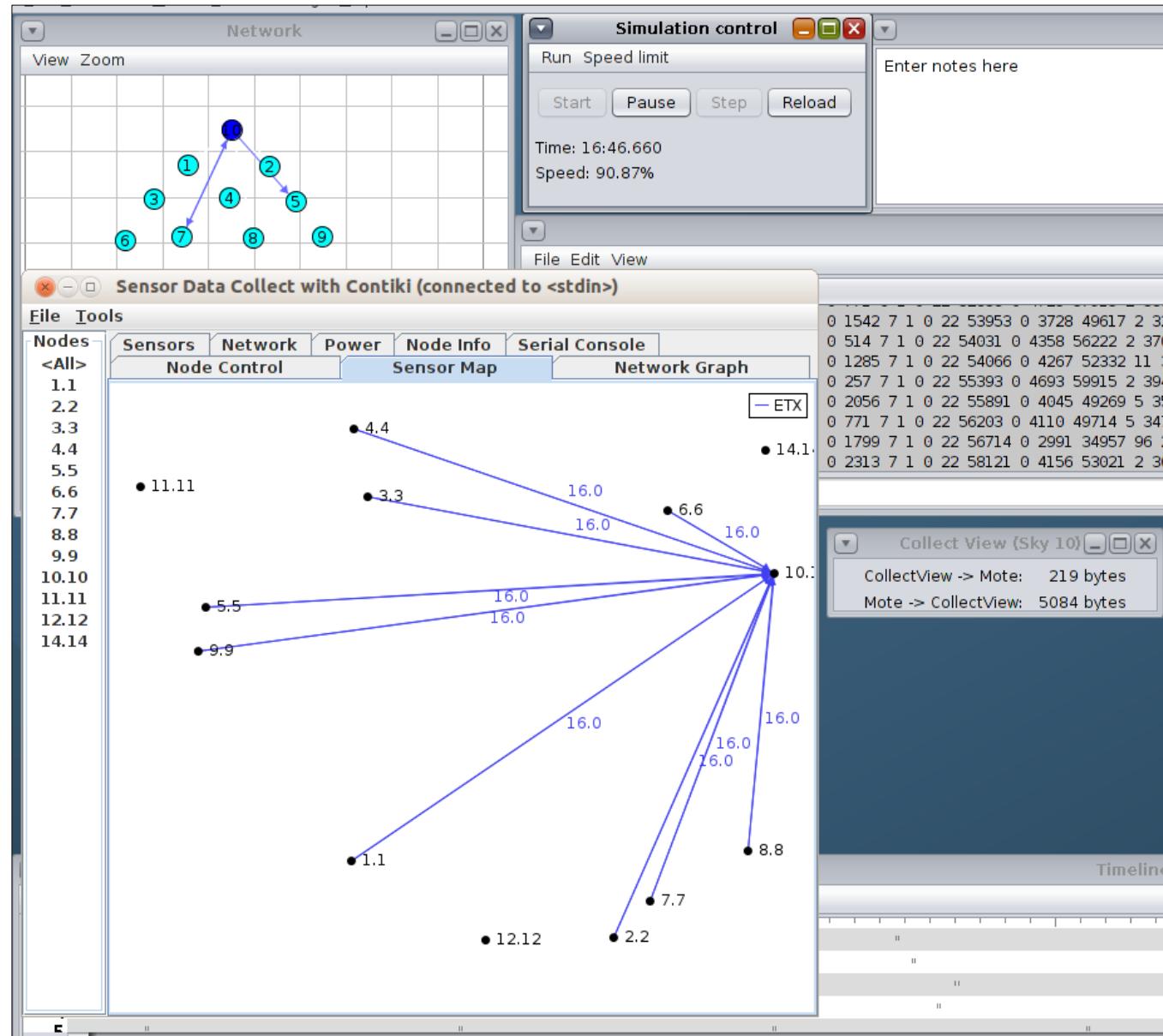


3. Click on Start in Simulation Control window for the simulation to start and Start Collect on Sensor Data Collect with Contiki window to observe related graphs and plots



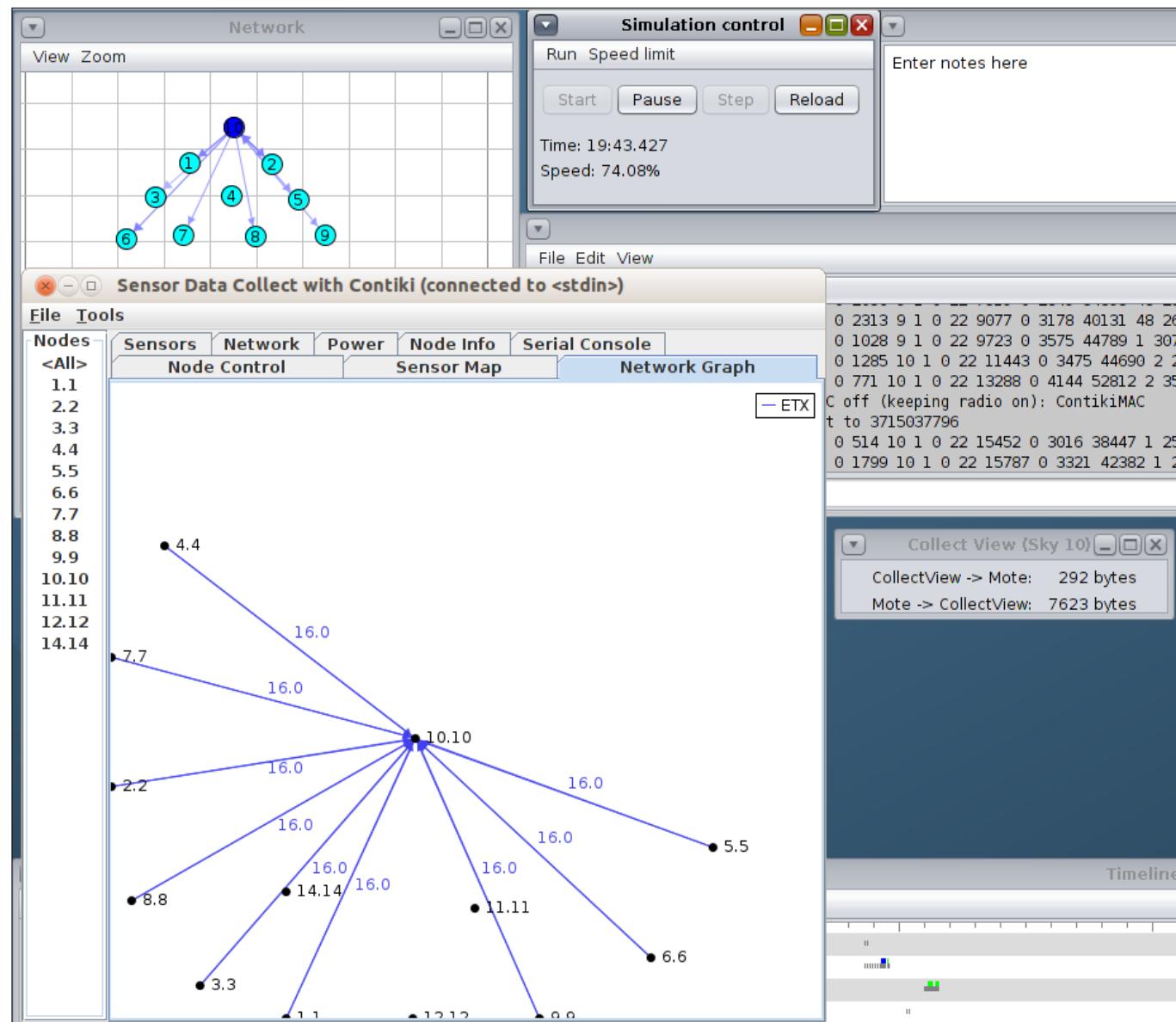
## i. Topological Graphs

### 1. Sensor Map



# i. Topological Graphs

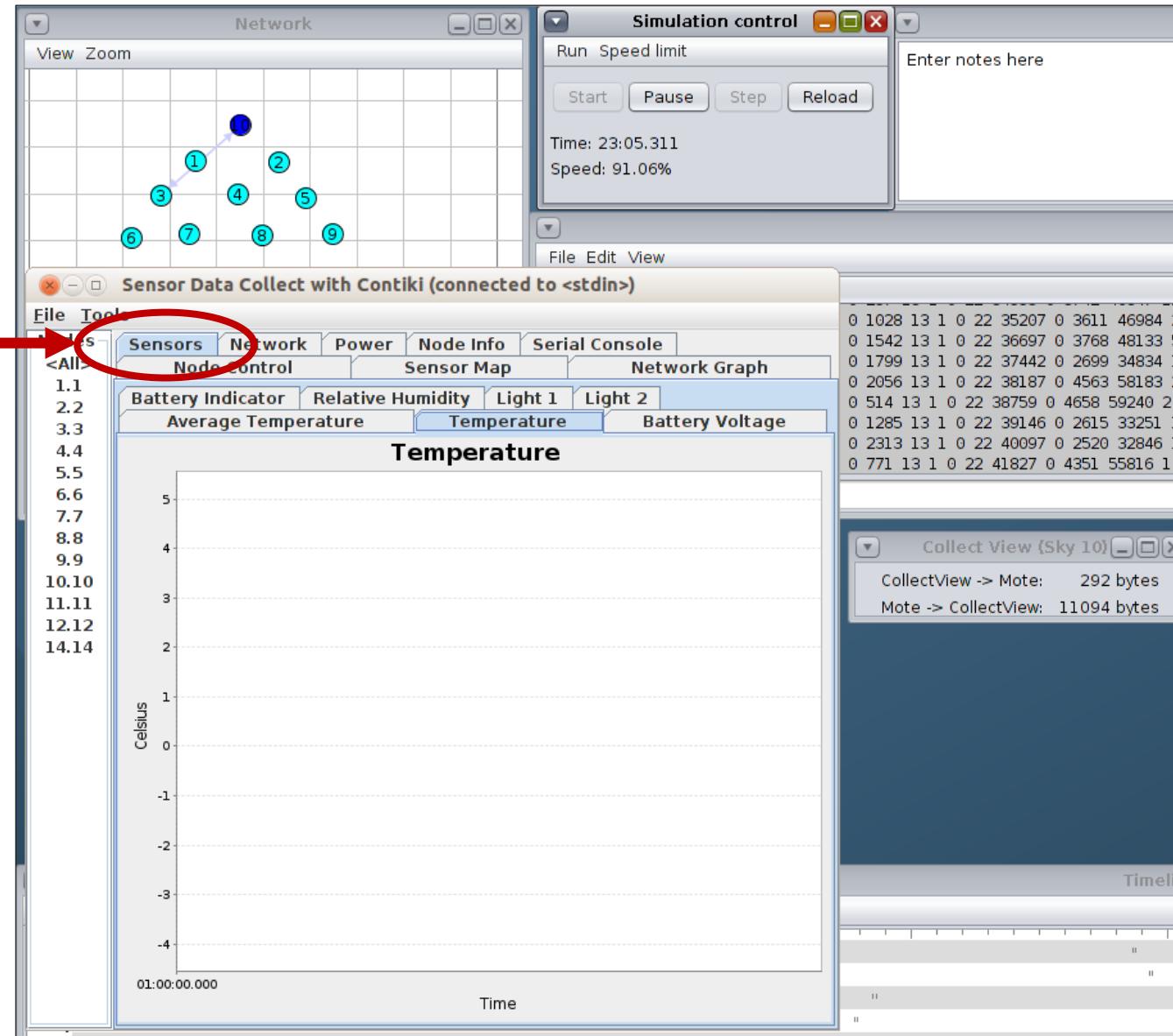
## 2. Network Graph



## ii. Sensor Related Plots

Click on Sensors to observe related metrics

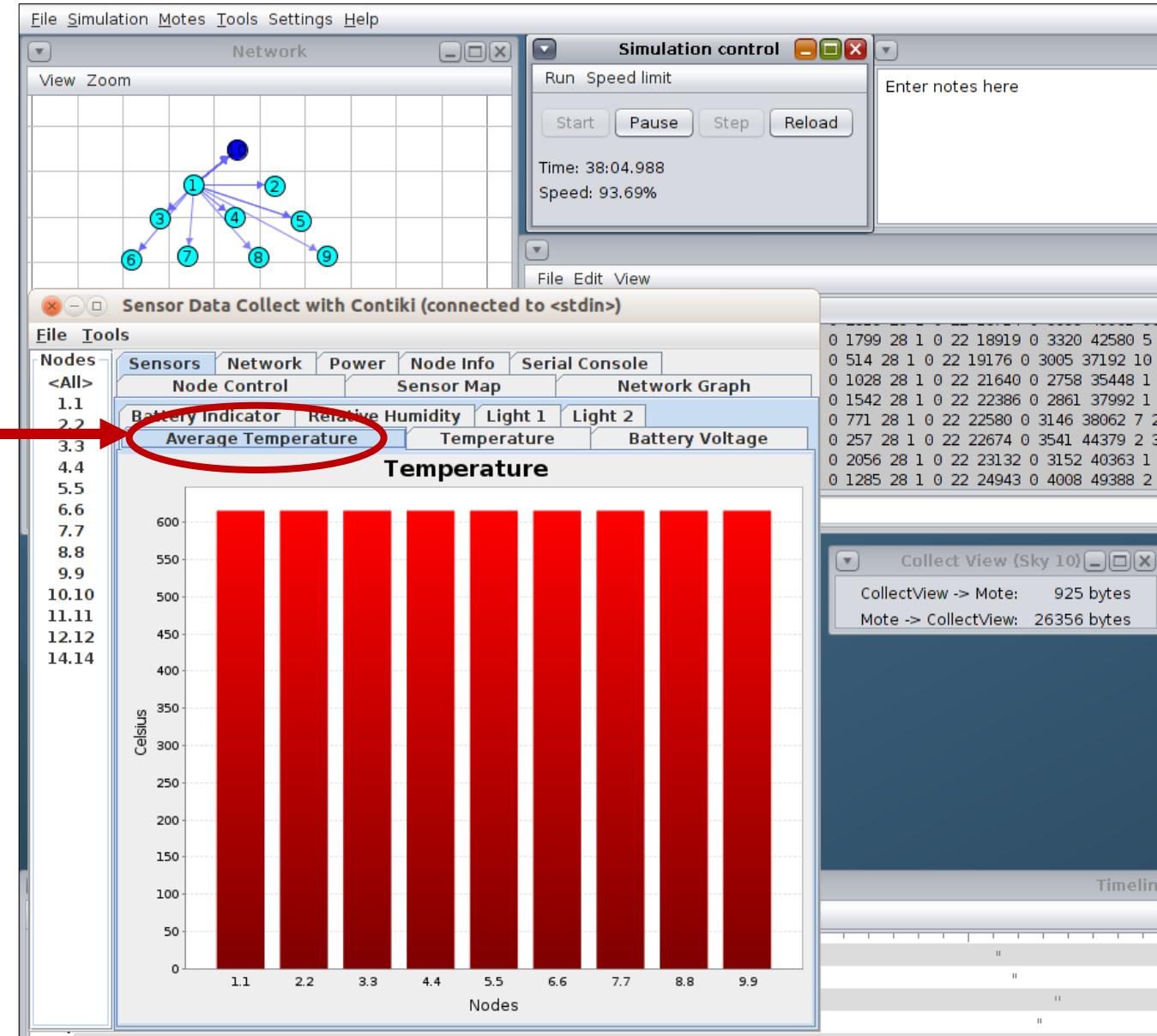
Click on  
Sensors



## ii. Sensor Related Plots

### Average Temperature and other sensor metrics

Average temperature of nodes 1-9 can be observed (600 Celsius in this demonstration)

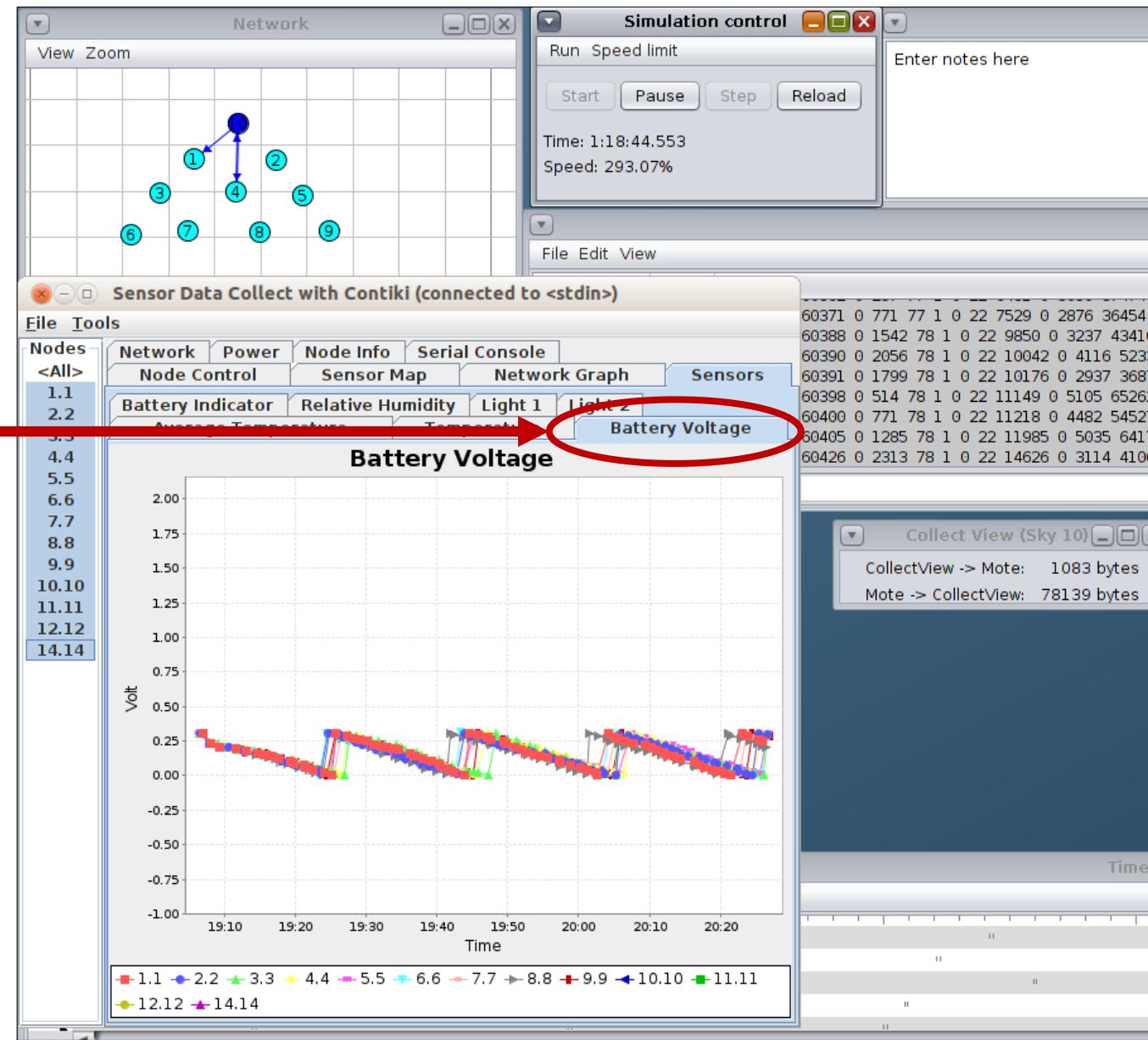


## ii. Sensor Related Plots

### Battery Voltage and other sensor metrics

Battery Voltage of all nodes can be observed in the plot.

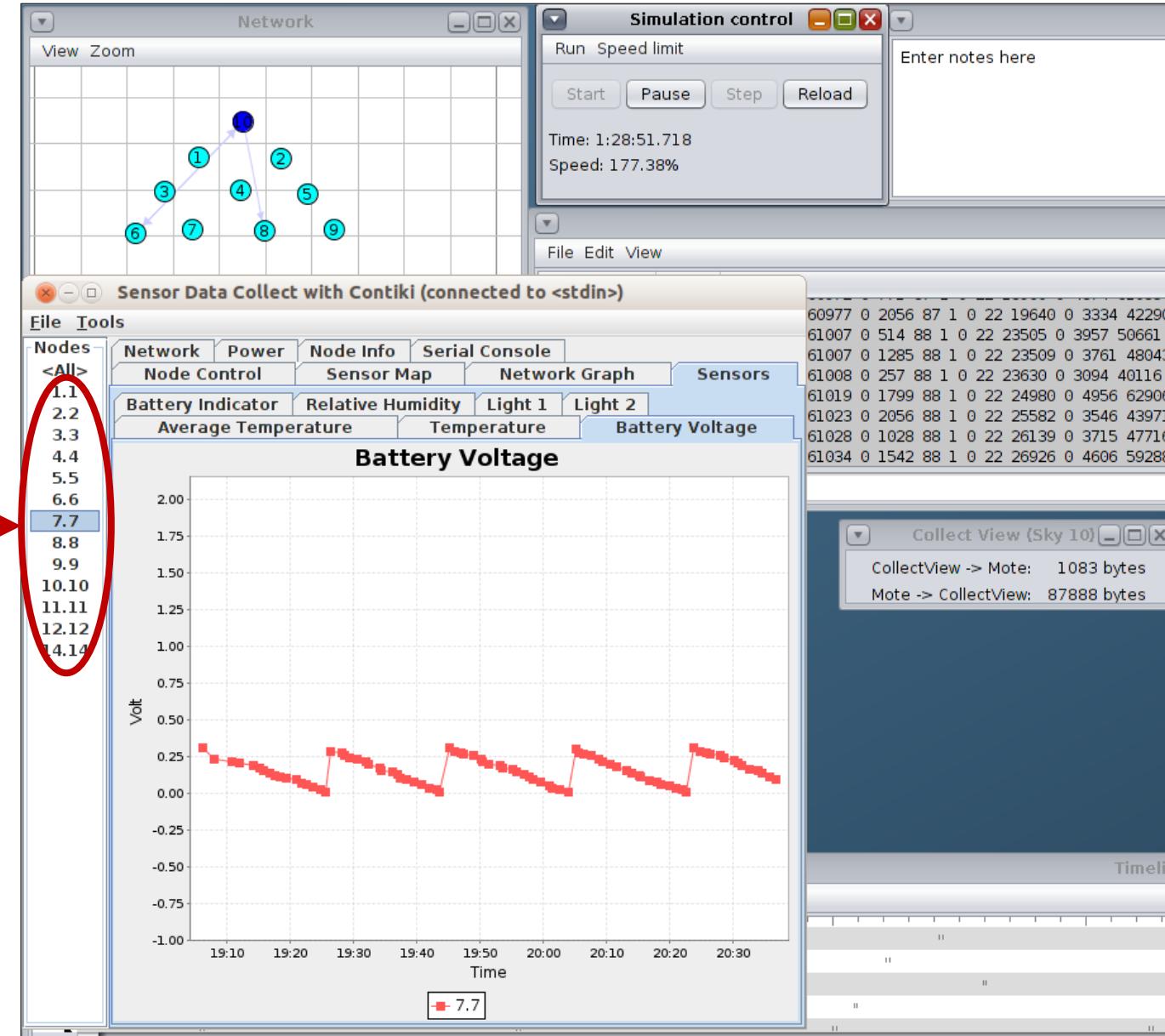
Individual values can be viewed by clicking on required node.



## ii. Sensor Related Plots

### Battery Voltage of Individual Nodes

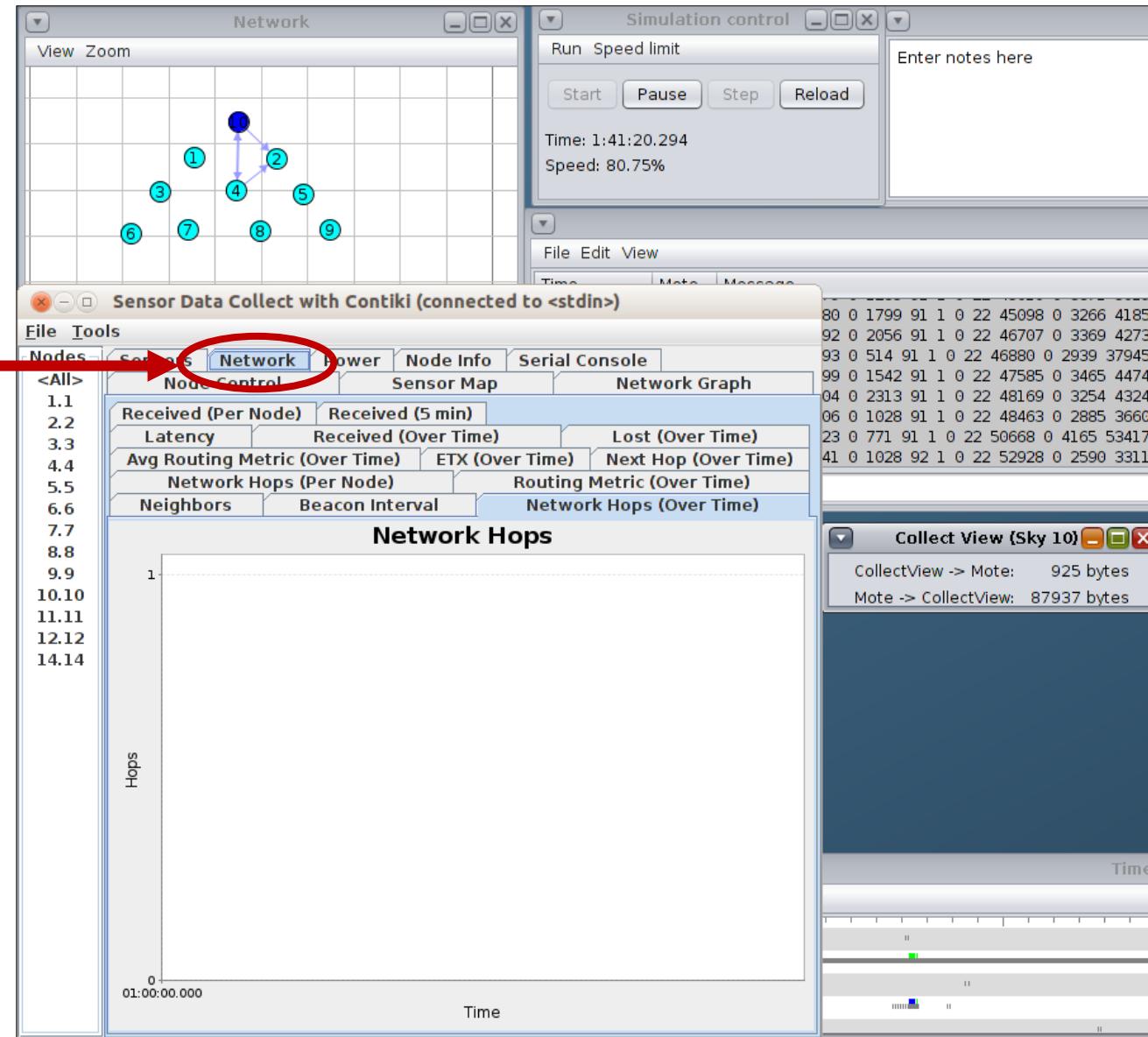
Individual values can be viewed by clicking on required node. Battery voltage of node 7 can be observed in this demonstration.



### iii. Network Metrics Related Plots

Click on Network to observe metrics

Click on  
Network

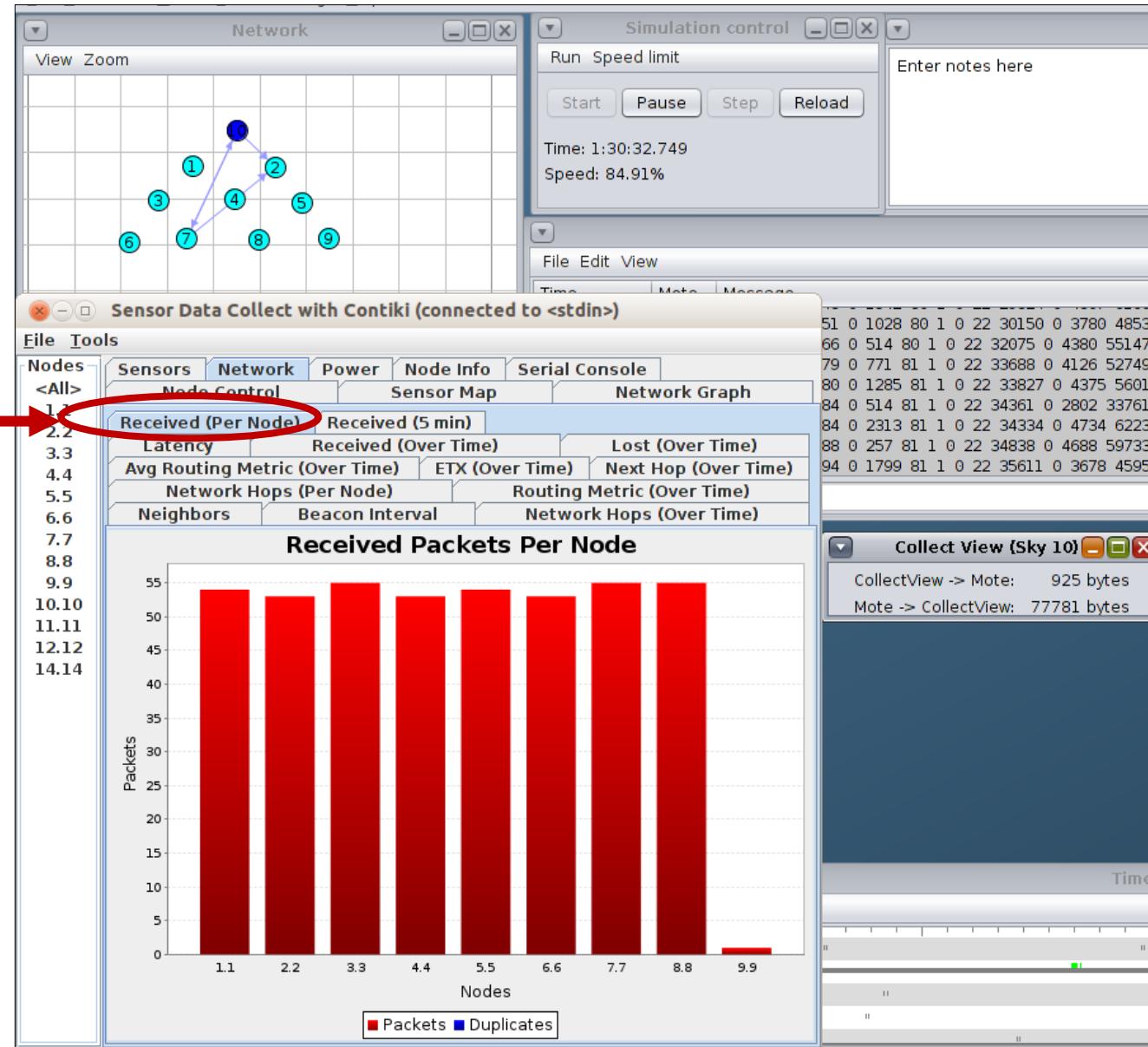


### iii. Network Metrics Related Plots

#### Packets Received (Per Node) and other network metrics

Packets received by nodes 1-9 at a certain time can be observed in the given plot.

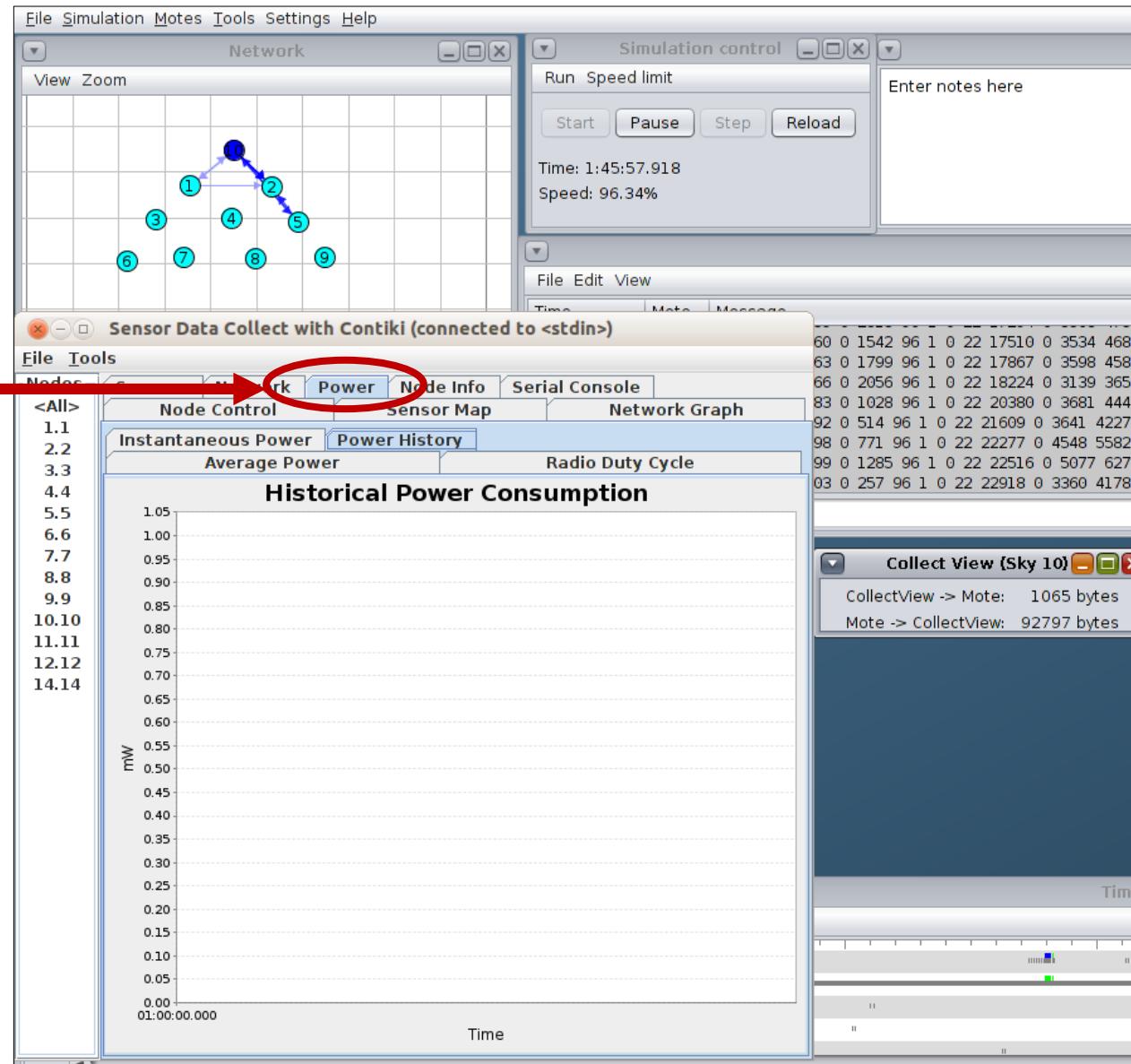
- Node 1: around 54
- Node 2: around 53
- Node 3: 55
- Node 4: around 53
- Node 5: around 54
- Node 6: around 53
- Node 7: 55
- Node 8: 55
- Node 9: around 1



#### iv. Power Related Plots

Click on Power to observe metrics

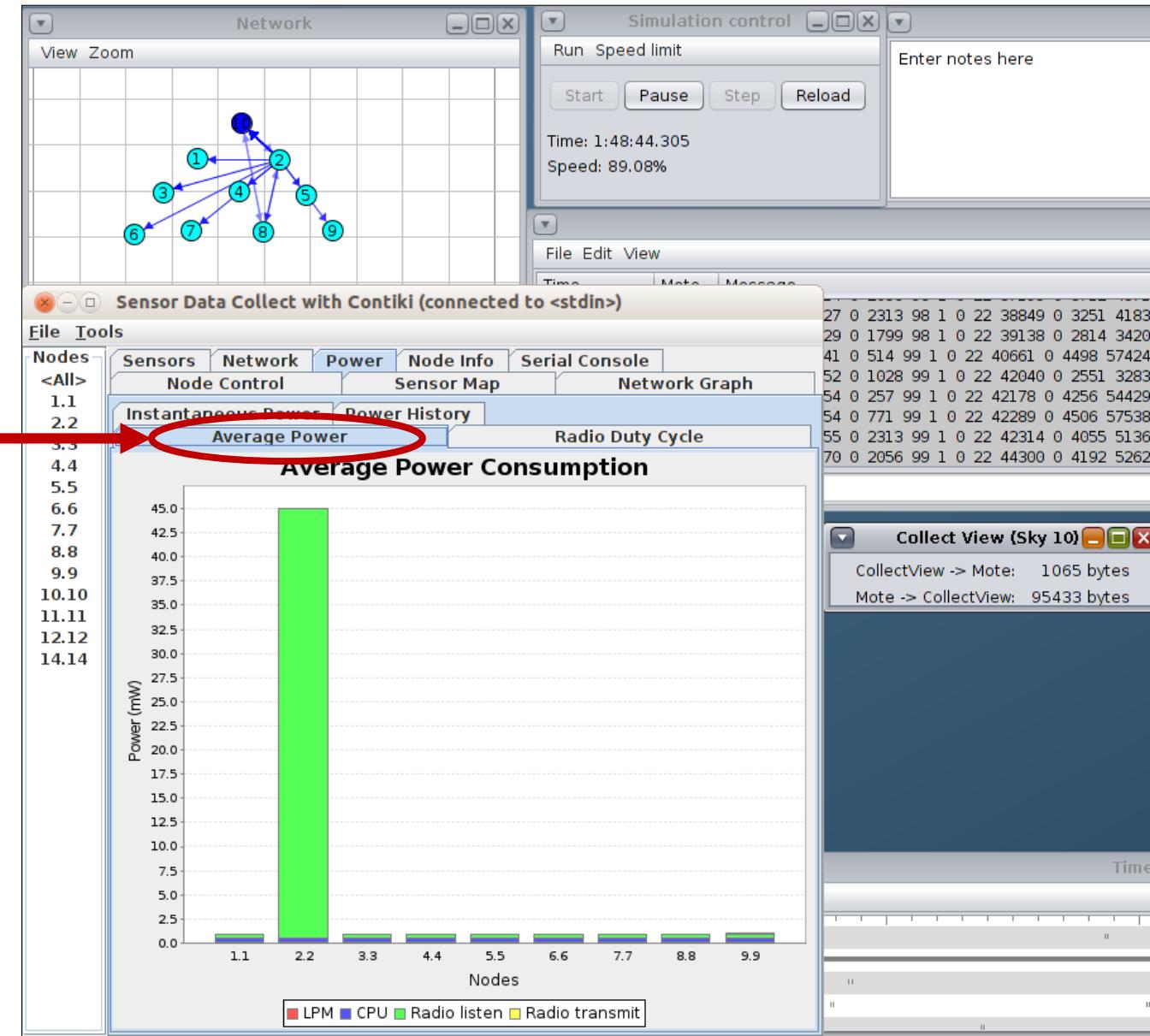
Click on  
Power



#### iv. Power Related Plots

### Average Power Consumption (Per Node) and other power related metrics

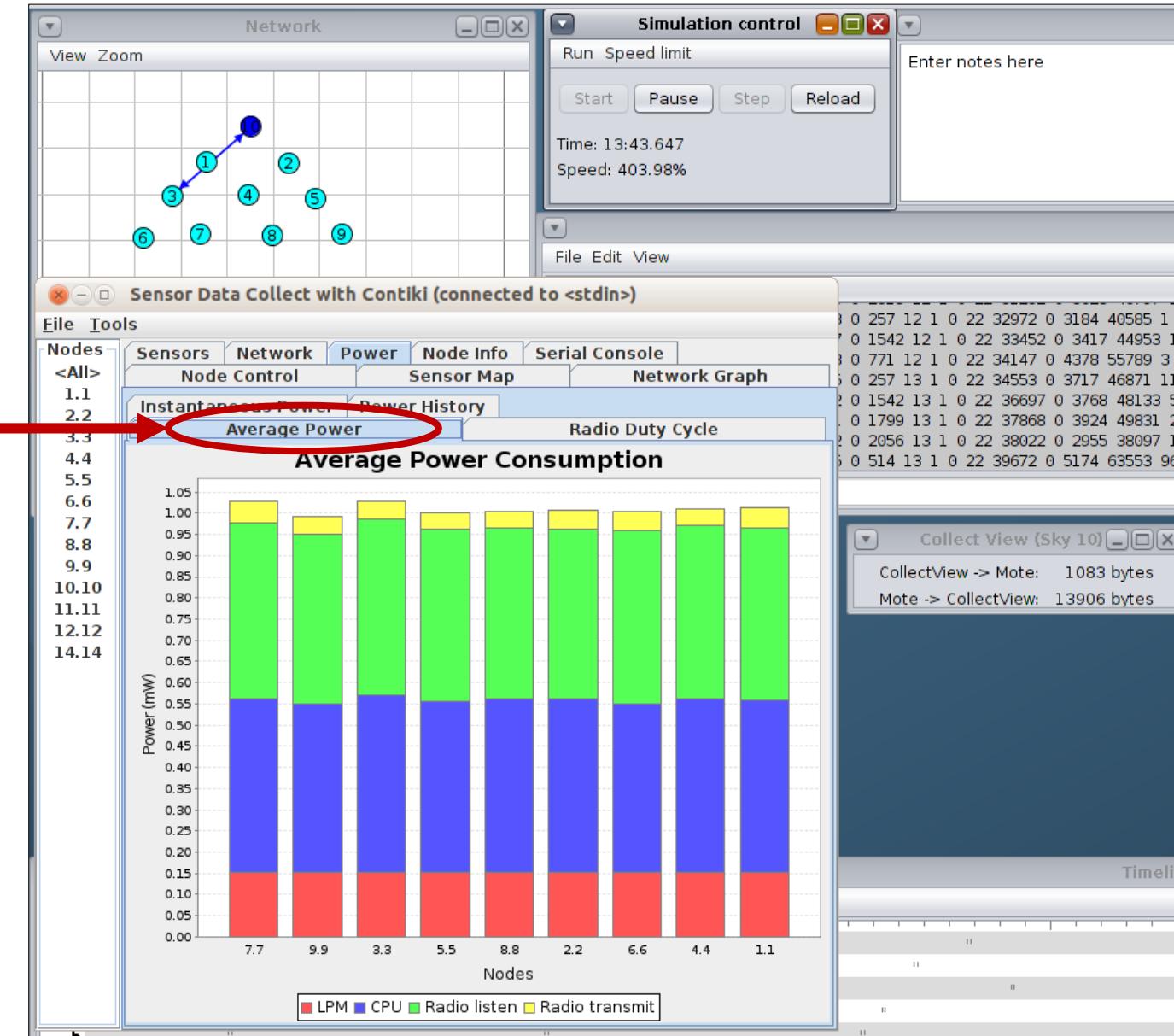
Average power consumed by nodes 1-9 can be observed at a certain time in the given plot



#### iv. Power Related Plots

#### Average Power Consumption Per Node (another view)

Another view of average power consumed by nodes 1-9 can be observed at a certain time in the given plot

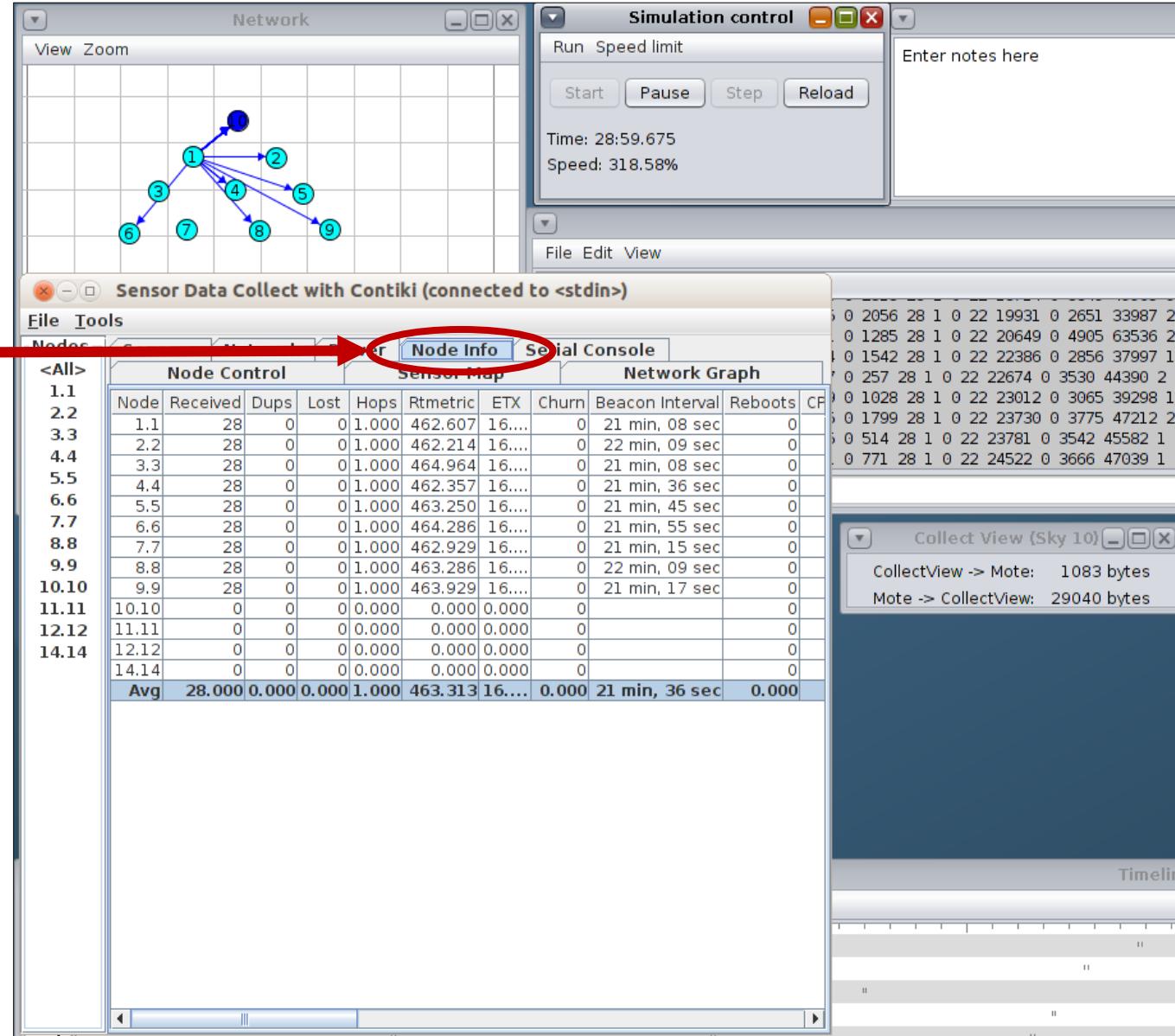


## v. Other Information

Click on **Node Info** to view various performance metrics

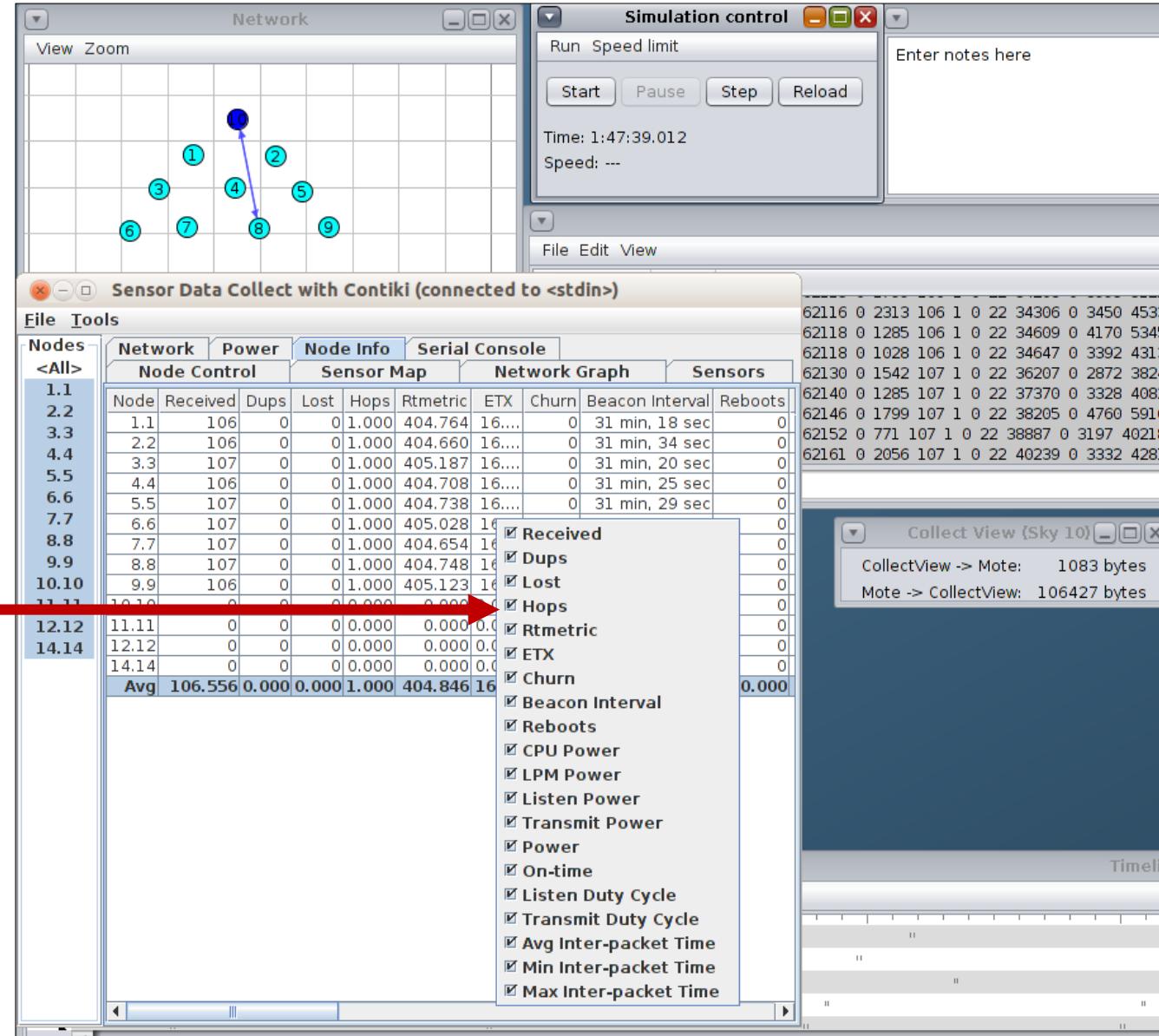
Click on **Node Info**

**Node Info** provides various individual as well as average of performance metrics of every reachable node in a cluster in the form of a database which can be used for plotting and analysis.



## v. Other Information

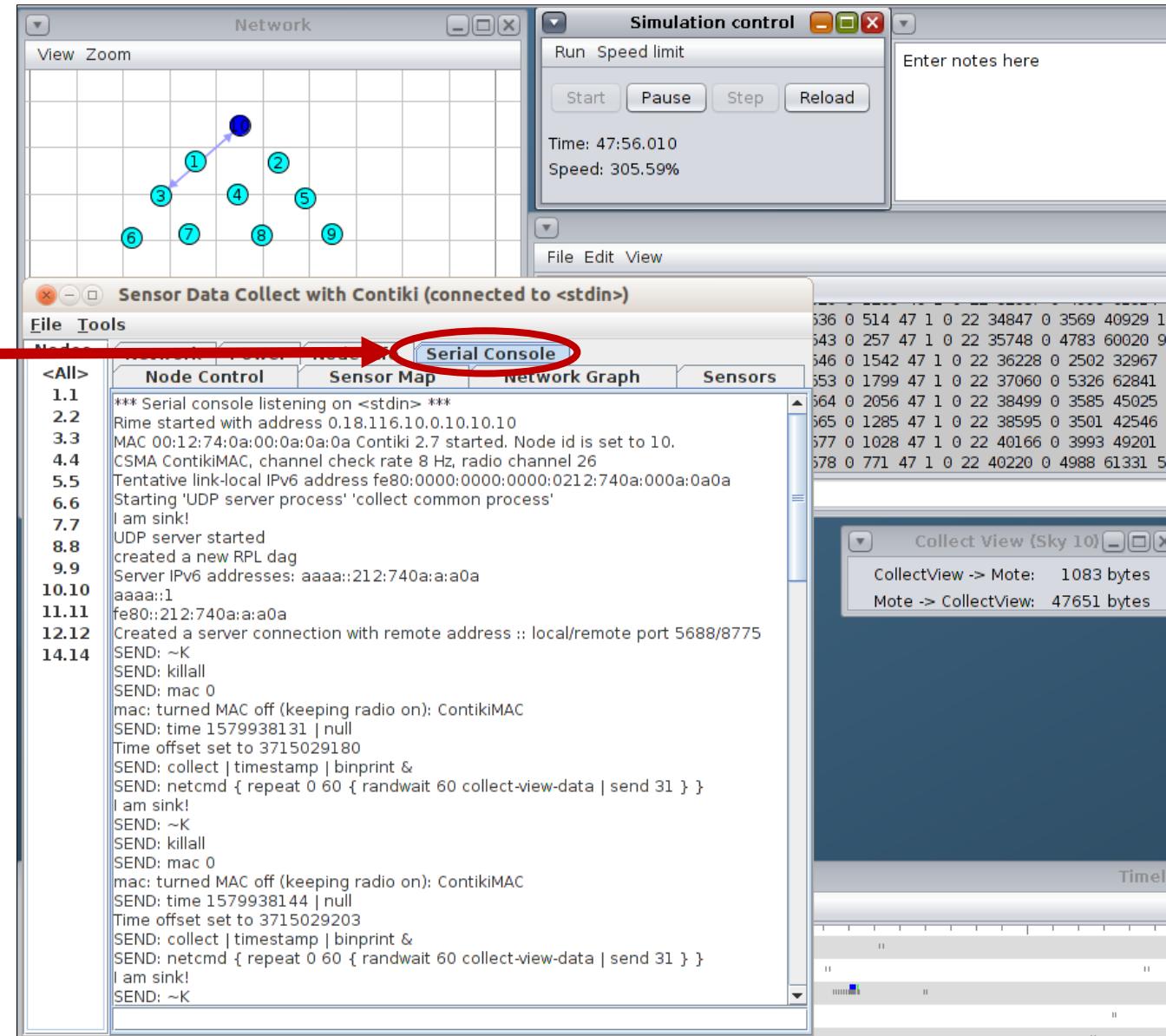
Click on **Node Info** to view various performance metrics



## v. Other Information

Click on **Serial Console** to view sequential information transmission

Click on Serial Console



# Notes

- All graphs and plots can be saved in .png format.
- Information about a particular node can be obtained by hovering over its representative bar, line, etc. in a bar or line graph.
- All or individual node data can be observed by selecting **All** or required node (as shown in **slide 55 and 56**).
- Sometimes VMWare might stop working due to an internal error, it can be repaired by the following process:
  - Control Panel → Programs → Uninstall a Program → VMWare Player → **Change** → Repair → Finish
  - Restart VMWare player and resume Instant Contiki OS

# Image References



**Cover Page Image Reference (slide 1):**

<https://www.directetudiant.com/actualite/alternance/2018/antoine-toutry-doit-faire-face-aux-dangers-de-l-e-reputation>



**Wireshark Logo Reference (slide 33):**

<https://www.varonis.com/blog/how-to-use-wireshark/>



**Wireshark Logo Design by 'realinfo' (slide 33):**

<https://steemit.com/utopian-io/@realinfo/wireshark-logo-design>



**End Page Image Reference (slide 67):**

<https://ya-webdesign.com/explore/baby-shark-clipart-cute/>

# Thank You

