A Toolchain for UML-based Modeling and Simulation of Networked Embedded Systems (Lab)

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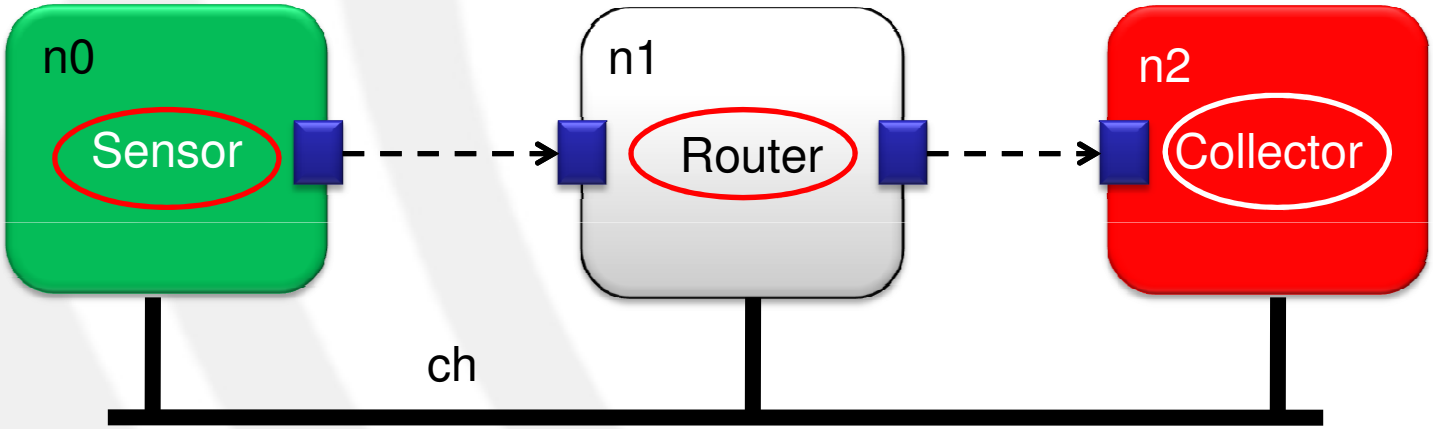
Outline

- Lab activities:
  - SCNSL code
    - Example # 2
  - UML model and Toolchain
    - Example # 3 and # 4
  - Toolchain and SCNSL
    - Example # 5

Example # 2
Three nodes with router



Proxy number: 1 2 1

Exercise # 2

1. Calculate the end-to-end delay
2. Calculate the single-hop delay
3. Calculate Packet Loss Rate
   - Use “grep” and “wc –l” BASH commands to count sent and received packets.
4. Change the transmitting power to the minimum and calculate the new PLR

ESD Electronic Systems Design

Synthesis Verification Testing Power Communication

UML toolchain

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UML2HIF, N2S

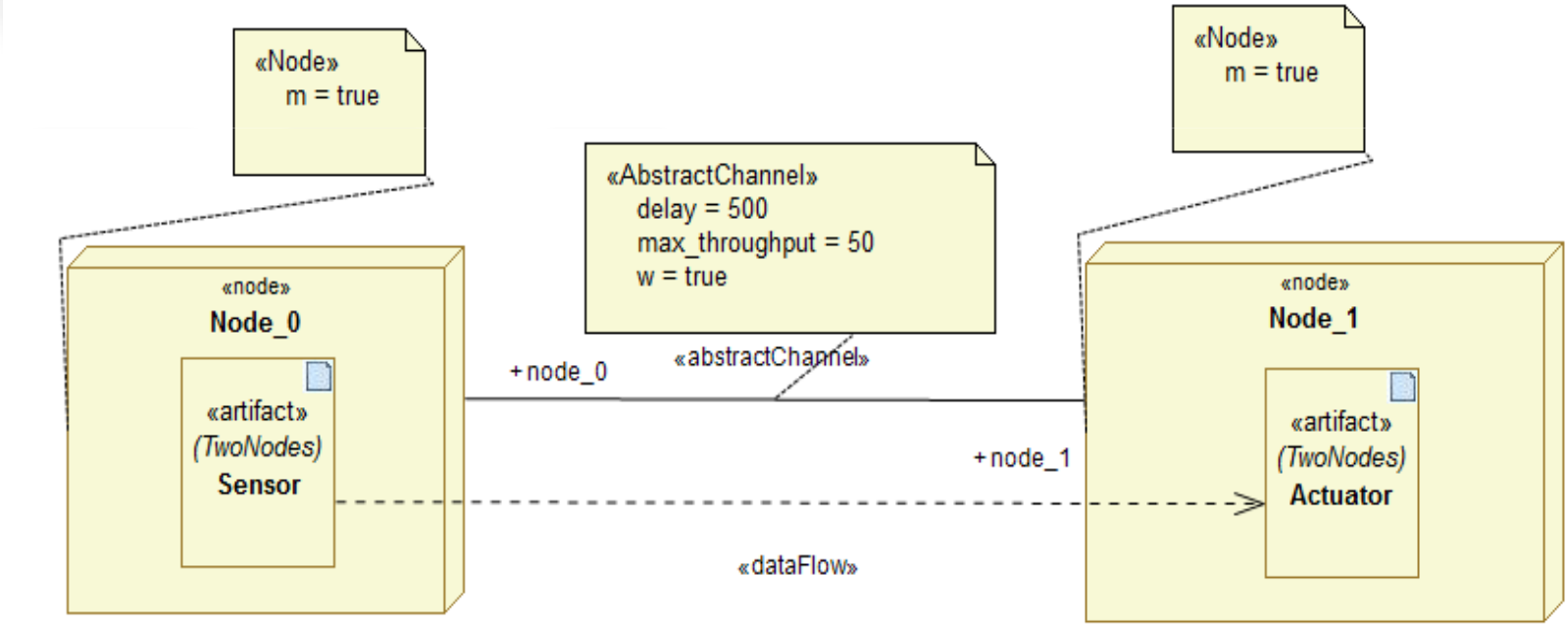
Simulation statistics

Virtual machine

- Open Oracle VM VirtualBox.
- Create a new virtual machine
  - O.S. Linux
  - Version: Debian 32bits
- Use existing Hard disk
  - Image in “/opt/HIF Demo VM clone”
- From VM: file-> preferences->general-> default machine folder-> /tmp/ create a folder here
- Create a snapshot for this machine
- Open the machine. (password is hifdemo)

Example # 3

- Two nodes with wireless channel

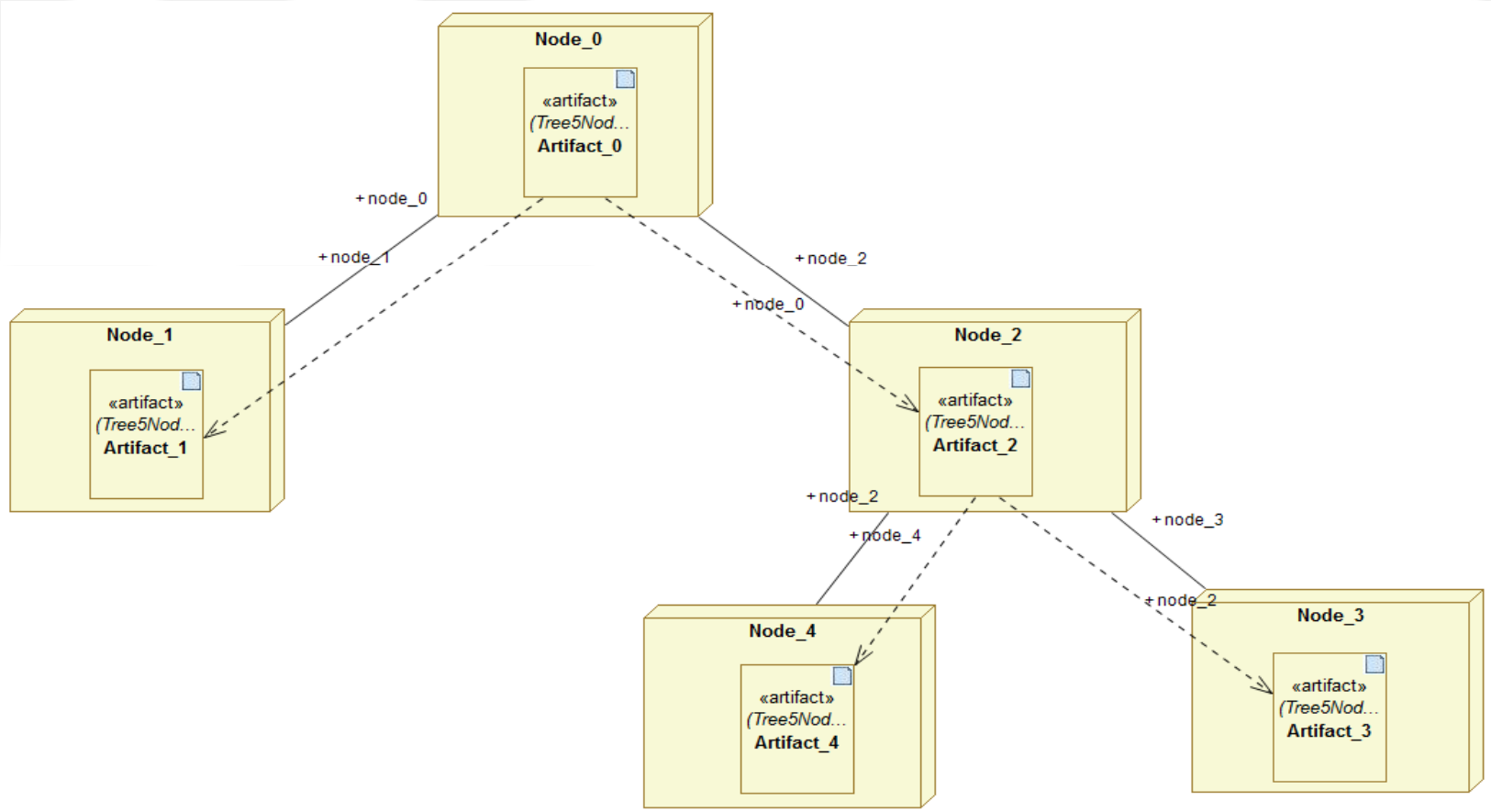


Exercise # 3

1. Model Example #3 by using Papyrus + NW profile
2. Use the toolchain to generate SCNSL code
3. Compile and execute it
4. Calculate the PLR and the Average delay

P.S. Time to finish this task is 10 minutes

Example # 4


Node_0
«artifact»
(Tree5Nod...
Artifact_0
+node_0
+node_1
+node_2
+node_0
Node_1
«artifact»
(Tree5Nod...
Artifact_1
Node_2
«artifact»
(Tree5Nod...
Artifact_2
+node_2
+node_4
+node_3
+node_2
Node_4
«artifact»
(Tree5Nod...
Artifact_4
Node_3
«artifact»
(Tree5Nod...
Artifact_3

Exercise # 4

- Model Example #4 by using a wired channel with **25 msec** of delay
- Change the tasks names which are deployed in nodes to be like that:
  - Node0 has task named sensor
  - Node1 has task named monitor1
  - Node2 has task named router
  - Node3 has task named monitor2
  - Node4 has task named actuator
- Generate SCNSL code and compile it

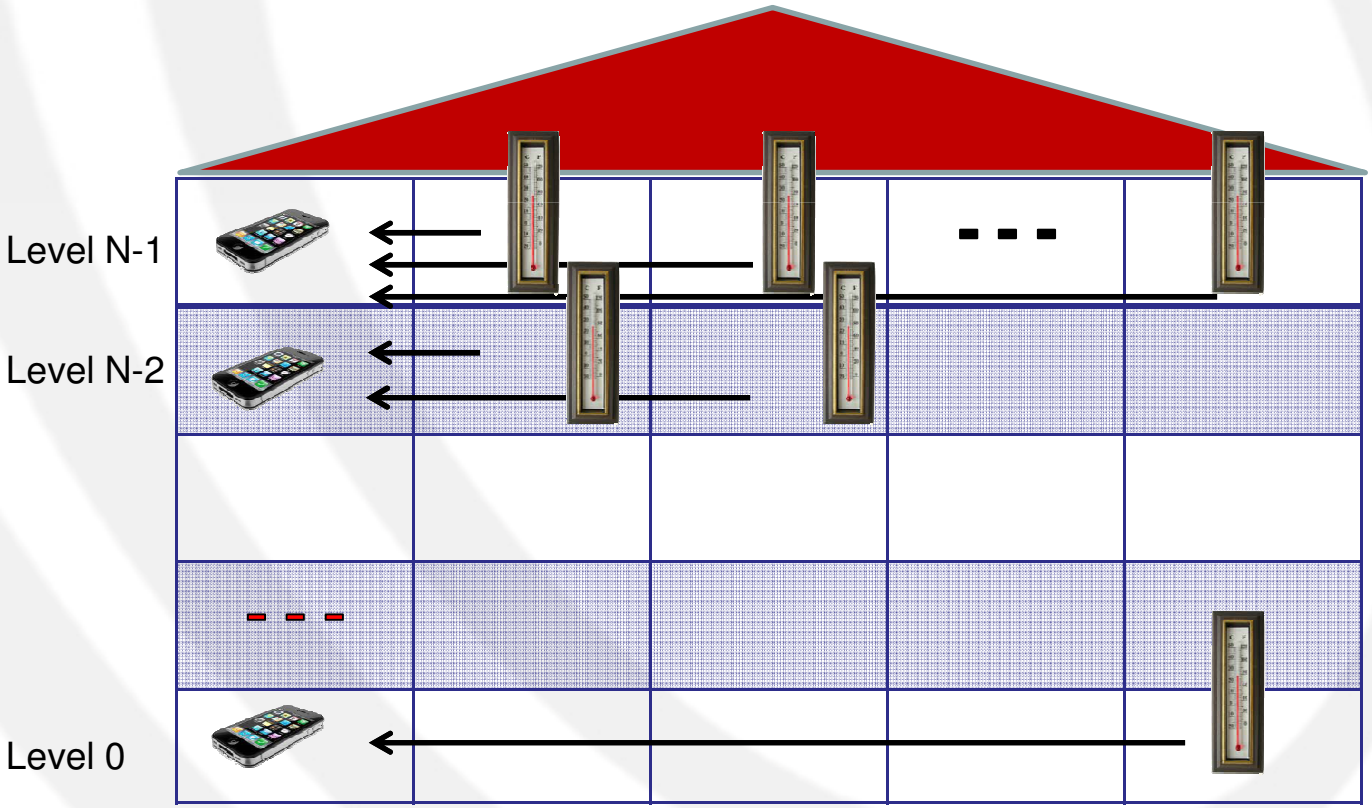
P.S. Time to finish this task is 20 minutes

Example # 5
Temperature Monitoring for Building Automation

There are N floors with N rooms for each floor.

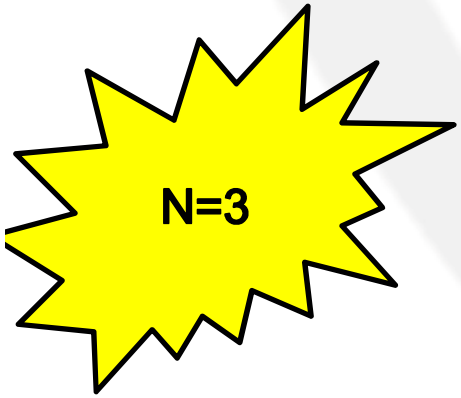
In each floor there is one sensor for each room which sends data to a controller.

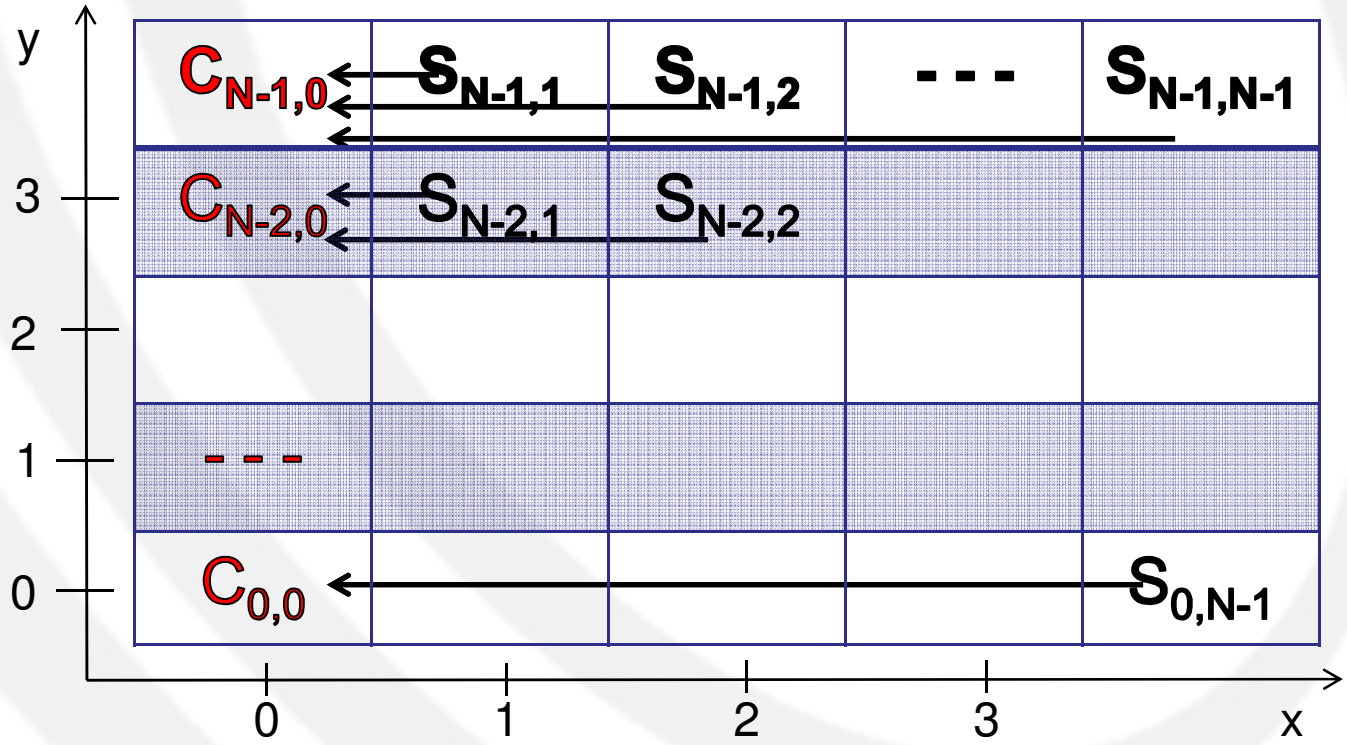
There is a separate controller for each floor



Example # 5
Simulation scenario

Idea: Network consists of a NxN matrix.
Nodes in the first column will work as a collector node (RX only) while other nodes as sensor nodes (TX only)





Exercise # 5

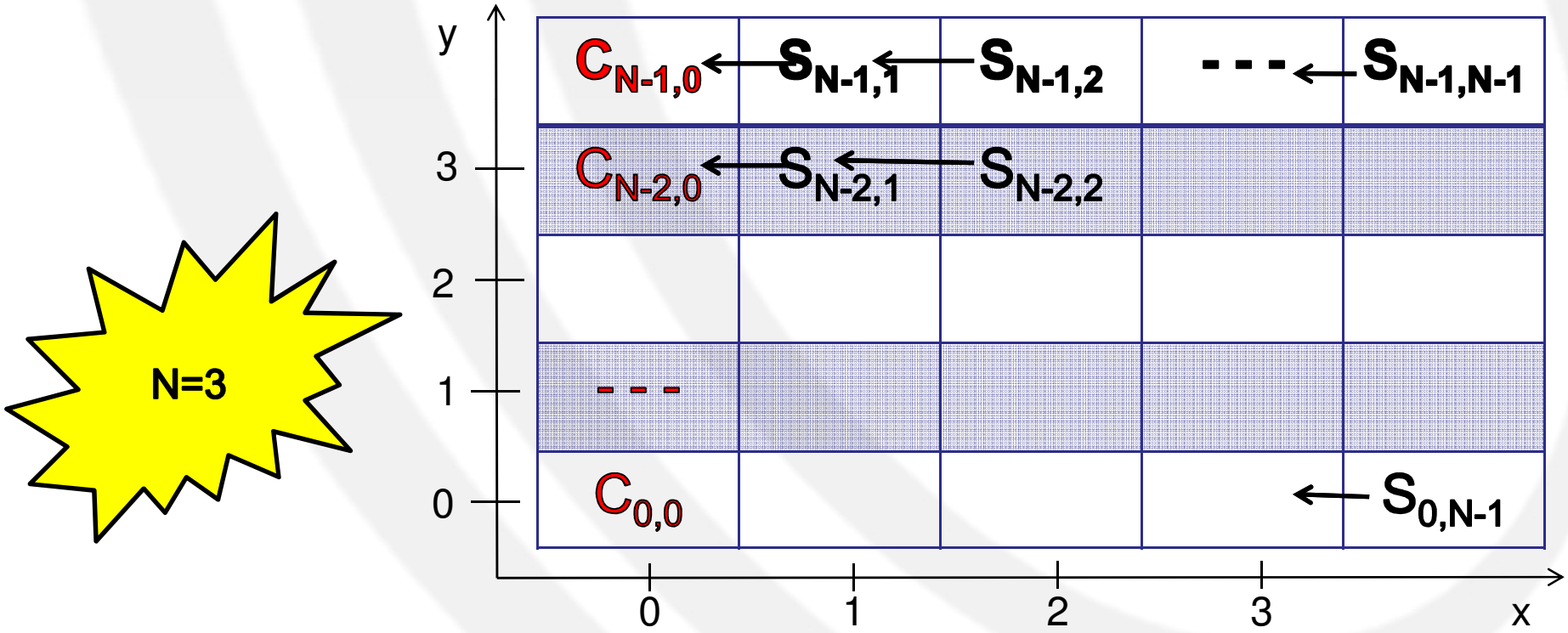
1. Model and write (UML model and SCNSL code) a simplified version of this scenario
   - 3 floors and each floor has 3 nodes (1 collector and 2 sensors)
2. Calculate the Packet Loss Rate
3. Change the transmitting power to the minimum needed by each sensor and calculate the new PLR
4. Why PLR is different?

P.S. Time to finish this task is 15 minutes,

SCNSL code without UML is a homework ☺

Example # 6
Multi-hop scenario

Idea: Network consists of a NxN matrix.
Nodes in the first column will work as a collector node (RX only) while other nodes as both router (RX/TX) and sensor nodes (TX)



Exercise # 6

1. Change connections between sensors and collectors so that a chain of nodes is created for each floor
2. Change the transmitting power to the minimum needed for each transmission
3. Calculate the total Packet Loss Rate and compare it with the previous exercise

P.S. Time to finish this task is 15 minutes,