Lab Report

Course Title: Computer Networks Laboratory
Course Code: CSE-3634

Spring-2023

Lab No: 1

Name of Labwork: Create a network containing 5 nodes. One of the nodes generates message and forwards it to the next node. The message is being forwarded by the nodes for indefinite time.

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Date of Performance	: 10/07/2023
Date of Submission	: 14/07/2023
Marks	:

1. Introduction:

The purpose of this lab experiment was to create a simple module network using OMNeT++. In this lab I develop a simulation that 5 nodes will circulate a message. The network consisted of five nodes: Lamisa, Sohana, Sadia, Marowa, and Tahnia.

2. Description:

The objective was to implement a message circulation loop among these nodes, starting from Lamisa and passing through each node in a specific order (Lamisa → Sohana → Sadia → Marowa → Tahnia), before returning to Lamisa to repeat the loop. One of the nodes will generate message, here **lamisa** will generate the message “**Hello**”. That message will be passed to Sohana, Sadia, Marowa, and Tahnia then it will send back to lamisa. I have created my Node module in **C++**, network in **NED** language and **ini file** for initialization of the simulation. Each of the file is described in the following sections.

3. Module: node_divergent

4. NED file:

```
simple node_divergent
{
   gates:
      input in;
      output out;
}

network lab1_divergent
{
   @display("bgb=556,512");
   submodules:
      lamisa: node_divergent {
         @display("p=275,89");
      }
      sohana: node_divergent {
         @display("p=440,248");
      }
      sadia: node_divergent {
         @display("p=363,428");
      }
      marowa: node_divergent {
         @display("p=188,428");
      }
      tahnia: node_divergent {

         @display("p=103,248");
      }
   connections:
      lamisa.out --> {  delay = 100ms; } --> sohana.in;
      sadia.in <-- {  delay = 100ms; } <-- sohana.out;
      sadia.out --> {  delay = 100ms; } --> marowa.in;
      marowa.out --> {  delay = 100ms; } --> tahnia.in;
      lamisa.in <-- {  delay = 100ms; } <-- tahnia.out;
}
```

5. Node_divergent.cc:

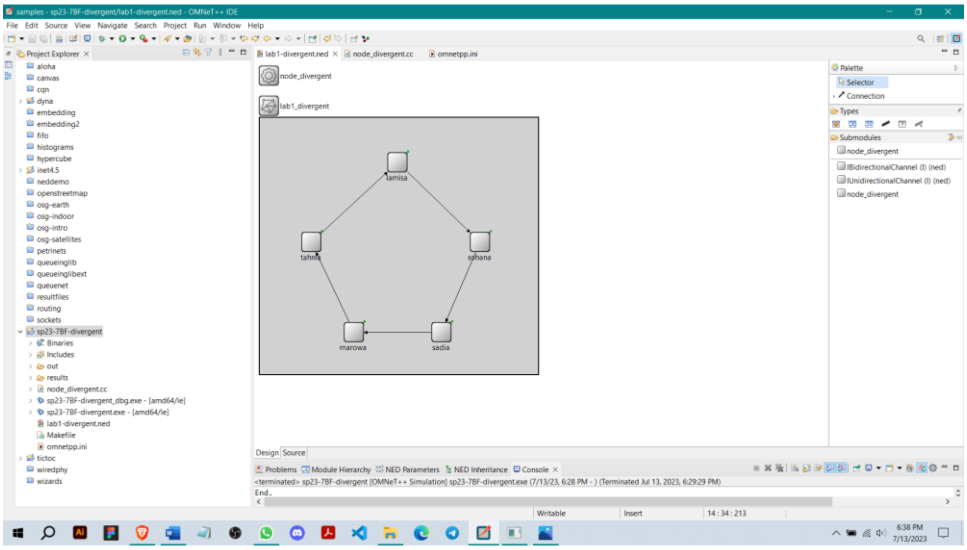
```
#include <string.h>
#include <omnetpp.h>
using namespace omnetpp;
class  node_divergent : public cSimpleModule
{
  protected:
    virtual void initialize() override;
    virtual void handleMessage(cMessage *msg) override;
};
// The module class needs to be registered with OMNeT++
Define_Module( node_divergent);
void  node_divergent::initialize()
{
    if (strcmp("lamisa", getName()) == 0) {
        cMessage *msg = new cMessage("HELLO");
        send(msg, "out");
    }
}
void  node_divergent::handleMessage(cMessage *msg)
{
    send(msg, "out"); // send out the message
}
```

6. INI File:

```
[General]
network =  lab1_divergent
```

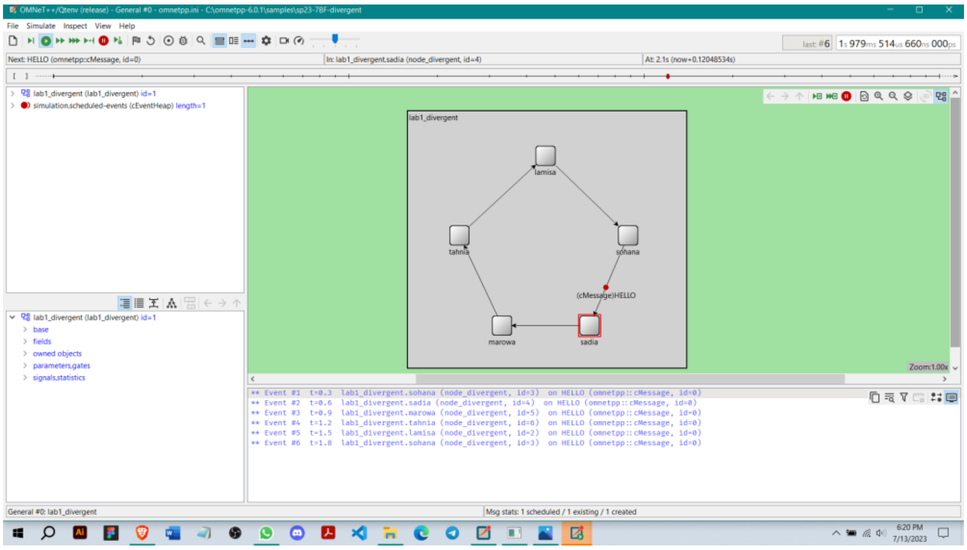
6. Build and Simulation:

The Design I developed from .ned source code is shown in fig.1



```
<terminated> sp23-7BF-divergent [OMNeT++ Simulation] sp23-7BF-divergent.exe (7/13/23, 6:28 PM - ) (Terminated Jul 13, 2023, 6:29:29 PM)
End.
```

Fig 1: Design of node_divergent network

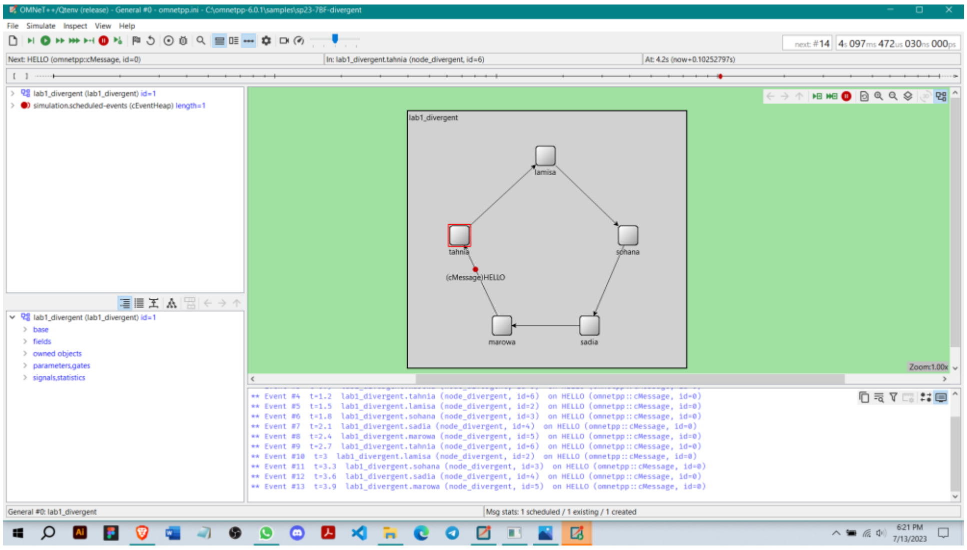

OMNeT++/Qtenv (release) - General #0 - omnetpp.ini - C:\omnetpp-6.0.1\samples\sp23-7BF-divergent
File Simulate Inspect View Help
last: #6
1s 979ms 514us 660ns 000ps
lab1_divergent (lab1_divergent) id=1
simulation.scheduled-events (cEventHeap) length=1
base
fields
owned objects
parameters,gates
signals,statistics
lab1_divergent
lamisa
tahnia
sohana
(cMessage)HELLO
marowa
sadia
Zoom:1.00x
General #0: lab1_divergent
6:20 PM
7/13/2023

Next: HELLO (omnetpp::cMessage, id=0) In: lab1_divergent.sadia (node_divergent, id=4) At: 2.1s (now+0.12048534s)

```
** Event #1  t=0.3  lab1_divergent.sohana (node_divergent, id=3)  on HELLO (omnetpp::cMessage, id=0)
** Event #2  t=0.6  lab1_divergent.sadia (node_divergent, id=4)  on HELLO (omnetpp::cMessage, id=0)
** Event #3  t=0.9  lab1_divergent.marowa (node_divergent, id=5)  on HELLO (omnetpp::cMessage, id=0)
** Event #4  t=1.2  lab1_divergent.tahnia (node_divergent, id=6)  on HELLO (omnetpp::cMessage, id=0)
** Event #5  t=1.5  lab1_divergent.lamisa (node_divergent, id=2)  on HELLO (omnetpp::cMessage, id=0)
** Event #6  t=1.8  lab1_divergent.sohana (node_divergent, id=3)  on HELLO (omnetpp::cMessage, id=0)
```

Msg stats: 1 scheduled / 1 existing / 1 created

Fig 2: Simulation Result


OMNeT++/Qtenv (release) - General #0 - omnetpp.ini - C:\omnetpp-6.0.1\samples\sp23-7BF-divergent
File Simulate Inspect View Help
next: #14
4s 097ms 472us 030ns 000ps
lab1_divergent (lab1_divergent) id=1
simulation.scheduled-events (cEventHeap) length=1
base
fields
owned objects
parameters,gates
signals,statistics
lab1_divergent
lamisa
tahnia
sohana
(cMessage)HELLO
marowa
sadia
Zoom:1.00x
General #0: lab1_divergent
6:21 PM
7/13/2023

Next: HELLO (omnetpp::cMessage, id=0) In: lab1_divergent.tahnia (node_divergent, id=6) At: 4.2s (now+0.10252797s)

```
** Event #4  t=1.2  lab1_divergent.tahnia (node_divergent, id=6)  on HELLO (omnetpp::cMessage, id=0)
** Event #5  t=1.5  lab1_divergent.lamisa (node_divergent, id=2)  on HELLO (omnetpp::cMessage, id=0)
** Event #6  t=1.8  lab1_divergent.sohana (node_divergent, id=3)  on HELLO (omnetpp::cMessage, id=0)
** Event #7  t=2.1  lab1_divergent.sadia (node_divergent, id=4)  on HELLO (omnetpp::cMessage, id=0)
** Event #8  t=2.4  lab1_divergent.marowa (node_divergent, id=5)  on HELLO (omnetpp::cMessage, id=0)
** Event #9  t=2.7  lab1_divergent.tahnia (node_divergent, id=6)  on HELLO (omnetpp::cMessage, id=0)
** Event #10  t=3  lab1_divergent.lamisa (node_divergent, id=2)  on HELLO (omnetpp::cMessage, id=0)
** Event #11  t=3.3  lab1_divergent.sohana (node_divergent, id=3)  on HELLO (omnetpp::cMessage, id=0)
** Event #12  t=3.6  lab1_divergent.sadia (node_divergent, id=4)  on HELLO (omnetpp::cMessage, id=0)
** Event #13  t=3.9  lab1_divergent.marowa (node_divergent, id=5)  on HELLO (omnetpp::cMessage, id=0)
```

Msg stats: 1 scheduled / 1 existing / 1 created

Fig 3: Simulation Result

In fig 2 and fig 3 the simulation scenario is presented. The message HELLO is circulating among the nodes.

7. Result Analysis: The simulation of the module network successfully demonstrated the message circulation loop among the five nodes (Lamisa, Sohana, Sadia, Marowa, and Tahnia). The message is being forwarded by the nodes for indefinite time with a 100ms delay in each node. The network is formed in a star shape. The network effectively transmitted messages in the specified order with the delay accounted for, enabling continuous circulation. Each node introduced a delay before forwarding the message to the next node, resulting in a cumulative delay along the circulation loop.

8. Conclusion: In conclusion, the module network simulation using OMNeT++ successfully demonstrated the message circulation loop among the five nodes. The network efficiently transmitted messages in the specified order (Lamisa → Sohana → Sadia → Marowa → Tahnia), with a 100-millisecond delay introduced between each transmission. It showcased the successful implementation of module creation, message passing, and event handling in OMNeT++. Overall, this lab experiment provided practical experience in creating module networks, simulating their behavior, and analyzing the results.