# International Islamic University Chittagong

## Department of Computer Science and Engineering

Course: Computer Networks Lab
Course Code: CSE3634
Section: 7BF Semester: Spring Year: 2022

## A Project Report on

## Project Title

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# Abstract

Design an Ethernet Centralized LAN with Hub and Switch Compare between Hub and Switch in terms of bandwidth sharing Investigate the performance of centralized LAN's. Here we import inet framework run the lan scenario under the Example/Ethernet/LAN.

A centralized LAN using Ethernet typically involves a central device, such as a hub or switch, which connects all the devices on the network together. A hub is a simple device that broadcasts all data it receives to all devices on the network. This means that all devices on the network share the same bandwidth, and collisions can occur if multiple devices try to transmit data at the same time.

On the other hand, a switch is a more advanced device that reads the destination address of each packet of data it receives and only forwards it to the device it is intended for. This means that each device on the network has its own dedicated bandwidth and collisions are minimized.

In terms of bandwidth sharing, a hub is generally less efficient than a switch as all devices share the same bandwidth. This can lead to network congestion and slower data transfer rates. A switch, on the other hand, provides each device with its own dedicated bandwidth, allowing for faster and more efficient data transfer.

The performance of a centralized LAN depends on various factors such as the number of devices on the network, the type of devices being used, and the bandwidth available. It is important to properly design and configure the network to ensure optimal performance and minimize network congestion.

Overall, when designing a centralized LAN using Ethernet, it is generally recommended to use a switch instead of a hub for better performance and efficiency in terms of bandwidth sharing.

## Acknowledgements

We would like to express our sincere gratitude to all those who have contributed to the completion of this project report.

Firstly, we would like to thank our supervisor and teacher Abdullahil Kafi sir for providing us with guidance, support, and constructive feedback throughout the project. Your encouragement and expertise have been invaluable.

We would also like to extend our appreciation to the red dead bandit youtube channel for providing us with the necessary resources and facilities to carry out our project work. We are grateful to our colleagues Mainuddin, Al Rafi, Jumman, Jibon and Arman for their constant support and collaboration in this project. Their inputs and discussions have greatly enriched our understanding of the subject matter.

Additionally, we would like to thank our family and friends for their unwavering support and encouragement. Your faith in us has been a constant motivation throughout the project.

Finally, we acknowledge the contribution of all the individuals who have helped us in one way or another, but may not be mentioned here. Thank you for your time, cooperation, and support.

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## Introduction:

The main goal of our project should be to design and develop a centralized Ethernet LAN that provides network redundancy from a physical and logical perspective. We think about items like default gateway redundancy, dual fiber-optic uplinks from the wiring closets to the core switches, and chassis-based core switches with dual CPU cards. We also consider the different layers of a network, including the access layer, distribution layer, and core layer, and how they work together to provide connectivity for users and forward traffic from one local network to another.

## Background:

The importance of our project is to design and develop a centralized Ethernet LAN that provides network redundancy from a physical and logical perspective. This will ensure that network uptime is maintained and that users have access to the network at all times. A centralized design model is recommended primarily for large site deployments because it provides IP address management, simplified configuration and troubleshooting, and roaming at scale.

To build our project, we use the tools and methods that are designed for network design and development. Some of the tools and methods that you can use include IP address management, simplified configuration, and troubleshooting. You should also think about items like default gateway redundancy, dual fiber-optic uplinks from the wiring closets to the core switches, and chassis-based core switches with dual CPU cards.

## literature review:

### 3.1. Multiple access and random access protocols:

Multiple Access Protocols are used to share a common communication channel among multiple devices. These protocols can be subdivided into three categories: Random Access Protocols, Controlled Access Protocols, and Channelization Protocols1.

Random Access Protocols are protocols in which all stations have the same priority, i.e., no station has more priority than another station. Any station can send data depending on the medium's state (idle or busy)1.

### 3.2. ALOHA vs Slotted ALOHA

ALOHA and Slotted ALOHA are two types of random access protocols. Pure ALOHA is used whenever data is available for sending over a channel at stations, whereas Slotted ALOHA is designed to overcome the problem of Pure ALOHA because there is a high possibility of frame hitting in Pure ALOHA.

In Pure ALOHA, data can be transmitted at any time by any station. In Slotted ALOHA, data can be transmitted at the beginning of the time slot.

### 3.3. OMNet++

OMNeT++ (Objective Modular Network Testbed in C++) is a modular, component-based C++ simulation library and framework, primarily for building network simulators. It is intended for simulating networks at different scenarios to identify the network behavior and performance in various conditions. OMNeT++ itself is a simulation framework without models for network protocols like IP or HTTP. The main computer network simulation models are available in several external frameworks. The most commonly used one is INET which offers a variety of models for all kind of network protocols and technologies like for IPv6, BGP.

## 4. Problem Statement:

**Example 1:**

**Scenario 1 -** A is composed of 4 nodes (host 1, 2, 3 and 4 ) connected through an Ethernet Hub. Host 1 is serving as a server (sending no traffic ). The other hosts are clients. In this network clients are generating a traffic size 1024 byte every 0.1 second.

**Question -** Build a simulation for scenario 1

Run the scenario for 200 seconds and collect the:

Mean delay at host 1

Network throughput in bits/second

Packet delivery ratio

**Example 2:**

**Scenario 2 -** A is composed of 4 nodes (host 1, 2, 3 and 4 ) connected through an Ethernet Switch and the link bandwidth is 10MBPS. Host 1 is serving as a server (sending no traffic ). The other hosts are clients. In this network clients are generating a traffic size 1000 byte every 0.2 second.

**Question -** Build a simulation for scenario 2

Run the scenario for 100 seconds and collect the:

Mean delay at host 1

Network throughput in bits/second

## 5. Implementation

### 5.1. Install OMNet++ on your system:

Installation process:

**a) Download:** Download the omnet++ package from the following url, in the site there multiple versions of the omnet++ is listed. Select your needed version of omnet++, here we select the eversion omnet++ 5.1 , after that click the download button , which is displayed in the below of selected version
https://omnetpp.org/download/old.html

**b) Unzip :** Unzip the downloaded file.

**c) Open the terminal/ mingwenv.cmd window :** Open the mingwenv.cmd window. By double click mingwenv.cmd window from the omnet++ installed Location.

**d) Execute the configure command window:** In the mingwenv command window , Execute the command -> ./configure.

**e) Execute the Make command window:** In the mingwenv command window , Execute the command -> make

**f) Execute the omnet++ command window:** In the mingwenv command window , Execute the command -> omnetpp g) Select the workspace window :
Select the stored workspace, with full location, to select the workspace , use the browse button and select the location and press ok button or type the full Location.

## 6. Experimental and Theoretical Results:

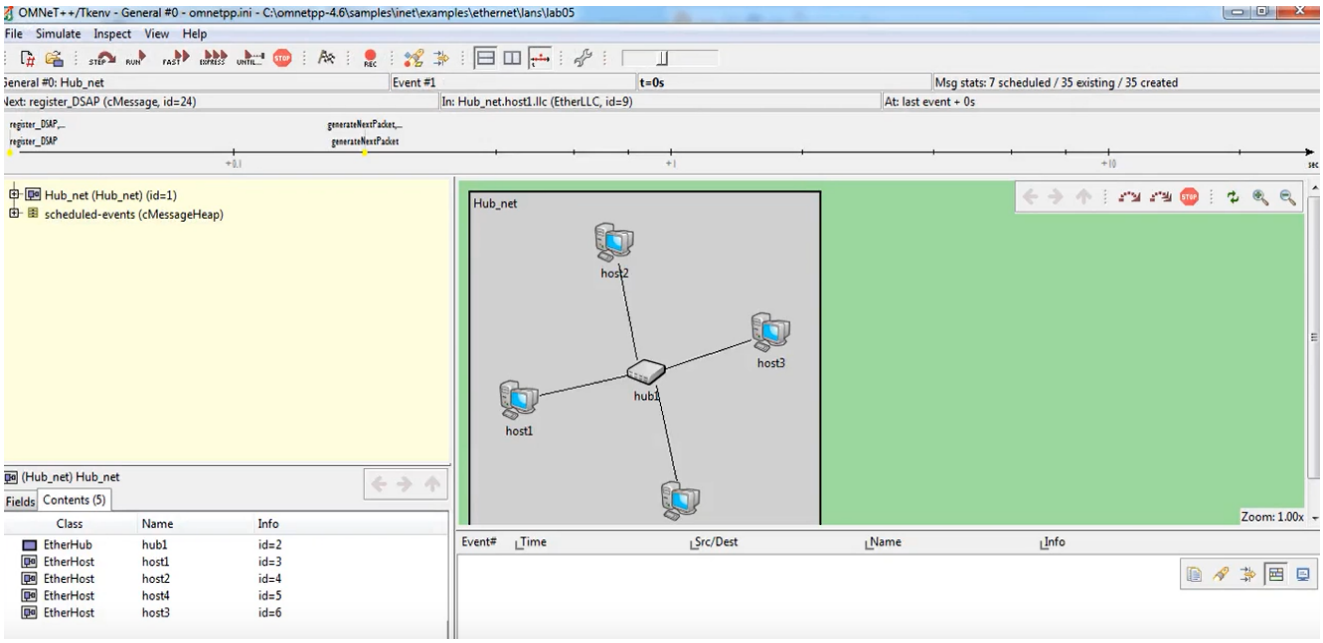


**Fig -1 :** ned design for Hub with 4 nodes

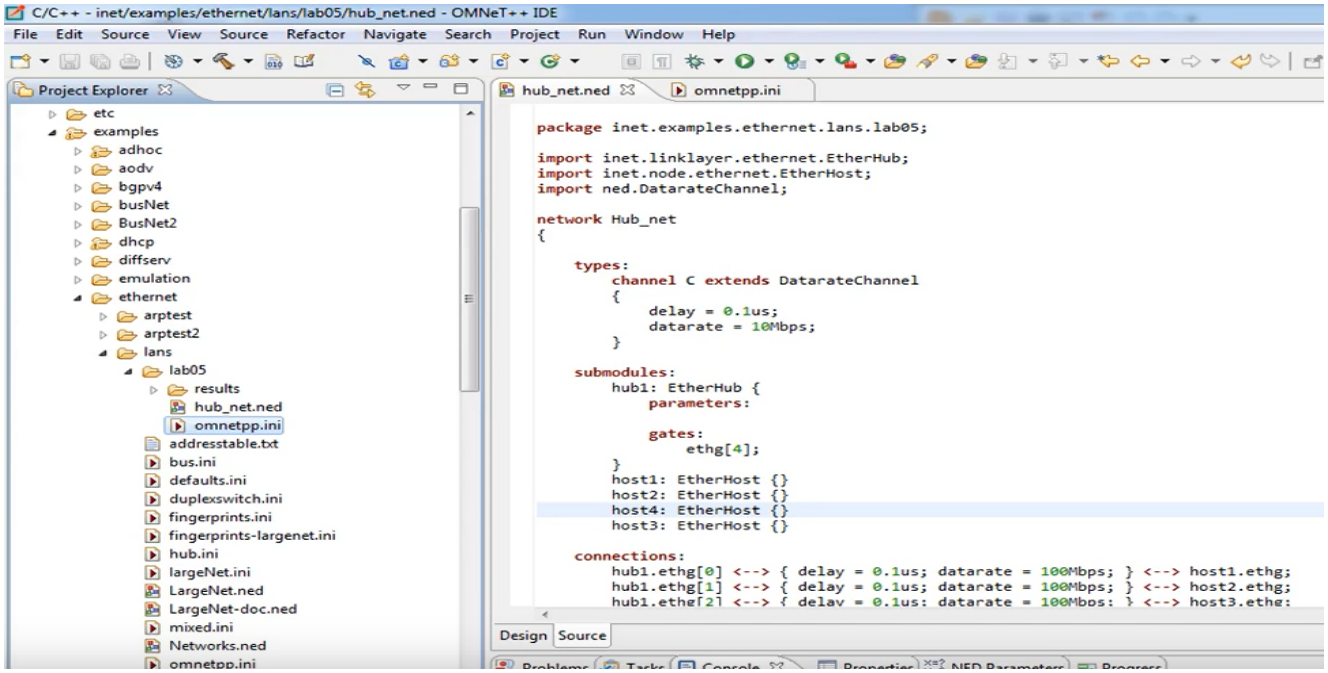


**Fig -2** : code for Hub net.ned with 4 nodes

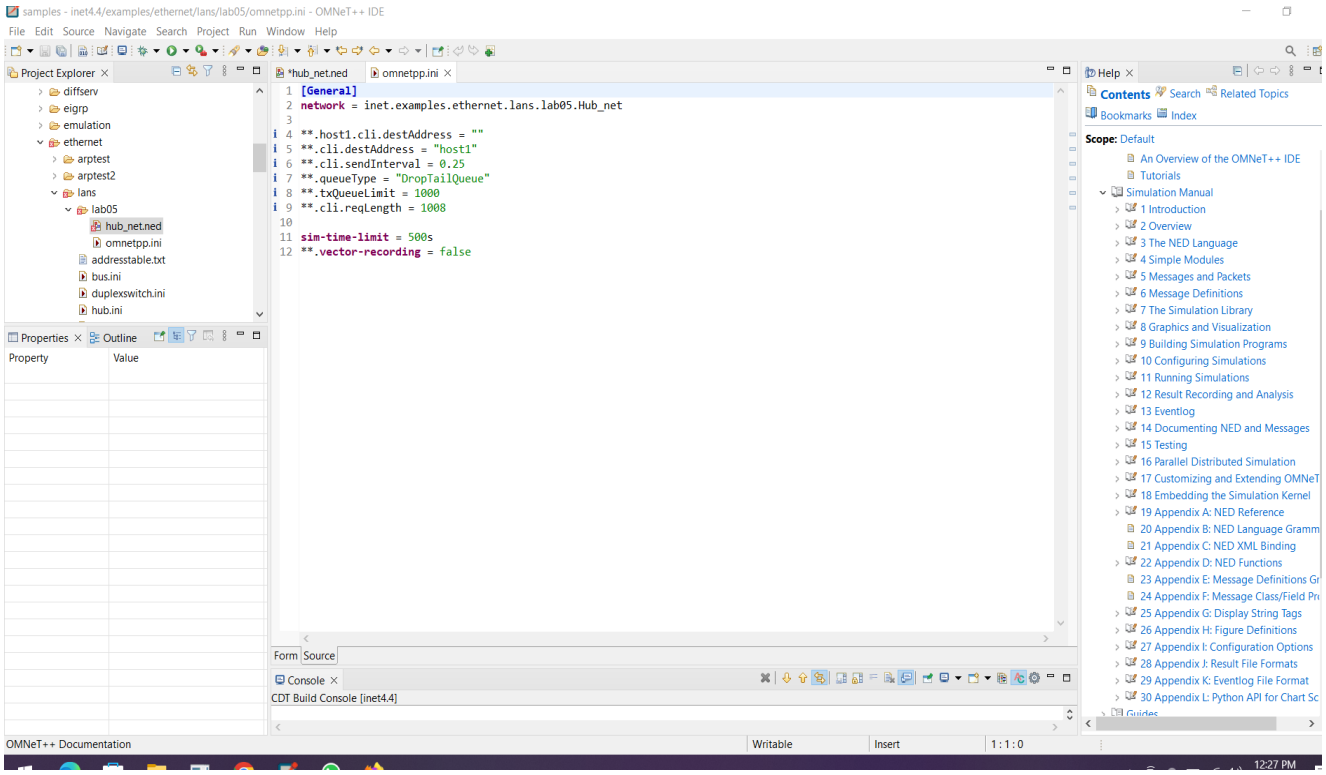


**Fig -3** : code for Hub omnet.ini with 4 nodes

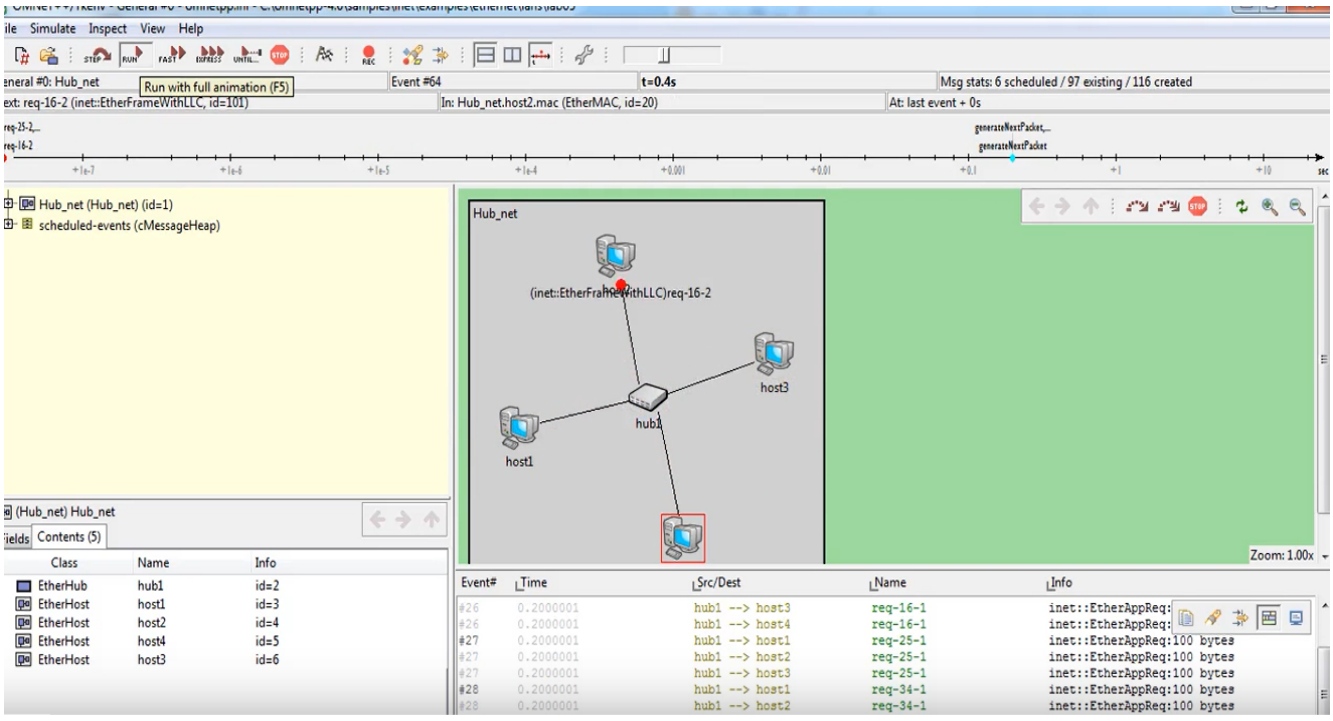


**Fig -4** : simulation of project for Hub

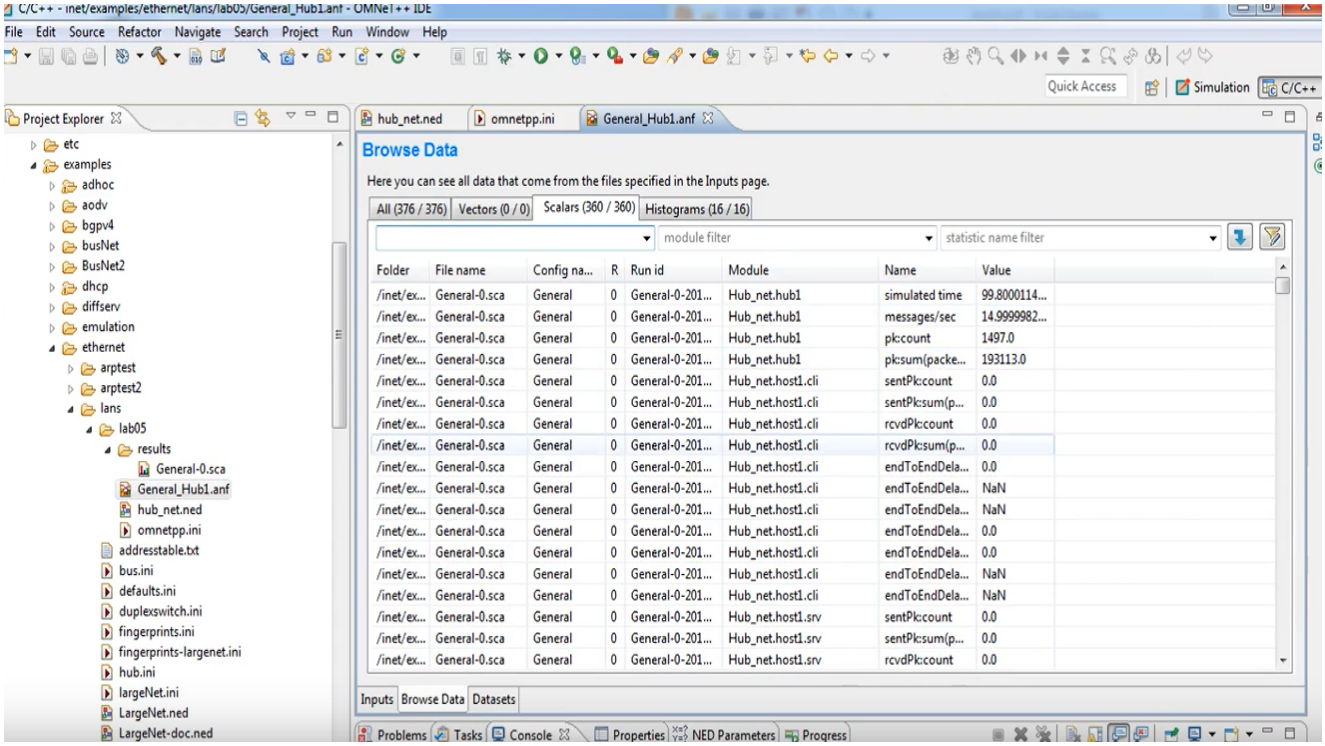


**Fig -5** : result of general_hub1.anf file

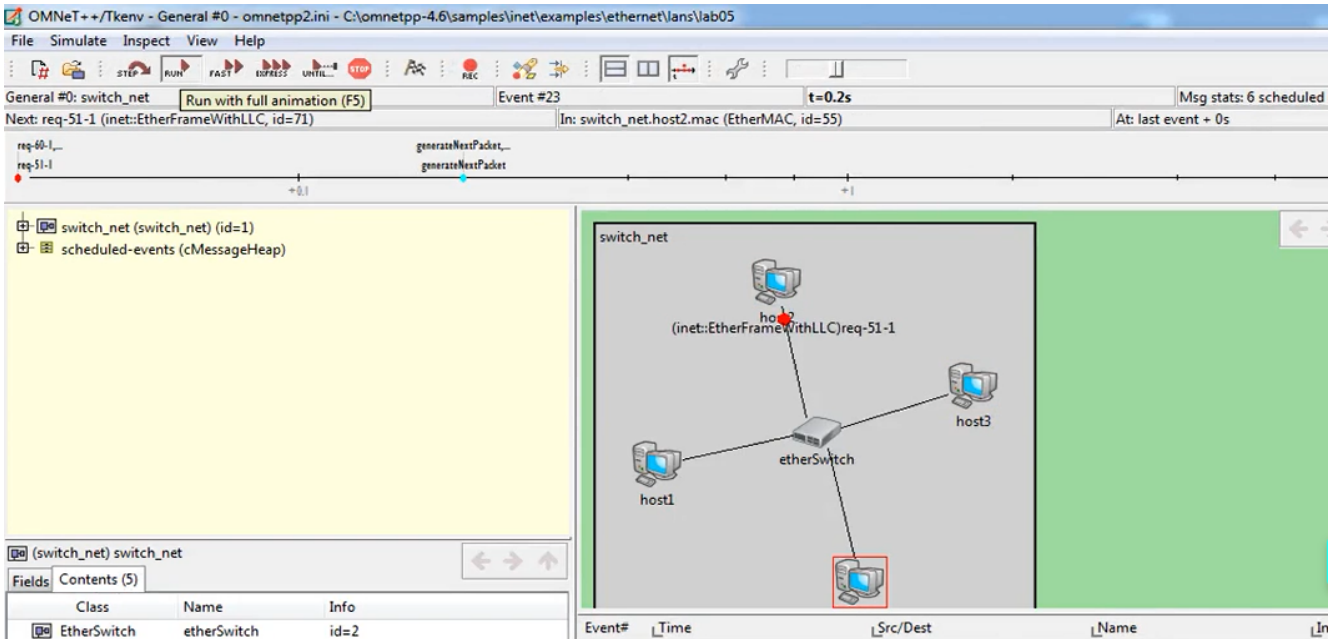


**Fig -6 :** ned design for Switch with 4 nodes

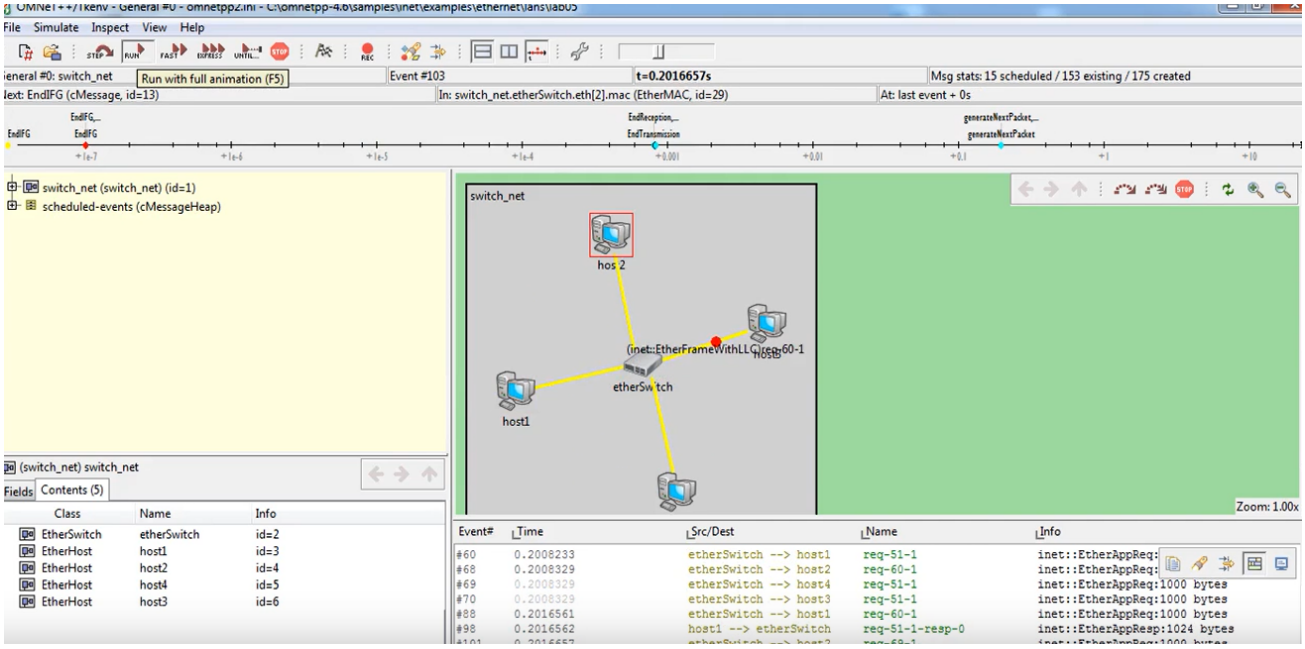


**Fig -7 :** simulation of project for Switch

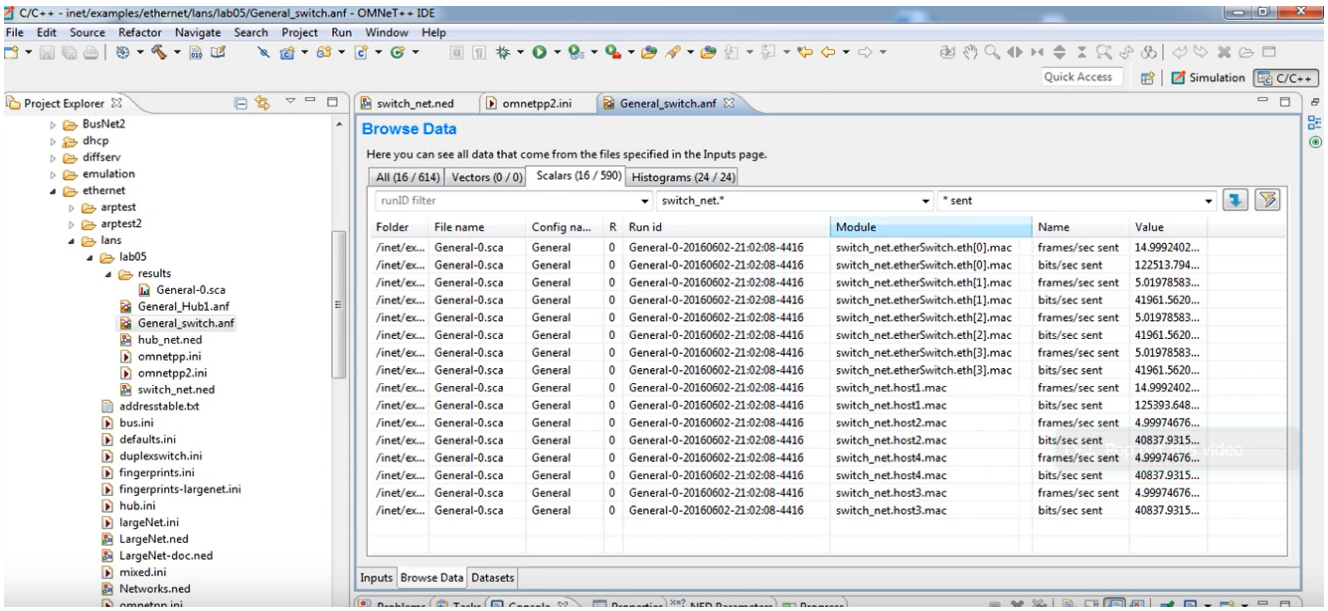


**Fig -8** : result of general_Switch.anf file

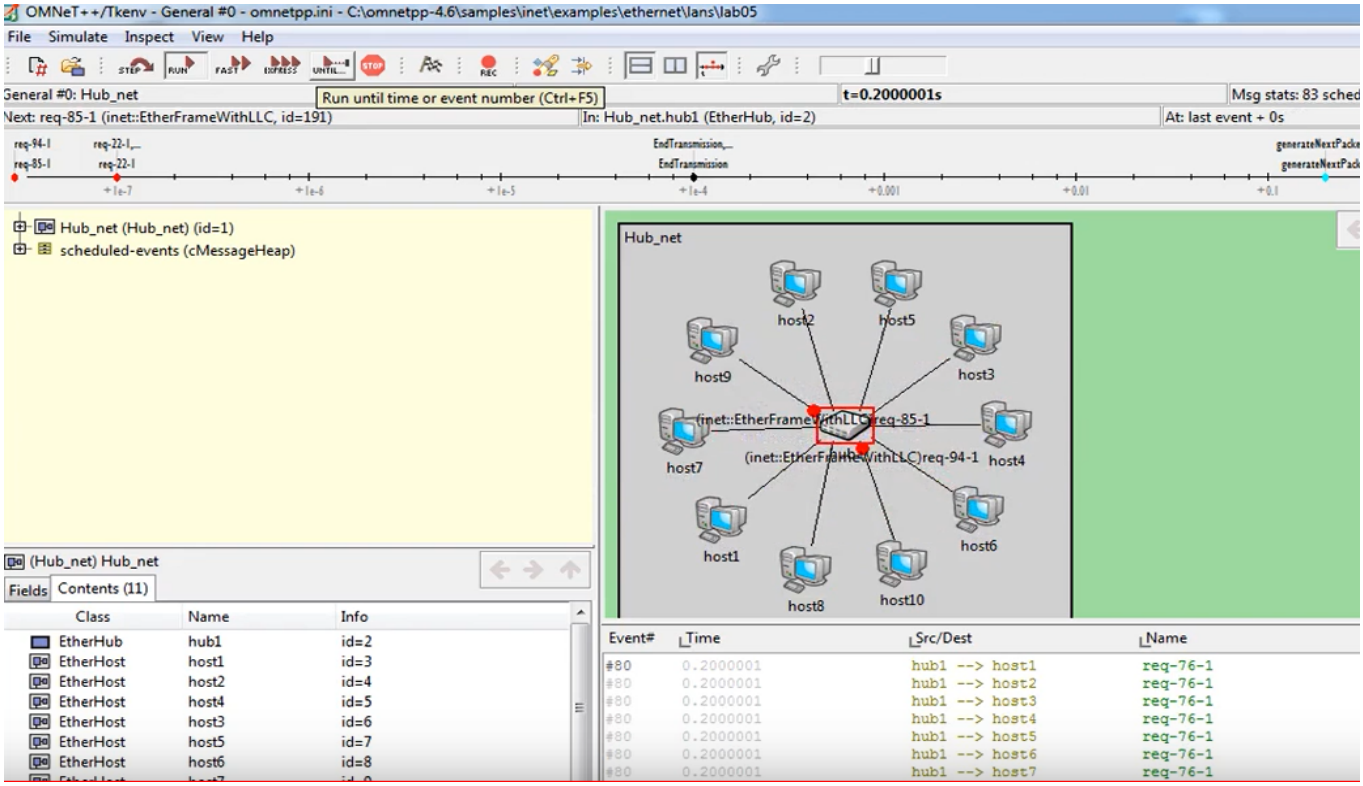


Fig-9 : simulation of project for Hub with 10 nodes

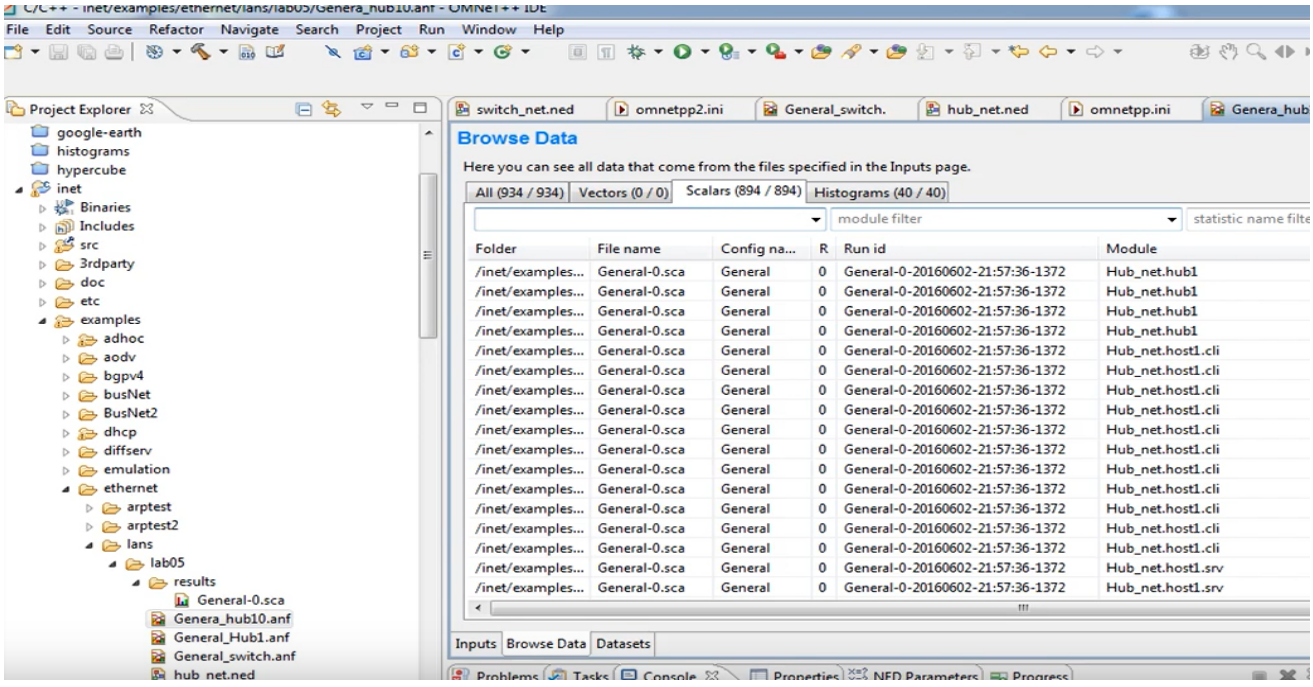


Fig-10 : Result of project for Hub with 10 nodes

Outcomes of the Modeling and Simulation of Wireless Networks Using OMNeT++ project include gaining valuable insights into the behavior and performance of wireless networks. By simulating and analyzing wireless networks using OMNeT++, we can collect data on network metrics, such as throughput, delay, and packet loss, and gain insights into network behavior under different conditions and scenarios. This can help us develop new techniques and technologies to improve wireless network performance and reliability.

Additionally, we can learn how to use the OMNeT++ simulation framework and its built-in features, such as the INET framework, to simulate and analyze wireless networks. Through this project, we can also develop programming skills in C++, which is used to define the behavior of the network modules. Furthermore, we can gain experience in data analysis and visualization, which are essential skills in many fields. Overall, the Modeling and Simulation of Wireless Networks Using OMNeT++ project can provide us with valuable knowledge and skills that can be applied to real-world scenarios in wireless communication and beyond.

## 7. Future Work:

There are several potential avenues for future work on Modeling and Simulation of Wireless Networks Using OMNeT++. Some possible directions for future research and development include:

**1. Extension to 5G and beyond:** As wireless networks continue to evolve, future work could focus on extending the simulation model to support the latest network technologies such as 5G and beyond.

**2. Integration of machine learning:** Machine learning techniques could be used to enhance the simulation model by enabling more accurate prediction of network behavior and the automatic optimization of network Parameters.

**3. Integration of security features:** The simulation model could be extended to include different security features, such as encryption and authentication, to assess the effectiveness of security protocols and evaluate network vulnerabilities.

**4. Simulation of hybrid networks:** Future work could focus on simulating hybrid networks that combine different types of wireless networks, such as WiFi and cellular, to evaluate the performance and feasibility of such Networks.

**5. Analysis of real-world datasets:** The simulation model could be validated and tested against real-world datasets, allowing for more accurate and realistic simulation results.

Overall, the potential future work on this project is extensive, and the above suggestions are just a few possibilities. Further research and development in this area will help to improve the accuracy, efficiency, and applicability of wireless network simulations, ultimately leading to better network design and optimization.

## 8. Conclusions:

In conclusion, the design of an Ethernet centralized LAN involves connecting all devices on the network to a central device, such as a hub or switch. The selection of a hub or switch is important as it affects the efficiency and performance of the network. A hub is a simple device that broadcasts all data it receives to all devices on the network, while a switch reads the destination

address of each packet of data it receives and only forwards it to the intended device. As a result, a switch provides each device with its own dedicated bandwidth, which results in faster and more efficient data transfer rates and less network congestion.

In this lab, we investigated the differences between using a hub and a switch in terms of bandwidth sharing and concluded that using a switch is generally more efficient. We also emphasized the importance of properly configuring the network and selecting the appropriate device to ensure optimal performance and reliability. Factors such as the number of devices on the network and the available bandwidth should be carefully considered when designing a centralized LAN.

Overall, the design of an Ethernet centralized LAN using a switch provides a reliable and efficient means of communication between devices. By properly configuring the network and selecting the appropriate device, optimal performance and reliability can be achieved.

**9. References:**


● how to create omnet++- wireless simulation , simple client to server wireless senario using omnet++ by red dead bandit
● Tictoc tutoral by OMNeT++ Technical Articles
● Google
● Chatgpt
● Youtube