EN 2150 – Communication Network Engineering

Group Project- Network Routing Simulation OSPF

Group- Techwiz

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Introduction

In this assignment, we will design the routing configuration for the university backbone network, which we previously proposed using the OSPF (Open Shortest Path First) protocol. By implementing OSPF in the backbone network, each node will be able to advertise the IP blocks of the connected departments and divisions, ensuring seamless communication and routing across the entire network.

We will address the following key points in this assignment:

- Design a suitable IP addressing plan for each department/division, ensuring proper subnetting and efficient utilization of IP address space.
- Implement redundancy within the backbone network to ensure high availability and fault tolerance for critical resources and services.
- Establish OSPF configuration on the backbone network nodes to enable dynamic routing and advertise the IP blocks of connected departments/divisions.

We have allocated IP address blocks for each department in previous assignment. We use the same IP address allocation for this assignment also.

IP address allocation (IPv4)

Node	Expected no of users	Subnet size	Network address
NOC	2500	4096	10.10.0.0/20
Administration	4000	8192	10.10.32.0/19
Civil	2500	4096	10.10.80.0/20
Business	4000	8192	10.10.96.0/19
Electronic	1000	2048	10.10.136.0/21
Sumanadasa	4000	8192	10.10.160.0/19
IT	3000	8192	10.10.192.0/19
Mechanical	2000	4096	10.10.224.0/20
Earth	2000	4096	10.10.240.0/20

Moreover, the backbone network has been meticulously designed with redundant links to ensure fault tolerance and high availability.

Basis of Routing Design

A key component of computer networking, routing design ensures effective data transmission and compatibility between devices via connected networks. Finding the best routes for data packets to go from source to destination is a key component of routing. To achieve dependable, scalable, and secure network performance, a well-designed routing architecture is essential. Network administrators and engineers must address a number of fundamental principles and factors that make up the foundation of routing designs in order to build resilient and flexible networking infrastructures.

Followings are the key factors of routing design.

1. **Redundancy and fault tolerance**: To ensure that connectivity is maintained even in the event that a link or node fails, we have included redundant links in the backbone network. This provides maximum availability of vital resources while minimizing downtime.
2. **OSPF as Dynamic Routing Protocol**: For the backbone network, we selected OSPF as the dynamic routing protocol. Based on connection measurements, OSPF determines the shortest path to a destination, ensuring optimal and effective routing throughout the network. In addition, OSPF can adjust to changes in network topology, which makes it appropriate for our architecture with redundant links.
3. **Hierarchical Design**: The main backbone network and access layer switches in each department are separated by layers in a hierarchical network design that we have used. Better traffic control and simpler troubleshooting are encouraged by this architecture.

Task 1

The routing path taken by a network session of student at ENTC who is accessing LMS servers

Simulation Panel

Event List

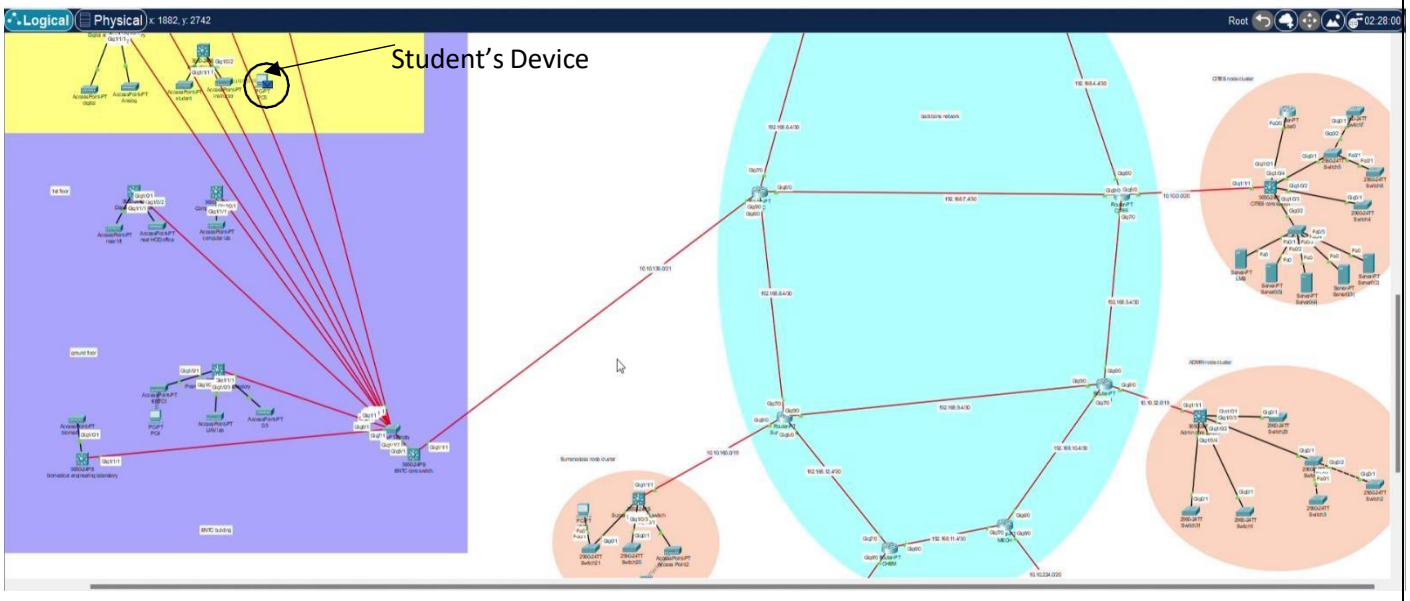
Vis.	Time(sec)	Last Device
	0.002	instructor
	0.003	Instructor room
	0.004	Switch0
	0.005	ENTC core switch
	0.005	--
	0.006	instructor
	0.006	ENTC
	0.007	CITES
	0.008	CITES core switch
	0.009	Switch6
	0.010	LMS
	0.011	Switch6
	0.012	CITES core switch
	0.013	CITES
	0.014	ENTC
	0.015	ENTC core switch
	0.016	Switch0
	0.017	Instructor room
	0.018	instructor
	0.388	--

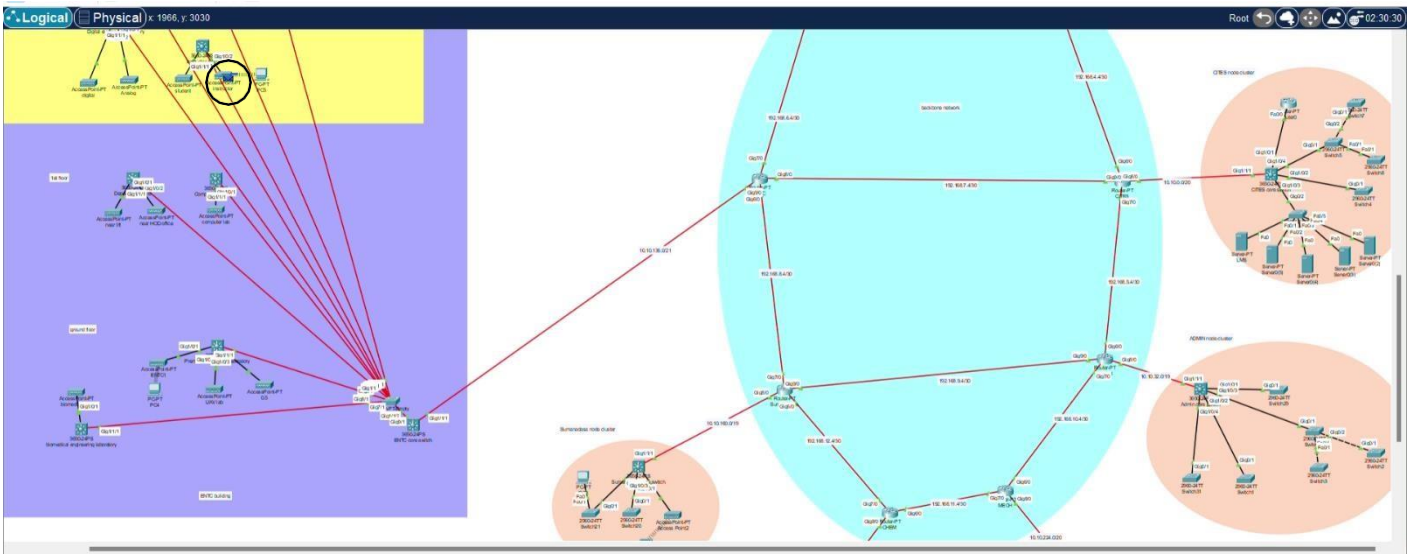
Forward path from student at ENTC to LMS

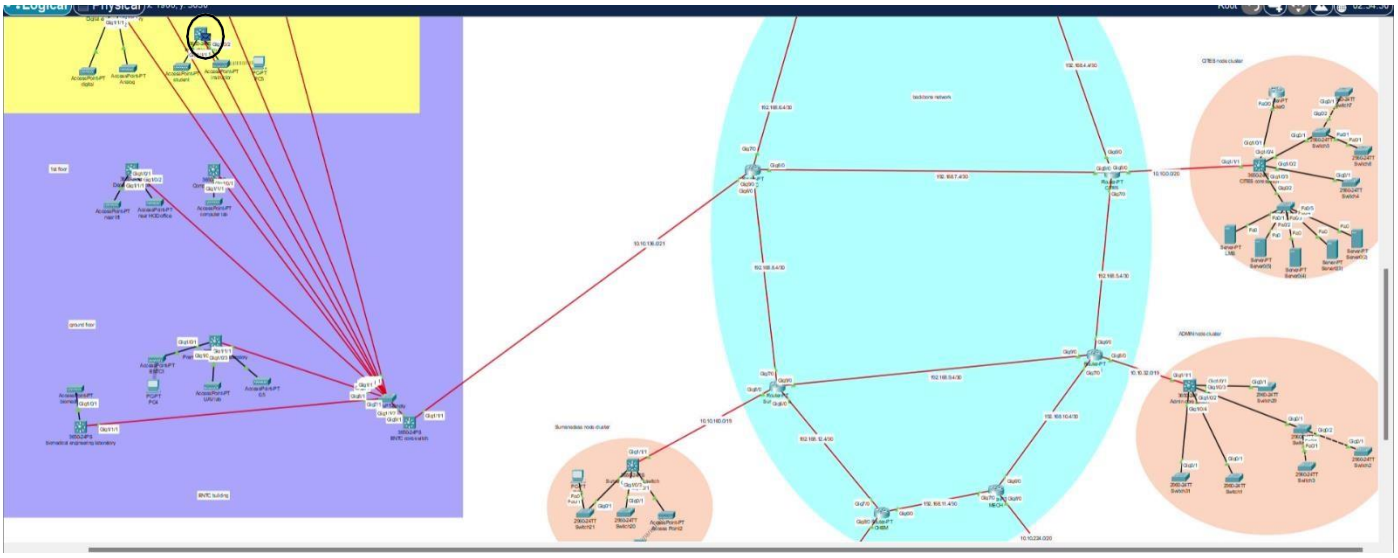
PC5 → Instructor → Instructor room → Switch0 → ENTC core switch → ENTC → CITES → CITES core switch → Switch6 → LMS

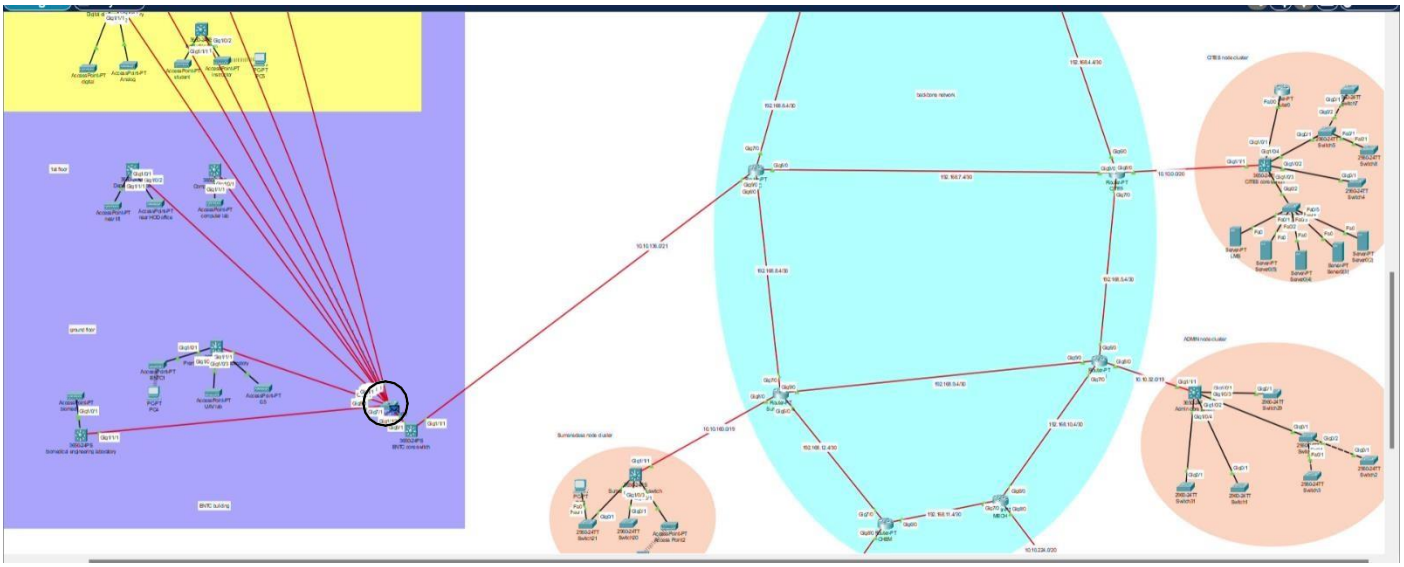
Backward path from LMS to student at ENTC

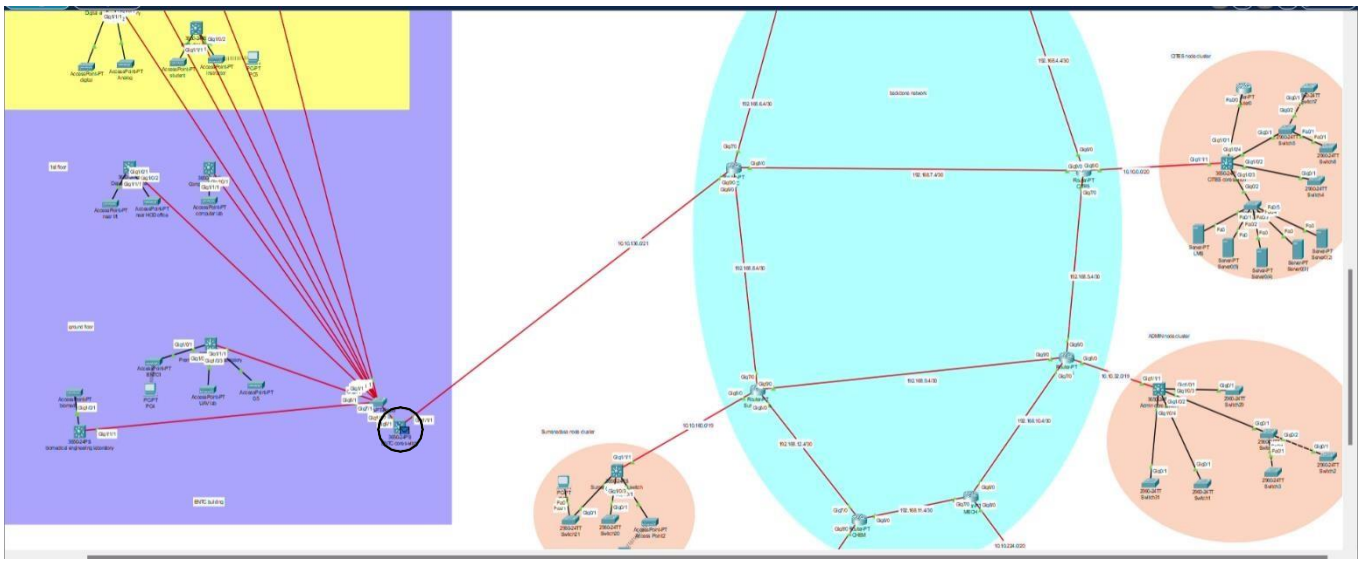
LMS → Switch6 → CITES core switch → CITES → ENTC → ENTC core switch → Switch0 → Instructor room → Instructor → PC5

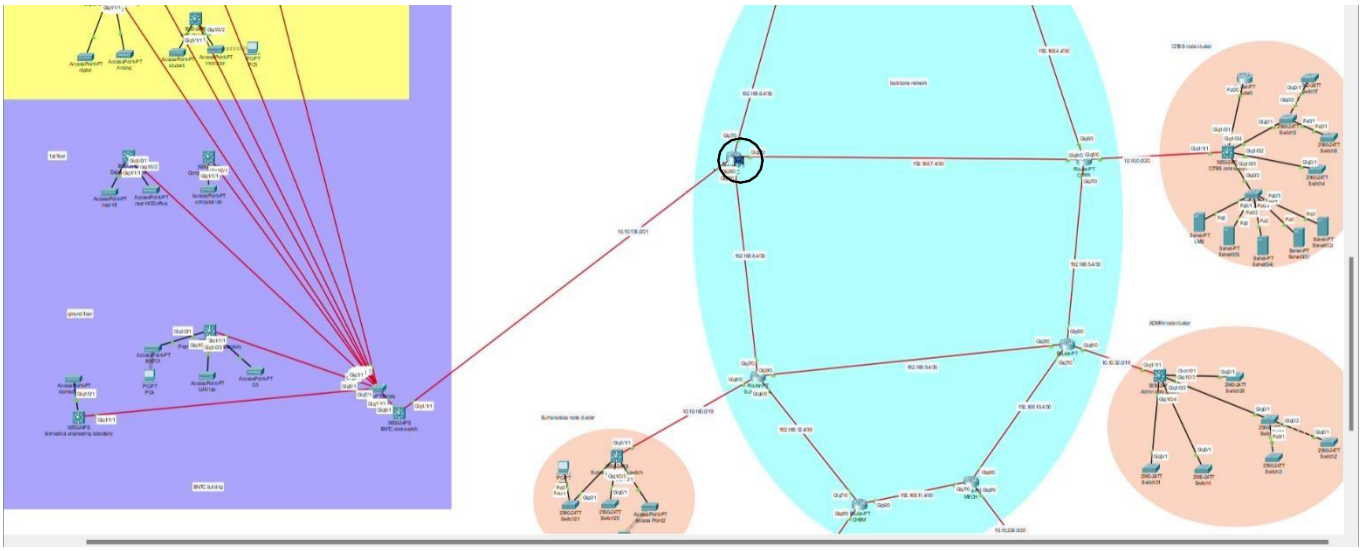


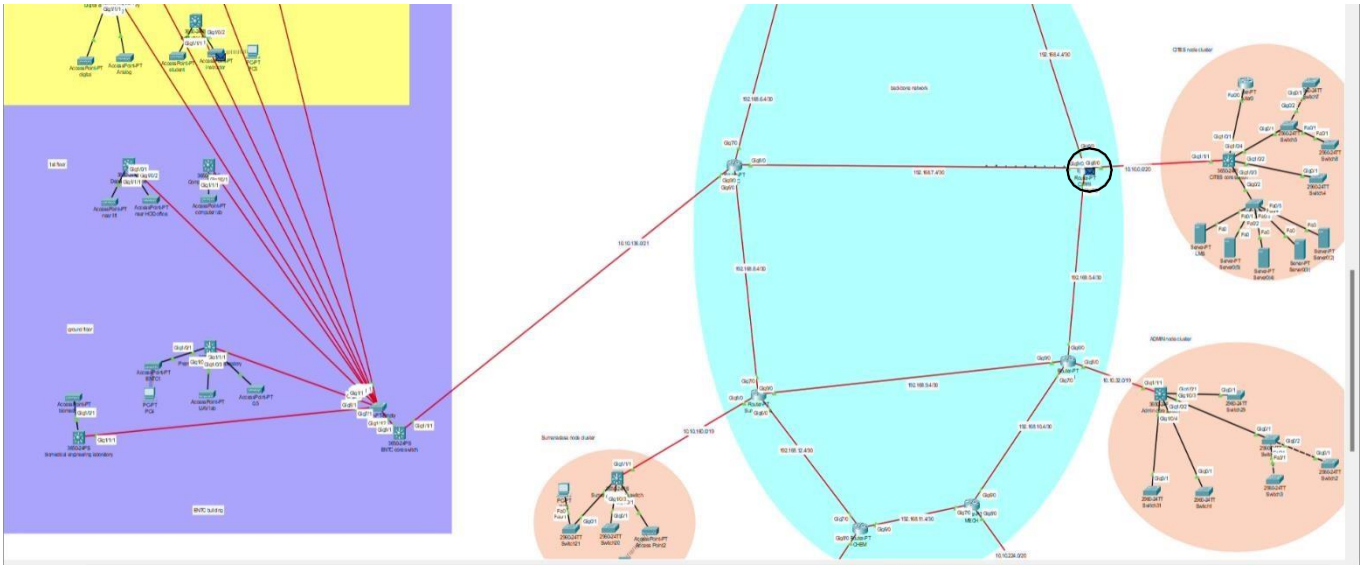

Logical
Physical
Root

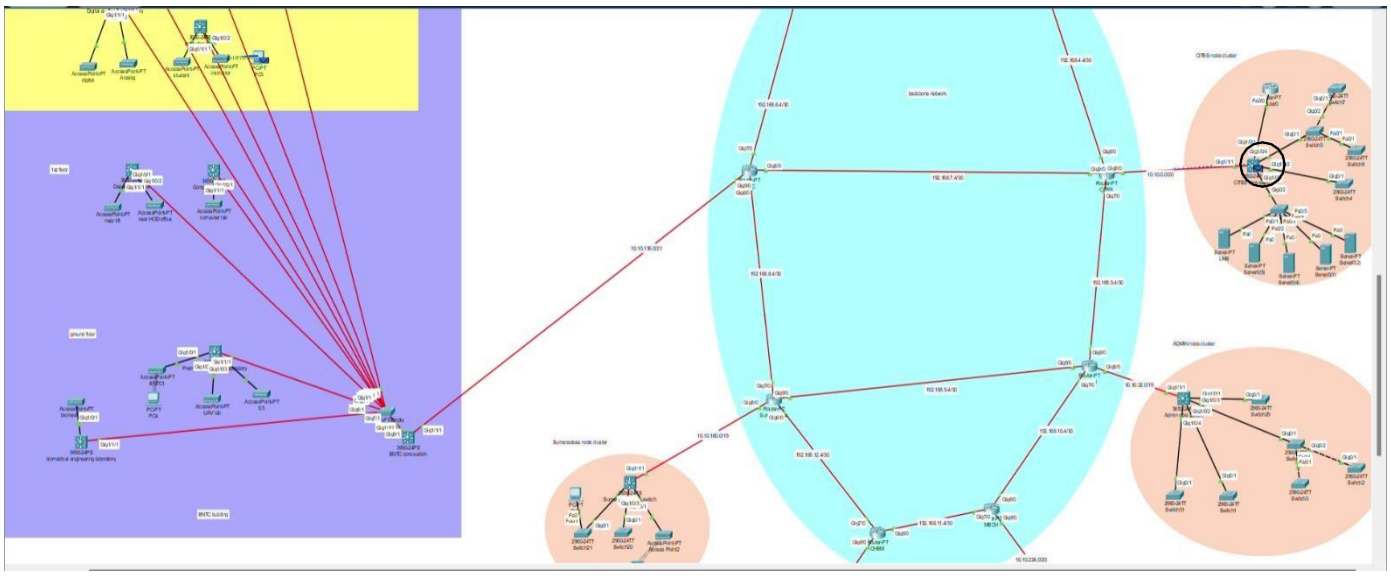


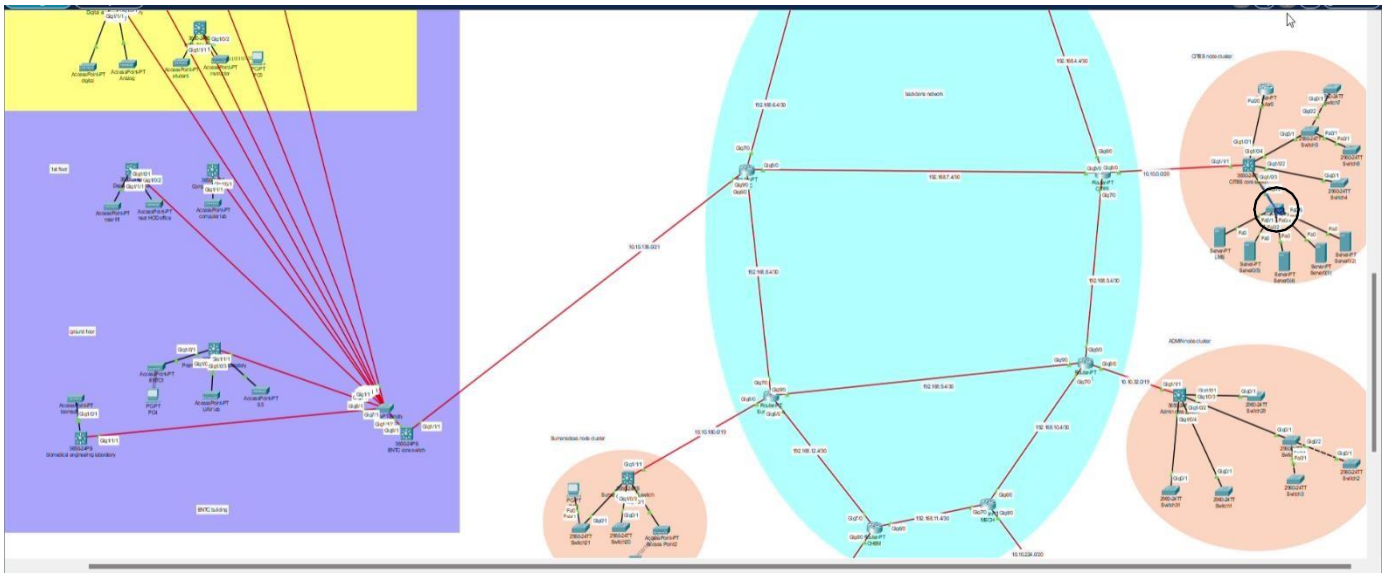


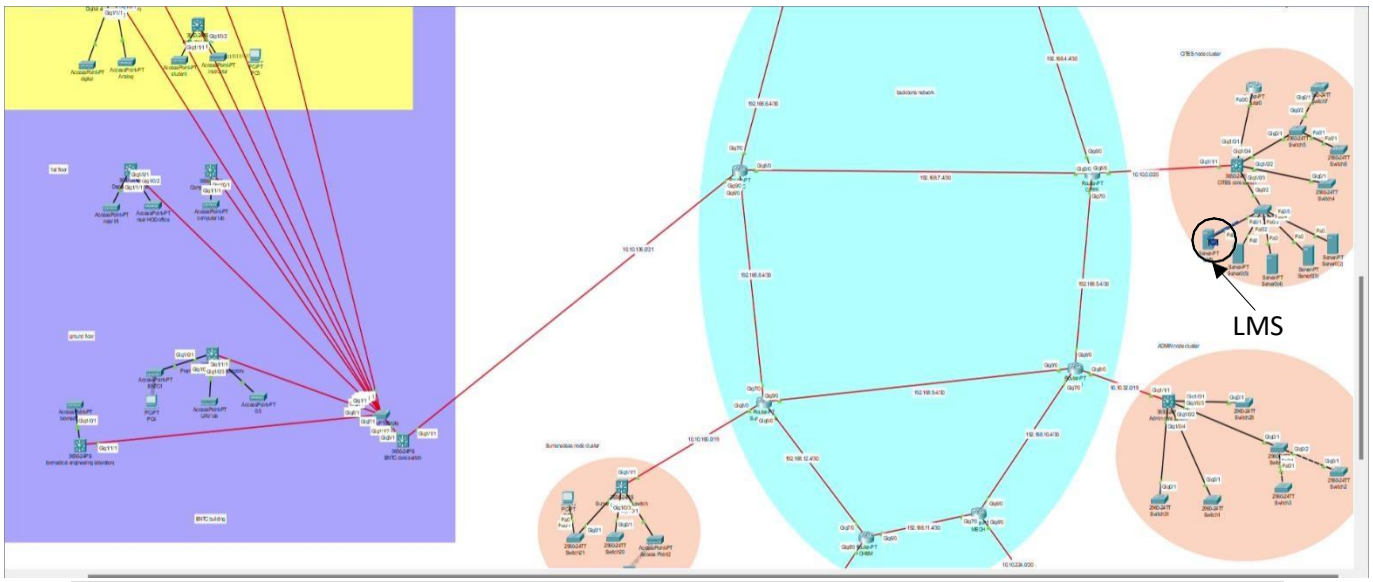




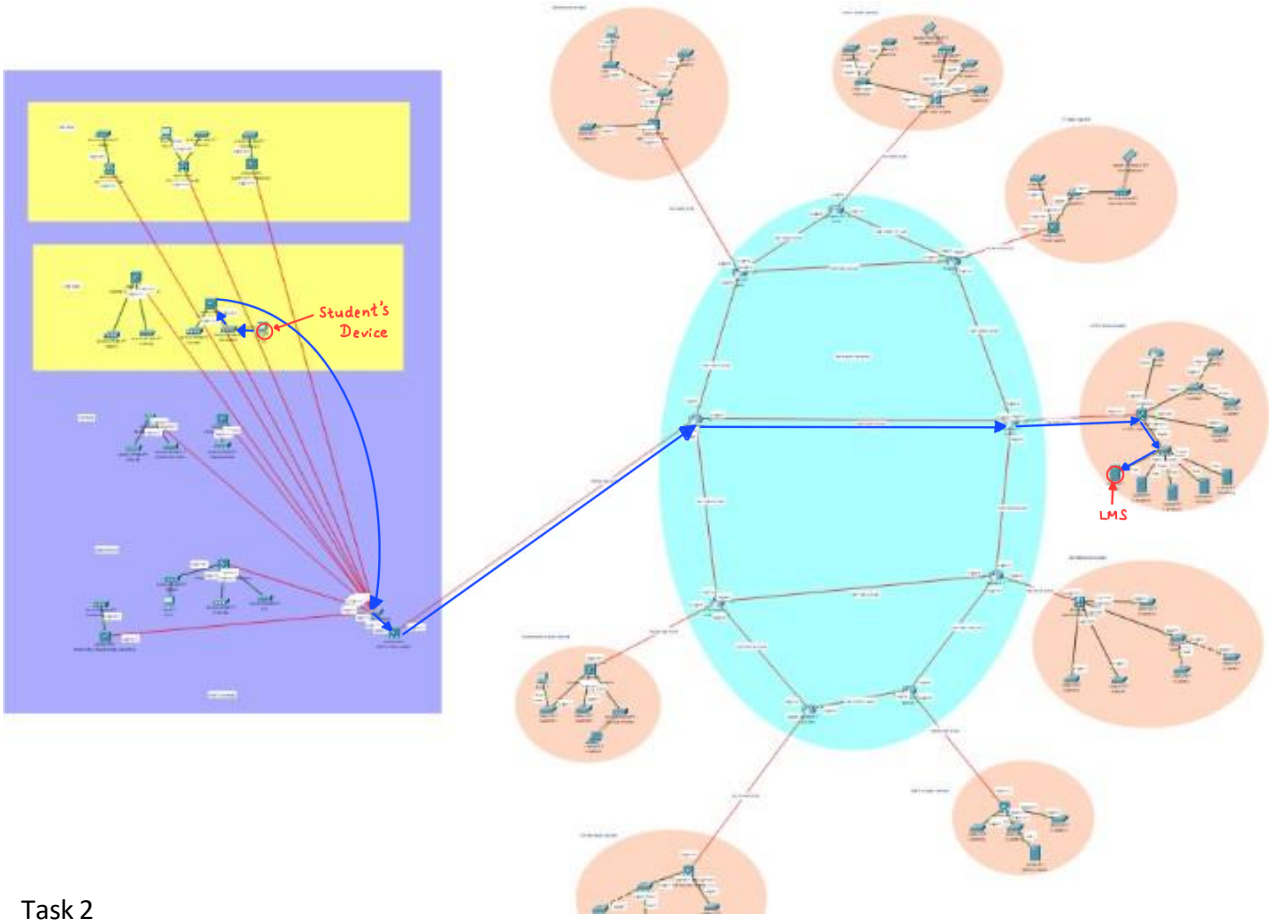







LMS

Full path



Task 2

Routing path when link connecting ENTC node and the data centre is broken

Event List

Vis.	Time(sec)	Last Device
	0.000	--
	0.001	PC5
	0.002	instructor
	0.003	Instructor room
	0.003	--
	0.004	instructor
	0.004	Switch0
	0.005	ENTC core switch
	0.006	ENTC
	0.007	Sumanadasa
	0.008	ADMIN
	0.009	CITES
	0.010	CITES core switch
	0.011	Switch6
	0.012	LMS
	0.013	Switch6
	0.014	CITES core switch
	0.015	CITES
	0.016	IT
	0.017	Archi
	0.018	ENTC
	0.019	ENTC core switch
	0.020	Switch0
	0.021	Instructor room
Visible	0.022	instructor

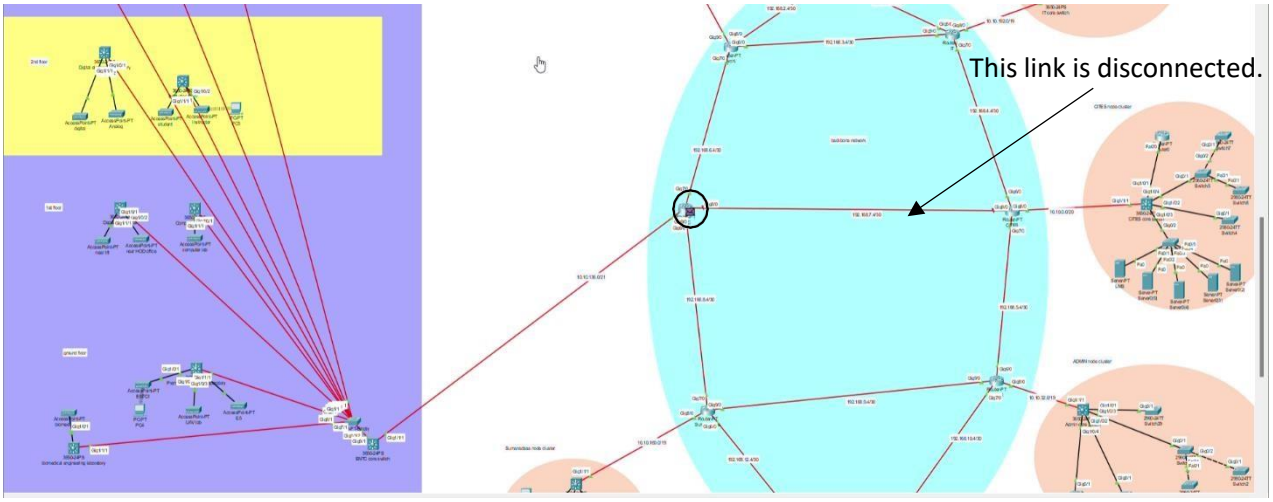
Forward path from student at ENTC to LMS

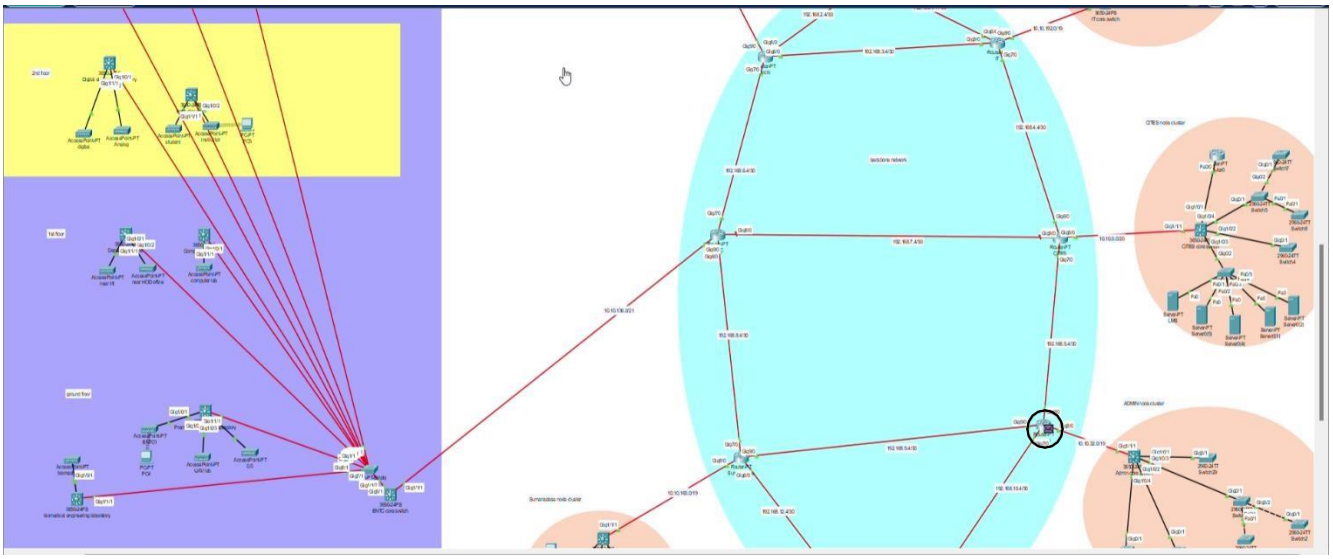
PC5 → Instructor → Instructor room → Switch0 → ENTC core switch → ENTC → Sumanadasa → ADMIN → CITES → CITES core switch → Switch6 → LMS

Backward path from LMS to student at ENTC

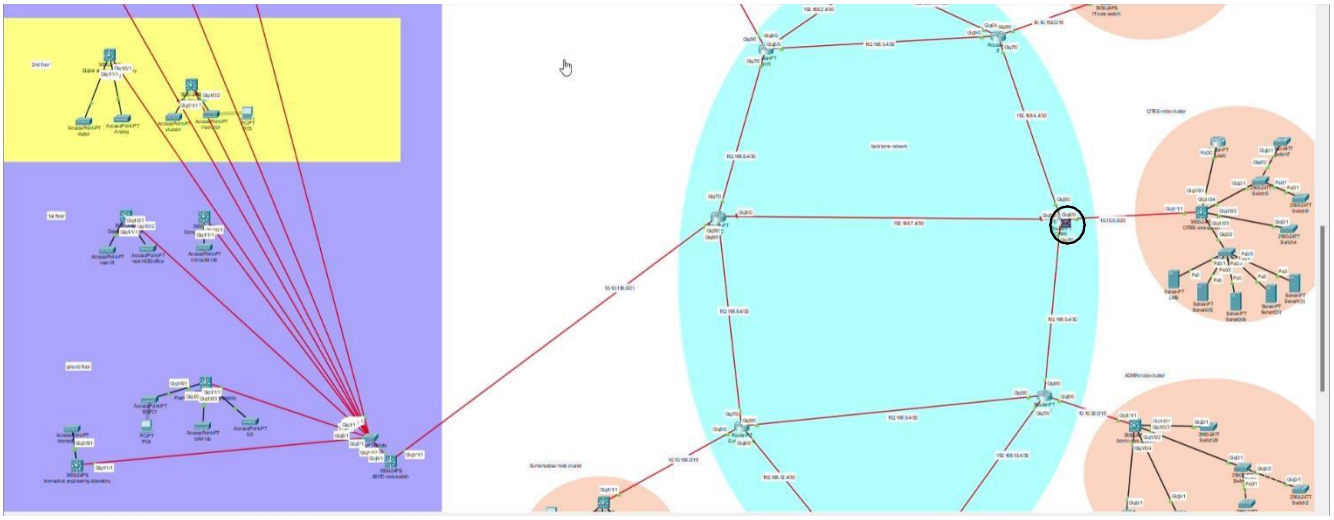
LMS → Switch6 → CITES core switch → CITES → IT → Archi → ENTC → ENTC core switch → Switch0 → Instructor room → Instructor → PC5

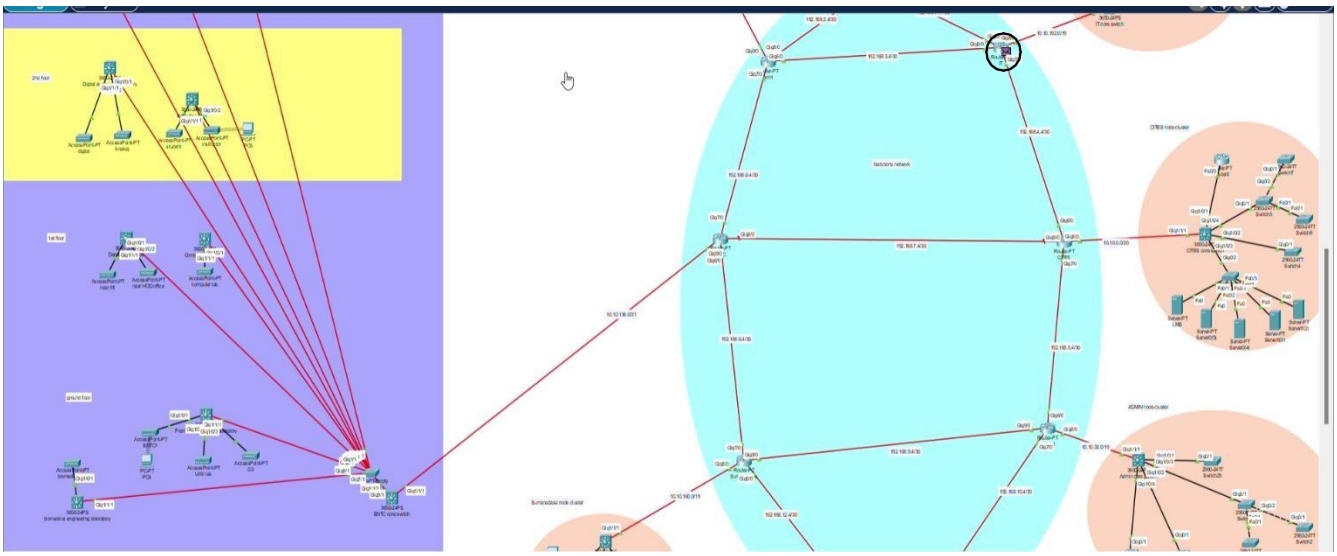
Some instances of simulation in forward path

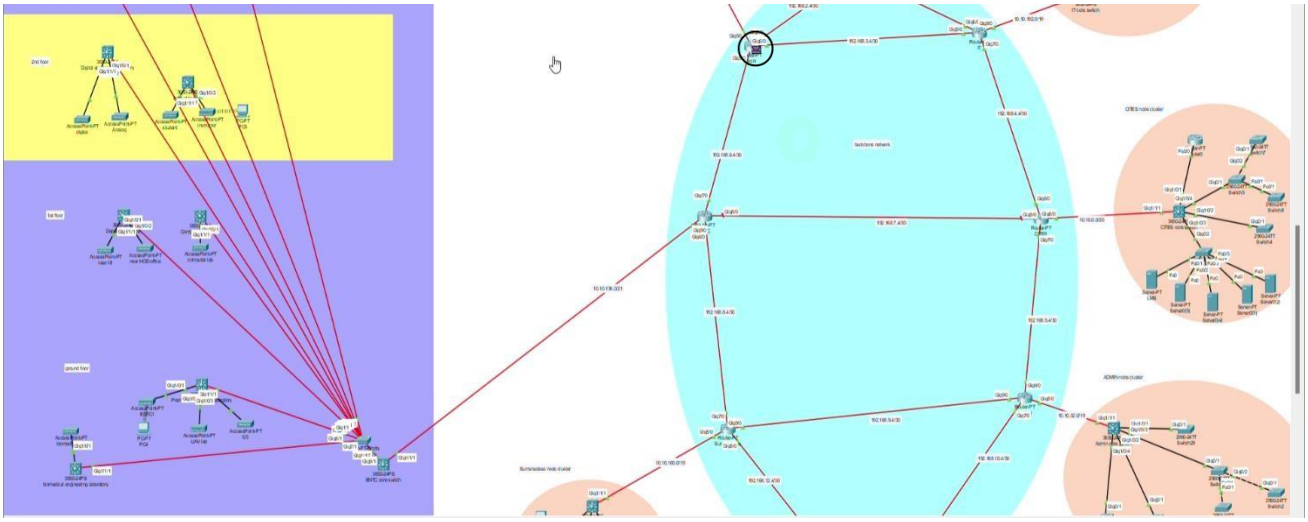




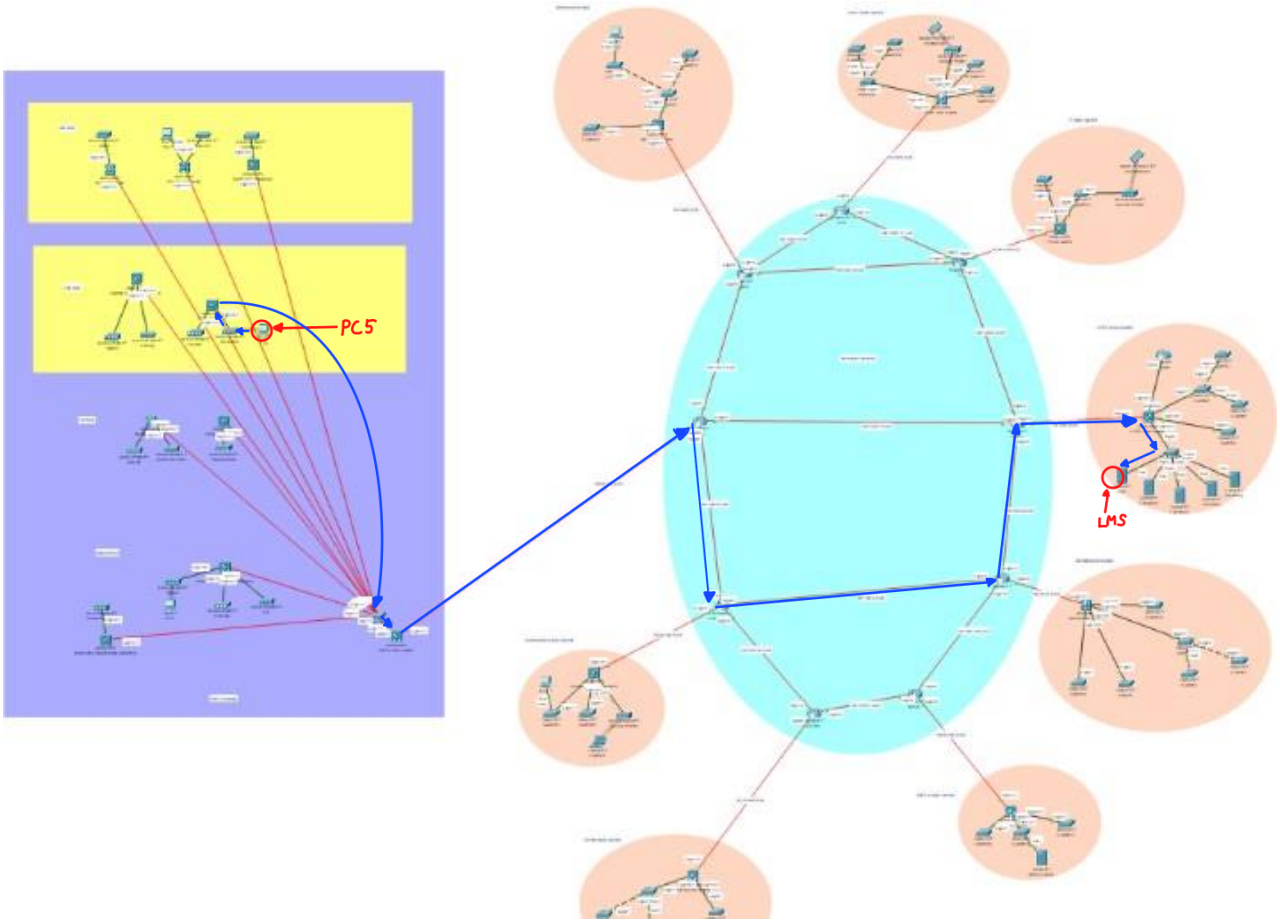
Some instances of simulation in backward path



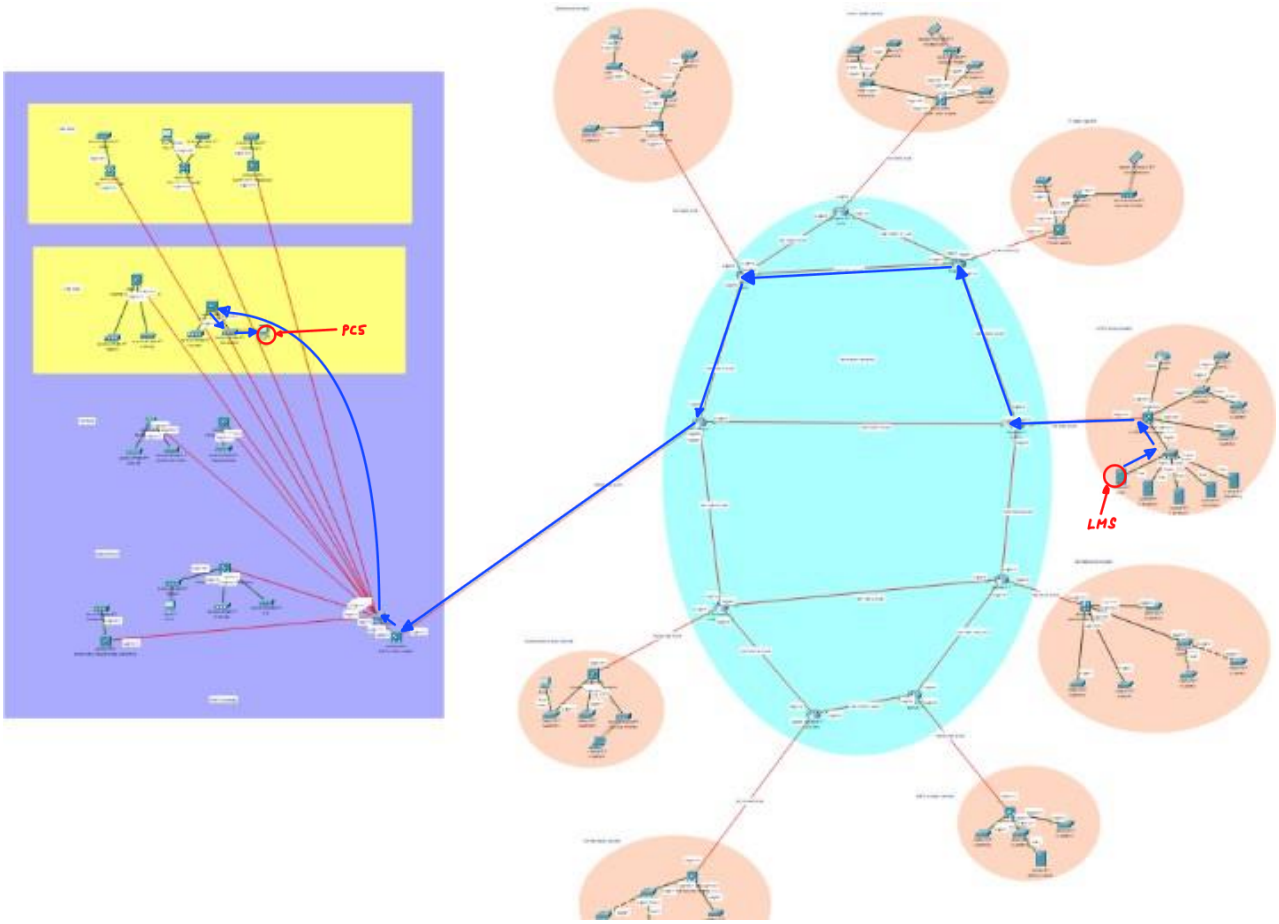




Full forward path



Full backward path



In some instances, forward and backward path will be interchanged.

Task 3

Path when accessing to a server at mechanical department

Event List

Vis.	Time(sec)	Last Device
	0.001	PC5
	0.002	instructor
	0.003	Instructor room
	0.004	Switch0
	0.005	ENTC core switch
	0.005	--
	0.006	instructor
	0.006	ENTC
	0.007	Sumanadasa
	0.008	CHEM
	0.009	MECH
	0.010	MECH core switch
	0.011	Switch28
	0.012	MECH server
	0.013	Switch28
	0.014	MECH core switch
	0.015	MECH
	0.016	ADMIN
	0.017	Sumanadasa
	0.018	ENTC
	0.019	ENTC core switch
	0.020	Switch0
	0.021	Instructor room
	0.022	instructor

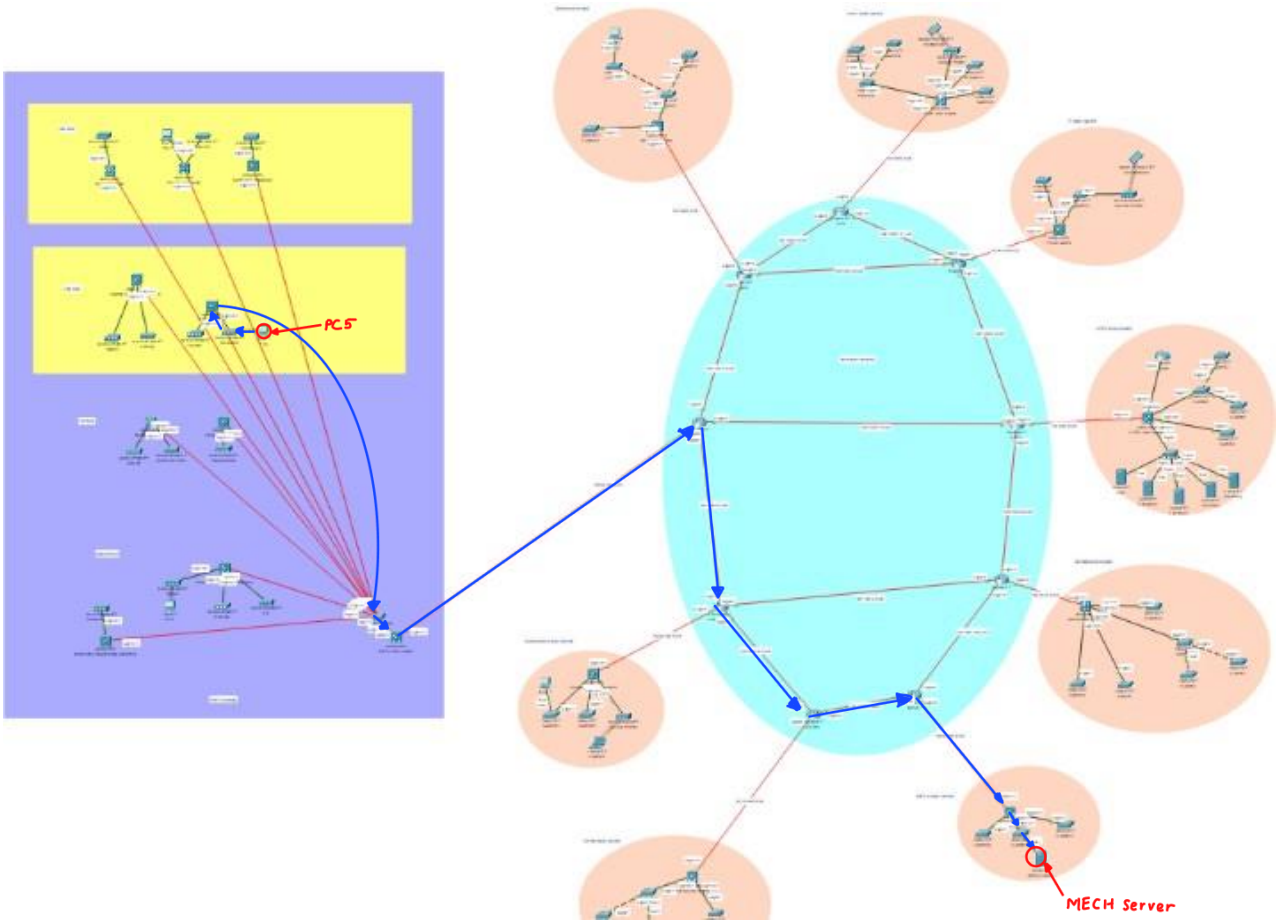
Path from student at ENTC to MECH server

PC5 → Instructor → Instructor room → Switch0 → ENTC core switch → ENTC → Sumanadasa → CHEM → MECH → MECH core switch → Switch28 → MECH server

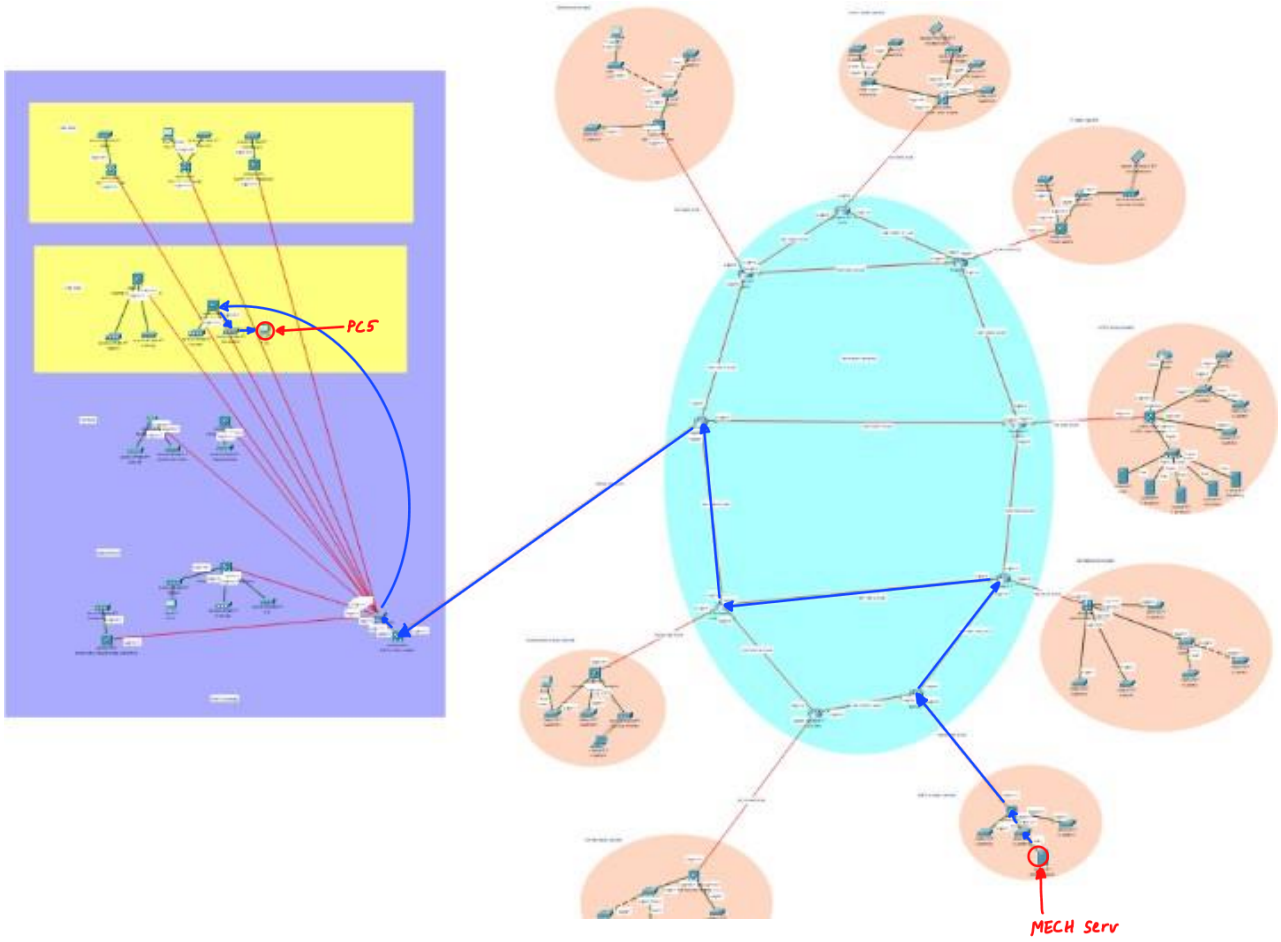
Path from MECH server to the student

MECH server → Switch28 → MECH core Switch → MECH → ADMIN → Sumanadasa → ENTC → ENTC core switch → Switch0 → Instructor room → Instructor → PC5

Full forward path



Full Backward path



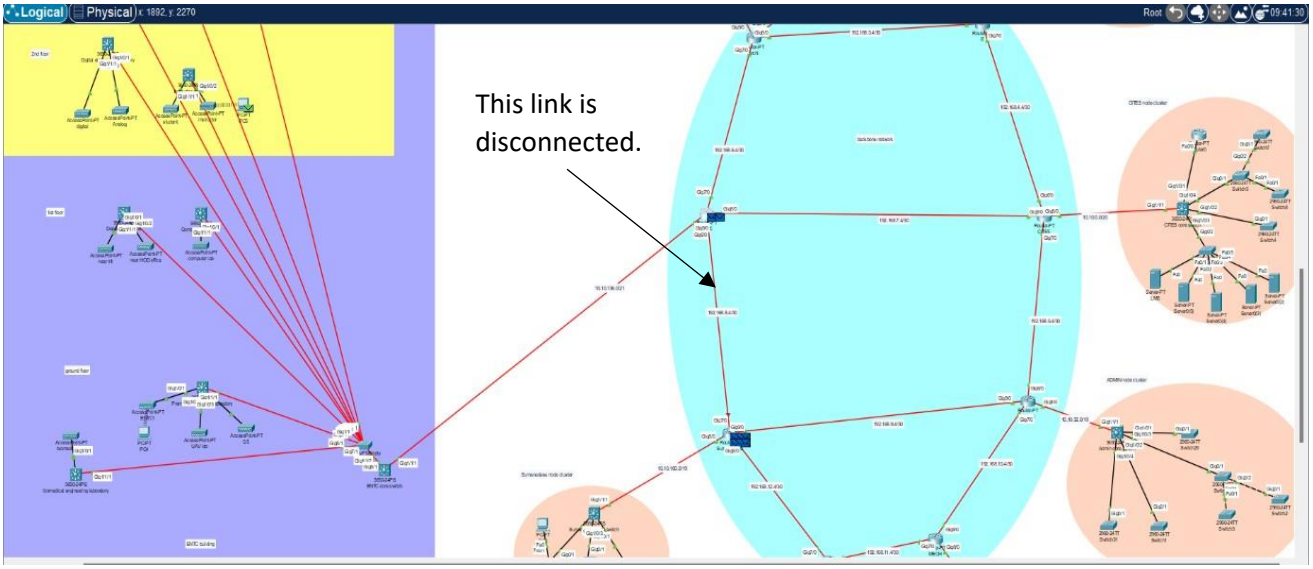
In some instances, forward and backward path will be interchanged.

Task 4

The new routing path when disconnected one of links used by task 3

Event List

Vis.	Time(sec)	Last Device
	0.001	PC5
	0.002	instructor
	0.003	Instructor room
	0.004	Switch0
	0.005	ENTC core switch
	0.006	ENTC
	0.006	--
	0.007	instructor
	0.007	CITES
	0.008	ADMIN
	0.009	MECH
	0.010	MECH core switch
	0.011	Switch28
	0.012	MECH server
	0.013	Switch28
	0.014	MECH core switch
	0.015	MECH
	0.016	ADMIN
	0.017	CITES
	0.018	ENTC
	0.019	ENTC core switch
	0.020	Switch0
	0.021	Instructor room
	0.022	instructor



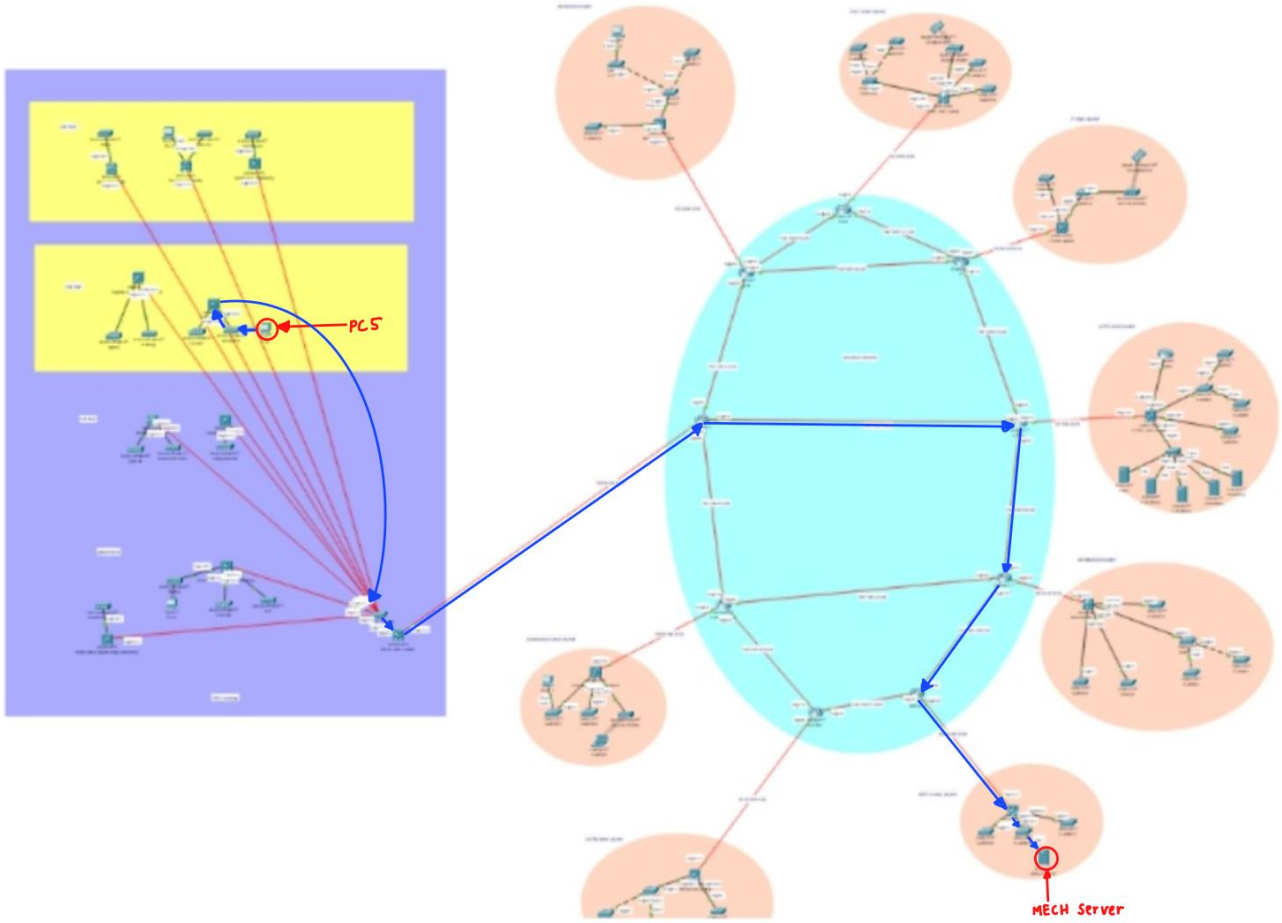
Path from student at ENTC to MECH server

PC5 → Instructor → Instructor room → Switch0 → ENTC core switch → ENTC → CITES → ADMIN → MECH → MECH core switch → Switch28 → MECH server

Path from MECH server to the student

MECH server → Switch28 → MECH core Switch → MECH → ADMIN → CITES → ENTC → ENTC core switch → Switch0 → Instructor room → Instructor → PC5

Full forward path



Backward path is the same as the forward path in this case.