



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS LAB

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Lab	08
Course	Computer Networks
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IN LAB TASKS

Warm up Task [30 Minutes]

Answer each question in your own words (3 to 4 lines)

- **What is Subnetting?**

Subnetting is the process of dividing a large IP network into smaller, manageable sub-networks called subnets. It helps organize and control traffic by grouping devices logically within a network [WebAsha Technologies](#).

- **Why Subnetting?**

Subnetting improves network efficiency by reducing congestion, enhancing security, and making IP address allocation more structured. It also helps isolate faults and manage traffic better [WebAsha Technologies](#).

- **Benefits of Subnetting:**

- Better bandwidth usage
- Easier network management
- Enhanced security and fault isolation
- Efficient IP address utilization [WebAsha Technologies](#)

- **Broadcast Address:**

A broadcast address is used to send data to all devices within a subnet. It's the highest address in a subnet, where all host bits are set to 1 (e.g., 192.168.1.255 for a /24 subnet) [WebAsha Technologies](#).

- **Network Address:**

The network address identifies the subnet itself and is used for routing. It's the lowest address in the subnet, with all host bits set to 0 (e.g., 192.168.1.0 for a /24 subnet) [WebAsha Technologies](#).

- **What is Classless Inter-Domain Routing (CIDR)?**

CIDR replaces old IP classes (A, B, C) with flexible subnet masks like /24 or /20. It allows more efficient IP address allocation and routing by using variable-length subnet masking [DigitalOcean](#).

- **What is DNS?**

DNS (Domain Name System) translates human-friendly domain names (like google.com) into IP addresses that computers use to communicate. It's like the internet's phonebook [GeeksForGeeks](#).

- **What is Address Resolution?**

Address resolution is the process of mapping an IP address to a physical MAC address. It's essential for devices to locate each other on a local network [GeeksForGeeks](#).

- **Difference between DNS Resolver and DNS Authoritative Server:**

- *DNS Resolver:* Queries DNS servers on behalf of users and caches results.
- *DNS Authoritative Server:* Holds the actual DNS records and responds with final answers for specific domains [GeeksForGeeks](#).

- **What is ARP and how does it work?**

ARP (Address Resolution Protocol) finds the MAC address of a device given its IP address. It sends a broadcast request asking “Who has this IP?” and the device replies with its MAC address [GeeksForGeeks](https://www.geeksforgeeks.org/arp-address-resolution-protocol/).

Task 1

Design University network topology diagram in Cisco Packet Tracer according to the given requirements. University network is divided into Four blocks and each block has different host requirements

1. CS Block: 136 hosts
2. AI Block: 95 hosts
3. SE Block: 51 hosts
4. CE Block: 24 hosts

Requirements:

- Apply concept of subnetting and use IP address of class C.
- Assign IP addresses to routers, switches, and PCs based on the subnetting scheme.
- Label each block and device in the topology.
- Ensure proper connectivity within each block and test the network.

Solution:

Finding the Range of IP Addresses

To determine the usable IP range within a subnet, follow these steps:

1. Identify the Subnet Mask (CIDR Notation)

- CIDR (e.g., /24, /25, /26, /27) defines how many bits are used for the network vs. host.
- Example:
 - /24 → Subnet mask: 255.255.255.0
 - Host bits: $32 - 24 = 8$

- Total addresses: $(2^8 = 256)$

2. Calculate Total IP Addresses

- Use the formula:
[\text{Total IPs} = 2^{\text{number of host bits}}]
- Example:
 - /26 → Host bits: 6
 - Total IPs: $(2^6 = 64)$

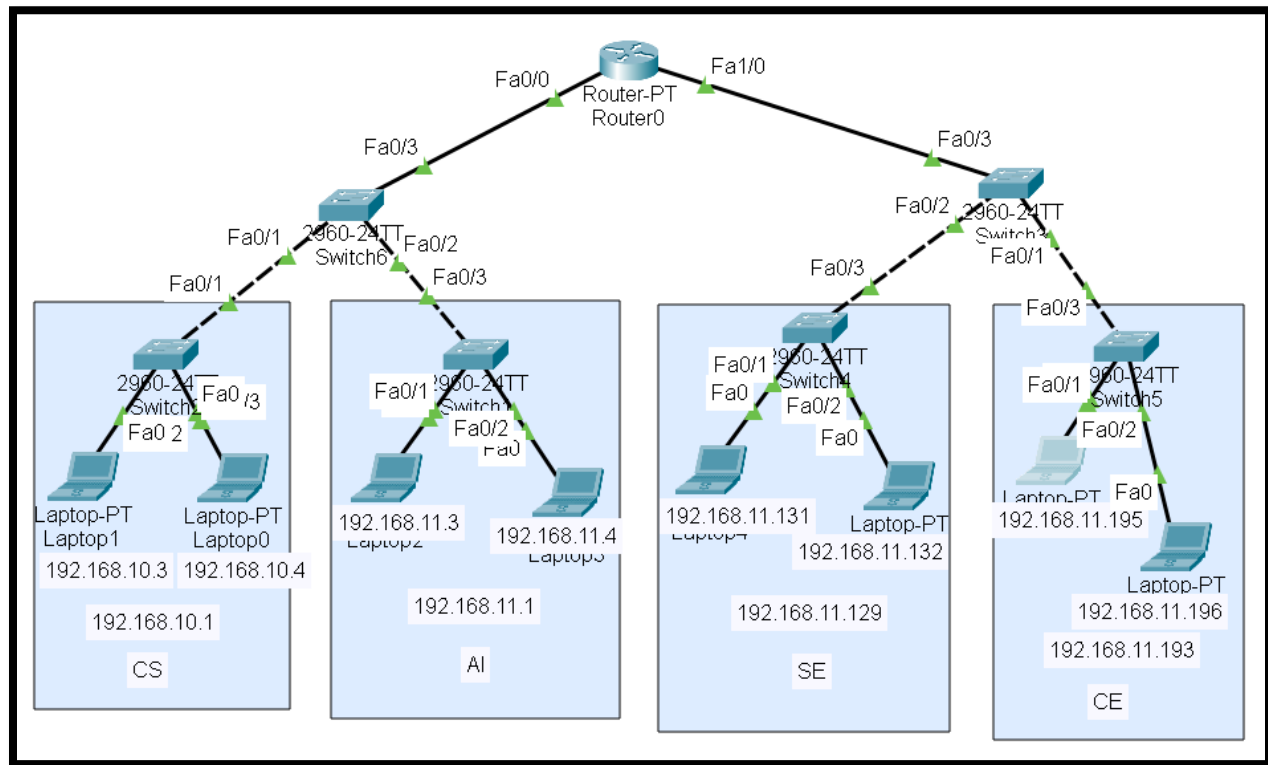
3. Find Network and Broadcast Addresses

- **Network Address:** First IP in the subnet (not usable by devices).
- **Broadcast Address:** Last IP in the subnet (used to communicate with all devices).

4. Determine the Usable IP Range

- Usable IPs lie between the network and broadcast addresses.
- Formula: [\text{Usable Range} = (\text{Network Address} + 1) \text{ to } (\text{Broadcast Address} - 1)]

STEPS:



Switches Configuration:-

CS-Switch:

```

Switch>enable
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname CS-SW
CS-SW(config)#interface vlan 1
CS-SW(config-if)#ip address 192.168.10.2 255.255.255.0
CS-SW(config-if)#no shutdown

CS-SW(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to
up

CS-SW(config-if)#exit
CS-SW(config)# ip default-gateway 192.168.10.1
CS-SW(config)#end
CS-SW#
%SYS-5-CONFIG_I: Configured from console by console
Write memory
Building configuration...
[OK]
CS-SW#

```

AI-Switch :

```

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname AI-SW
AI-SW(config)#interface vlan 1
AI-SW(config-if)#ip address 192.168.11.2 255.255.255.128
AI-SW(config-if)#no shutdown

AI-SW(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed
state to up

AI-SW(config-if)#exit
AI-SW(config)#ip default-gateway 192.168.11.1
AI-SW(config)#exit
AI-SW#
%SYS-5-CONFIG_I: Configured from console by console

AI-SW# write memory
Building configuration...
[OK]
AI-SW#

```

Main-Switch1:

```

Switch>enable
Switch# configure terminal
Enter configuration commands, one per line.  End with
CNTL/Z.
Switch(config)#hostname Main-SW1
Main-SW1(config)#interface vlan 1
Main-SW1(config-if)#ip address 192.168.10.10 255.255.255.0
Main-SW1(config-if)#no shutdown

Main-SW1(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1,
changed state to up

Main-SW1(config-if)#exit
Main-SW1(config)#ip default-gateway 192.168.10.1
Main-SW1(config)#exit
Main-SW1#
%SYS-5-CONFIG_I: Configured from console by console

Main-SW1#write memory
Building configuration...
[OK]
Main-SW1#

```

SE-Switch:

```

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname SE-SW
SE-SW(config)#interface vlan 1
SE-SW(config-if)#ip address 192.168.11.130 255.255.255.192
SE-SW(config-if)#no shutdown

SE-SW(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to
up

SE-SW(config-if)#exit
SE-SW(config)#ip default-gateway 192.168.11.129
SE-SW(config)#exit
SE-SW#
%SYS-5-CONFIG_I: Configured from console by console

SE-SW#write memory
Building configuration...
[OK]
SE-SW#

```

CE-Switch:

```

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname CE-SW
CE-SW(config)#interface vlan 1
CE-SW(config-if)#ip address 192.168.11.194 255.255.255.224
CE-SW(config-if)#no shutdown

CE-SW(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

CE-SW(config-if)#exit
CE-SW(config)#ip default-gateway 192.168.11.193
CE-SW(config)#exit
CE-SW#
%SYS-5-CONFIG_I: Configured from console by console
write memory
Building configuration...
[OK]
CE-SW#

```

Main-Switch2:

```

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname Main-SW2
Main-SW2(config)#interface vlan 1
Main-SW2(config-if)#ip address 192.168.11.140 255.255.255.192
Main-SW2(config-if)#no shutdown

Main-SW2(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to up

Main-SW2(config-if)#exit
Main-SW2(config)#ip default-gateway 192.168.11.129
Main-SW2(config)#exit
Main-SW2#
%SYS-5-CONFIG_I: Configured from console by console

Main-SW2#write memory
Building configuration...
[OK]
Main-SW2#

```

Router Configuration:


```

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1
R1(config)#interface fa0/0
R1(config-if)#description connected to Main-Sw1c(CS+AI)
R1(config-if)#ip address 192.168.10.1 255.255.255.0
R1(config-if)#no shutdown

R1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

R1(config-if)#exit
R1(config)#interface fa1/0
R1(config-if)#description connected to Main-SW2 (SE+CE)
R1(config-if)#ip addresses 192.168.11.129 255.255.255.192
^
% Invalid input detected at '^' marker.

R1(config-if)#ip address 192.168.11.129 255.255.255.192
R1(config-if)#no shutdown

R1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet1/0, changed state to up

```

```









R1(config-if)#exit
R1(config)# router rip
R1(config-router)# version 2
R1(config-router)#network 192.168.10.0
R1(config-router)#network 192.168.11.0
R1(config-router)#no auto-summary
R1(config-router)#exit
R1(config)#write memory
^
% Invalid input detected at '^' marker.

R1(config)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#write memory
Building configuration...
[OK]
R1#

```

Packet Transfer:

<div> <div></div> <div>Realtime</div> <div>Simulation</div> </div>										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop1	Laptop0	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Laptop2	Laptop3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop4	Laptop5	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop7	Laptop6	ICMP		0.000	N	3	(edit)	(delete)

Task 2

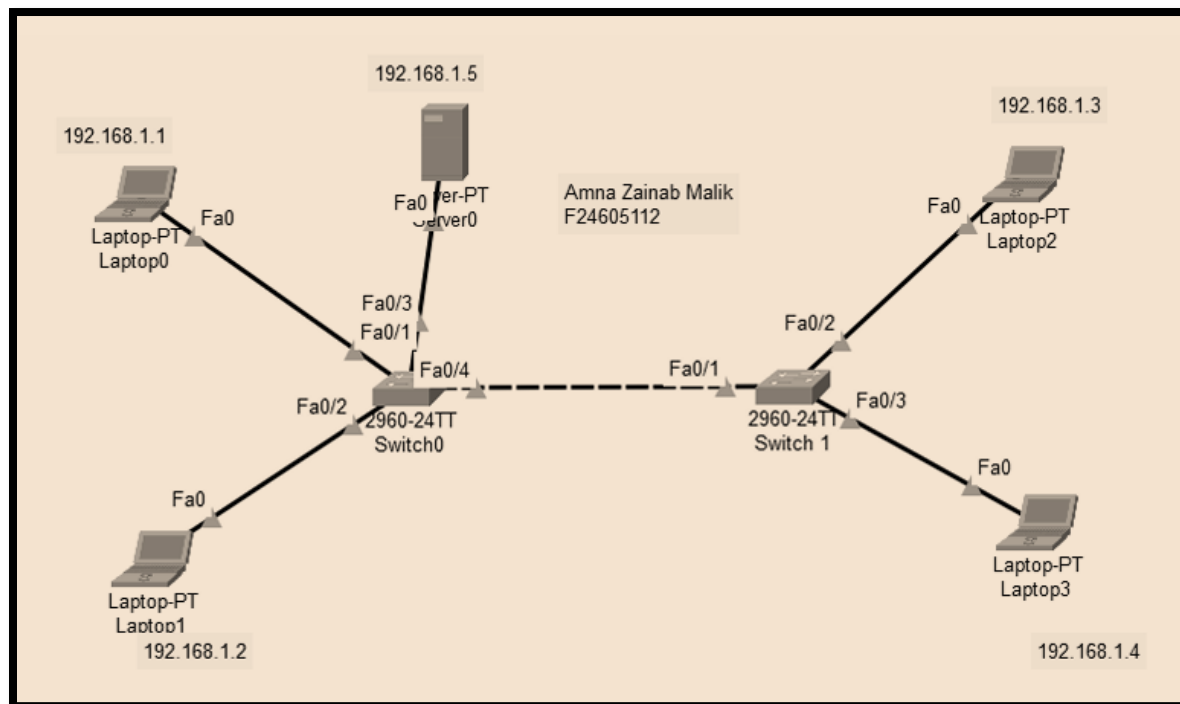
Design topology diagram in Cisco Packet Tracer according to the given requirements. University network is divided into Four blocks and each block has different host requirements

The network consists of the following components:

- 4 PCs
- Two Switches
- One DNS Server (DNS Server)

PCs needs to resolve the domain name www.NUTECH.com to an IP address using the DNS Server. Configure the network components to ensure that PCs can successfully resolve the domain name.

Solution:



Steps:

Laptop0

Physical Config **Desktop** Programming Attributes

IP Configuration

Interface FastEthernet0

IP Configuration

☐ DHCP ☒ Static

IPv4 Address 192.168.1.1

Subnet Mask 255.255.255.0

Default Gateway 0.0.0.0

DNS Server 192.168.1.5

IPv6 Configuration

☐ Automatic ☒ Static

IPv6 Address

Link Local Address FE80::201:97FF:FE78:8148

Default Gateway

DNS Server

802.1X

Server0

Physical Config **Services** Desktop Programming Attributes

SERVICES

HTTP

DHCP

DHCPv6

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

IoT

VM Management

Radius EAP

DNS

DNS Service ☒ On ☐ Off

Resource Records

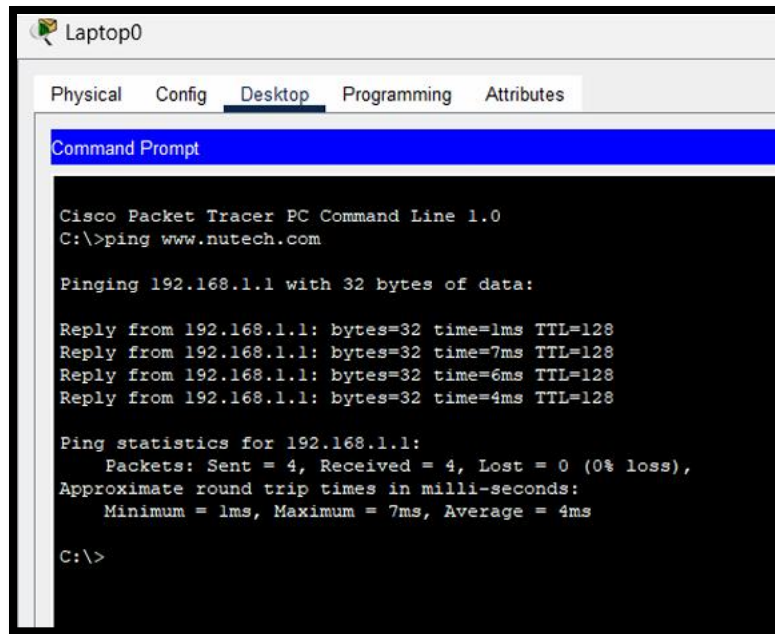
Name Type A Record

Address

Add Save Remove

No.	Name	Type	Detail
0	www.nutech.com	A Record	192.168.1.5

Checking Ping:



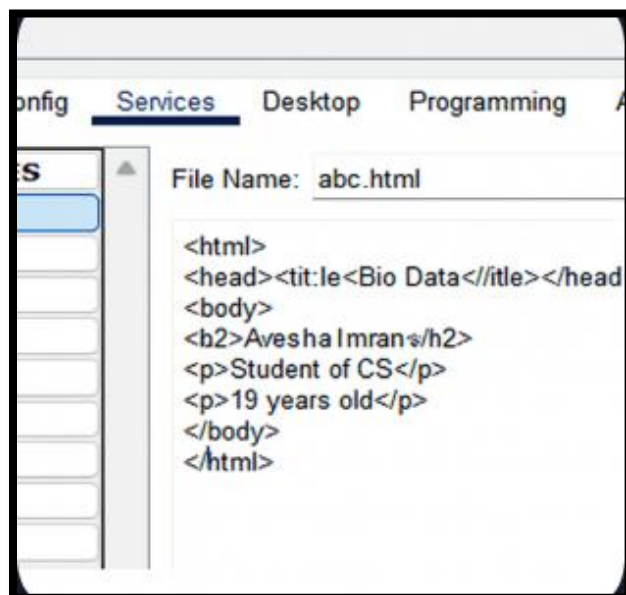
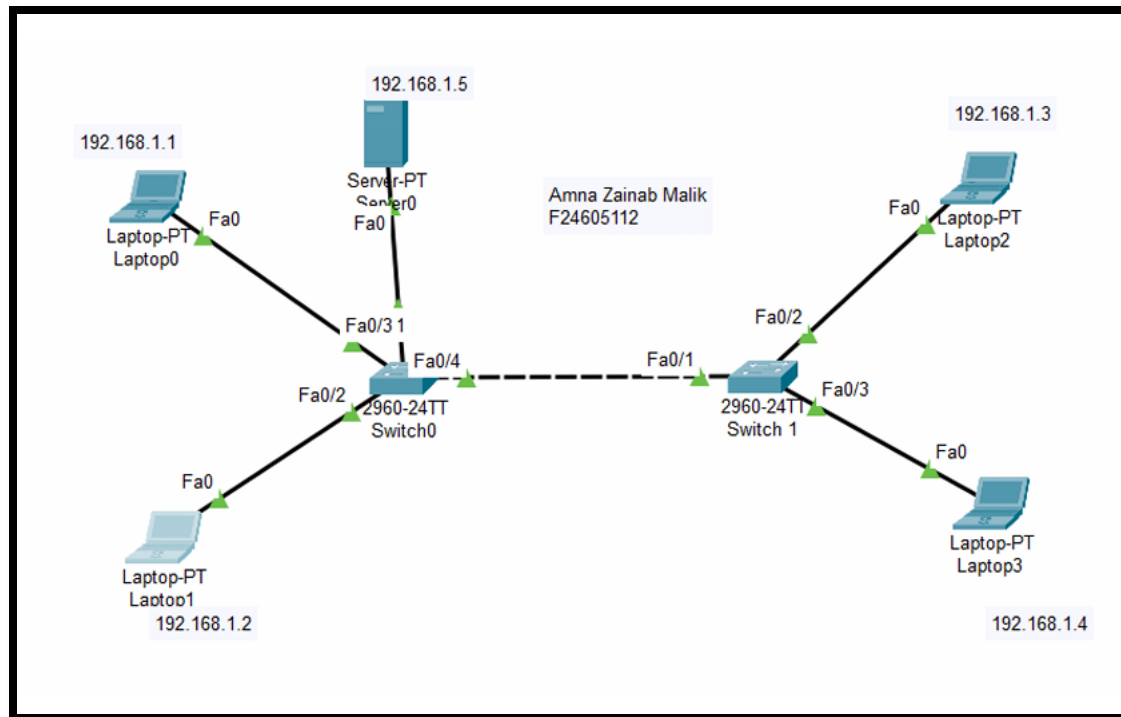
Packet Transfer:

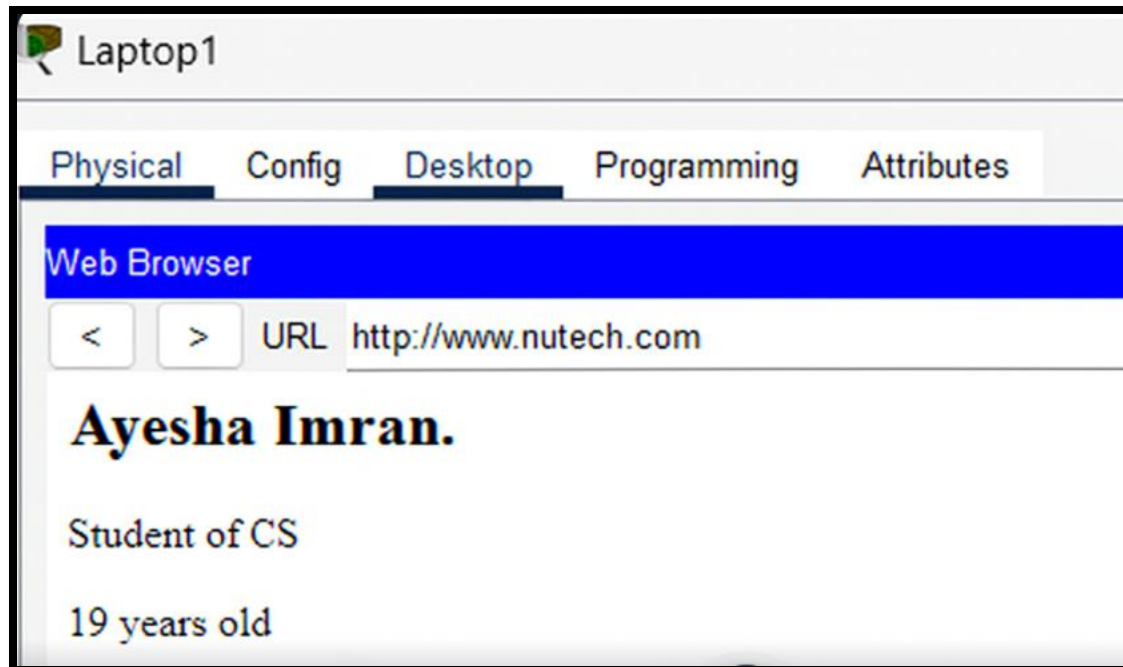
Realtime Simulation										
Scenario 0	Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit Delete
New Delete Toggle PDU List Window		Successful	Laptop0	Laptop3	ICMP	Orange	0.000	N	0	(edit) (delete)
		Successful	Laptop4	Laptop1	ICMP	Green	0.000	N	1	(edit) (delete)
		Successful	Laptop2	Laptop5	ICMP	Purple	0.000	N	2	(edit) (delete)
		Successful	Laptop1	Laptop0	ICMP	Pink	0.000	N	3	(edit) (delete)

Task 03:

Implement Task 2 topology with DNS resolver, DNS authoritative server and website of your name for example (abc.html). Content of website consist of your Bio Data.

Steps:





- **Send packets (Real time).**

Realtime Simulation										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop4	Laptop3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop3	Laptop0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop6	Laptop4	ICMP		0.000	N	3	(edit)	(delete)

- **Send packets(Simulation).**

Event List Realtime Simulation										
Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	Laptop0	Laptop6	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Laptop4	Laptop3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Laptop3	Laptop0	ICMP		0.000	N	2	(edit)	(delete)
	Successful	Laptop6	Laptop4	ICMP		0.000	N	3	(edit)	(delete)