

COLLEGE NETWORK

PROJECT REPORT

BAHRIA UNIVERSITY ISLAMABAD CAMPUS

DCN LAB FINAL PROJECT

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01. INTRODUCTION

This College Network Scenario is about designing a topology of a network that is a LAN (Local Area Network) for a college in which various computers of different departments are set up so that they can interact and communicate with each other by interchanging data. To design a networking scenario for a college which connect various departments to each other's, it puts forward communication among different departments. CNS is used to design a systematic and well-planned topology, satisfying all the necessities of the college (i.e. client). CNS come up with a network with good performance.

02. OBJECTIVES

The main objective of the proposed network design for the college is to modernize the existing network infrastructure, enhancing its overall capabilities and increasing its flexibility to meet the evolving needs of the institution. By updating the network, the aim is to significantly improve performance, ensuring faster data transmission and reliable connectivity across various departments. This enhancement will support a higher volume of devices and applications, facilitating seamless communication and collaboration among students, faculty, and administrative staff.

03. NETWORK

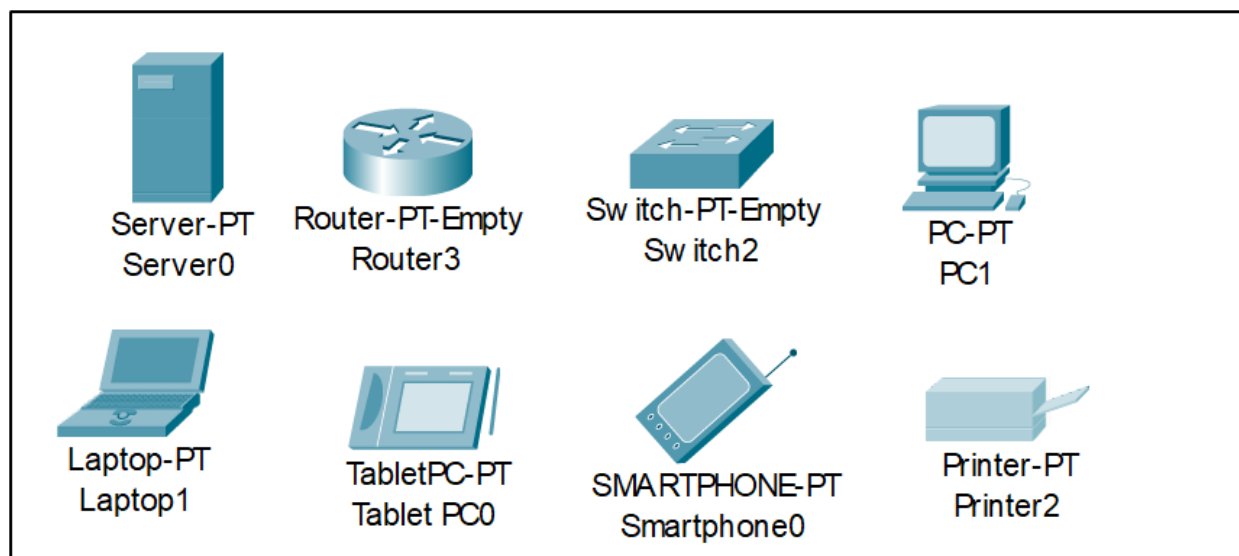
REQUIREMENTS

1. The new system should be able to reduce internet downtime.
Download and upload links should be.
2. maintained above 5 Mbps speed requirement.
3. The network will be scalable.
4. The system should support remote access.
5. Should comprise of data centers with necessary security features and support.

04. NETWORK DEVICES

Devices Used in The Network

Devices	Quantity
Servers	3
Routers	3
Switches	5
PCs	15
Laptops	1
Tablets	1
Smart Phones	1
Printers	3



05. IP ADDRESSING PLAN

IT DEPARTMENT (192.168.1.0)	
IT INSTRUCTOR	192.168.1.2
IT LAB 1	192.168.1.3
IT LAB 2	192.168.1.4
IT LAB 3	192.168.1.5
IT LAB 4	192.168.1.6
PRINTER 0	192.168.1.7

CS DEPARTMENT (192.168.2.0)	
CS INSTRUCTOR	192.168.2.2
CS LAB 1	192.168.2.3
CS LAB 2	192.168.2.4
CS LAB 3	192.168.2.5
CS LAB 4	192.168.2.6
PRINTER 7	192.168.2.7

SERVER ROOM (1.0.0.0)	
FTP SERVER	1.0.0.4
DNS SERVER	1.0.0.2
WEB SERVER	1.0.0.3

INTERNET LAB (192.168.0.0)	
LAB PC2	128.168.0.2
LAB PC3	128.168.0.3
LAB PC4	128.168.0.4
LAB PCS5	128.168.0.5
PRINTER 5	128.168.0.6

PRINCIPAL ROOM (192.168.4.0)	
PC 0	128.168.4.2
LAPTOP 0	128.168.4.3
SMARTPHONE1	128.168.100
TABLE PC 1	128.168.0.101

07. IP CONFIGURATION

We have attached the screenshots of all the IP configuration below:

Router 0

Display Name	Router0	
Hostname	Router	
NVRAM	Erase	Save
Startup Config	Load...	Export...
Running Config	Export...	Merge...

FastEthernet0/0

IP Configuration	
IPv4 Address	192.168.1.1
Subnet Mask	255.255.255.0

FastEthernet1/0

IP Configuration	
IPv4 Address	192.168.2.1
Subnet Mask	255.255.255.0

Serial2/0

IP Configuration	
IPv4 Address	10.10.0.1
Subnet Mask	255.0.0.0

RIP

Network Address
10.0.0.0
192.168.1.0
192.168.2.0

Router 1

Display Name	Router1	
Hostname	Router	
NVRAM	Erase	Save
Startup Config	Load...	Export...
Running Config	Export...	Merge...

FastEthernet0/0

IP Configuration	
IPv4 Address	192.168.3.1
Subnet Mask	255.255.255.0

FastEthernet1/0

IP Configuration	
IPv4 Address	192.168.4.1
Subnet Mask	255.255.255.0

Seria2/0

IP Configuration	
IPv4 Address	10.10.0.2
Subnet Mask	255.0.0.0

Seria3/0

IP Configuration	
IPv4 Address	20.20.0.1
Subnet Mask	255.0.0.0

RIP

Network Address
10.0.0.0
20.0.0.0
192.168.3.0
192.168.4.0

Router 2

Display Name	<input type="text" value="Router2"/>	
Hostname	<input type="text" value="Router"/>	
NVRAM	<input type="button" value="Erase"/>	<input type="button" value="Save"/>
Startup Config	<input type="button" value="Load..."/>	<input type="button" value="Export..."/>
Running Config	<input type="button" value="Export..."/>	<input type="button" value="Merge..."/>

FastEthernet0/0

IP Configuration	
IPv4 Address	<input type="text" value="1.0.0.1"/>
Subnet Mask	<input type="text" value="255.0.0.0"/>

FastEthernet1/0

IP Configuration	
IPv4 Address	<input type="text" value="128.168.0.1"/>
Subnet Mask	<input type="text" value="255.255.0.0"/>

Serial2/0

IP Configuration	
IPv4 Address	<input type="text" value="20.20.0.2"/>
Subnet Mask	<input type="text" value="255.0.0.0"/>

RIP

Network Address
<input type="text" value="1.0.0.0"/>
<input type="text" value="20.0.0.0"/>
<input type="text" value="128.168.0.0"/>

FTP Server

IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	1.0.0.4
Subnet Mask	255.0.0.0
Default Gateway	1.0.0.1
DNS Server	0.0.0.0

Display Name	FTP
Gateway/DNS IPv4	
<input type="radio"/> DHCP	
<input checked="" type="radio"/> Static	
Default Gateway	1.0.0.1
DNS Server	

WEB Server

IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	1.0.0.3
Subnet Mask	255.0.0.0
Default Gateway	1.0.0.1
DNS Server	0.0.0.0

Display Name	WEB
Gateway/DNS IPv4	
<input type="radio"/> DHCP	
<input checked="" type="radio"/> Static	
Default Gateway	1.0.0.1
DNS Server	

DNS Server

IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	<input type="text" value="1.0.0.2"/>
Subnet Mask	<input type="text" value="255.0.0.0"/>
Default Gateway	<input type="text" value="1.0.0.1"/>
DNS Server	<input type="text" value="0.0.0.0"/>

IP Configuration	
<input type="radio"/> DHCP	<input checked="" type="radio"/> Static
IPv4 Address	<input type="text" value="1.0.0.2"/>
Subnet Mask	<input type="text" value="255.0.0.0"/>

06. ROUTING PROTOCOL PLAN

Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance vector routing protocol which has AD value 120 and works on the application layer of OSI model.

Router 0:

The screenshot displays the Cisco Packet Tracer interface. On the left, a network topology is visible with several PCs connected to a central router (Router0). The router is labeled 'Router0' and has a 'CLI' tab selected. The CLI window shows the following commands and output:

```
Router0#enable
Router0#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R  1.0.0.0/8 [120/2] via 10.10.0.2, 00:00:10, Serial2/0
C  10.0.0.0/8 is directly connected, Serial2/0
R  20.0.0.0/8 [120/1] via 10.10.0.2, 00:00:10, Serial2/0
R  128.168.0.0/16 [120/2] via 10.10.0.2, 00:00:10, Serial2/0
C  152.168.1.0/24 is directly connected, FastEthernet0/0
C  152.168.2.0/24 is directly connected, FastEthernet1/0
R  192.168.4.0/24 [120/1] via 10.10.0.2, 00:00:10, Serial2/0

Router0#
```

The bottom right corner of the screenshot shows a table with network simulation data:

Destination	Type	Color	Time(sec)	Periodic	Num	Edt
IT LAB 3	ICMP		0.000	N	15	(ec
Tablet PC1	ICMP		0.000	N	16	(ec

Router 1

Press RETURN to get started!

```
Router1>
Router1>enable
Router1>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 20.20.0.2, 00:00:14, Serial3/0
C    10.0.0.0/8 is directly connected, Serial2/0
C    20.0.0.0/8 is directly connected, Serial3/0
R    128.168.0.0/16 [120/1] via 20.20.0.2, 00:00:14, Serial3/0
R    192.168.1.0/24 [120/1] via 10.10.0.1, 00:00:08, Serial2/0
R    192.168.2.0/24 [120/1] via 10.10.0.1, 00:00:08, Serial2/0
C    192.168.4.0/24 is directly connected, FastEthernet1/0

Router1#
```

Ctrl+F8 to exit CLI focus

Copy Paste

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Router 2

Press RETURN to get started!

```
Router2>
Router2>enable
Router2>show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, FastEthernet0/0
R    10.0.0.0/8 [120/1] via 20.20.0.1, 00:00:01, Serial2/0
C    20.0.0.0/8 is directly connected, Serial2/0
C    128.168.0.0/16 is directly connected, FastEthernet1/0
R    192.168.1.0/24 [120/2] via 20.20.0.1, 00:00:01, Serial2/0
R    192.168.2.0/24 [120/2] via 20.20.0.1, 00:00:01, Serial2/0
R    192.168.4.0/24 [120/1] via 20.20.0.1, 00:00:01, Serial2/0

Router2#
```

Ctrl+F8 to exit CLI focus

Copy Paste

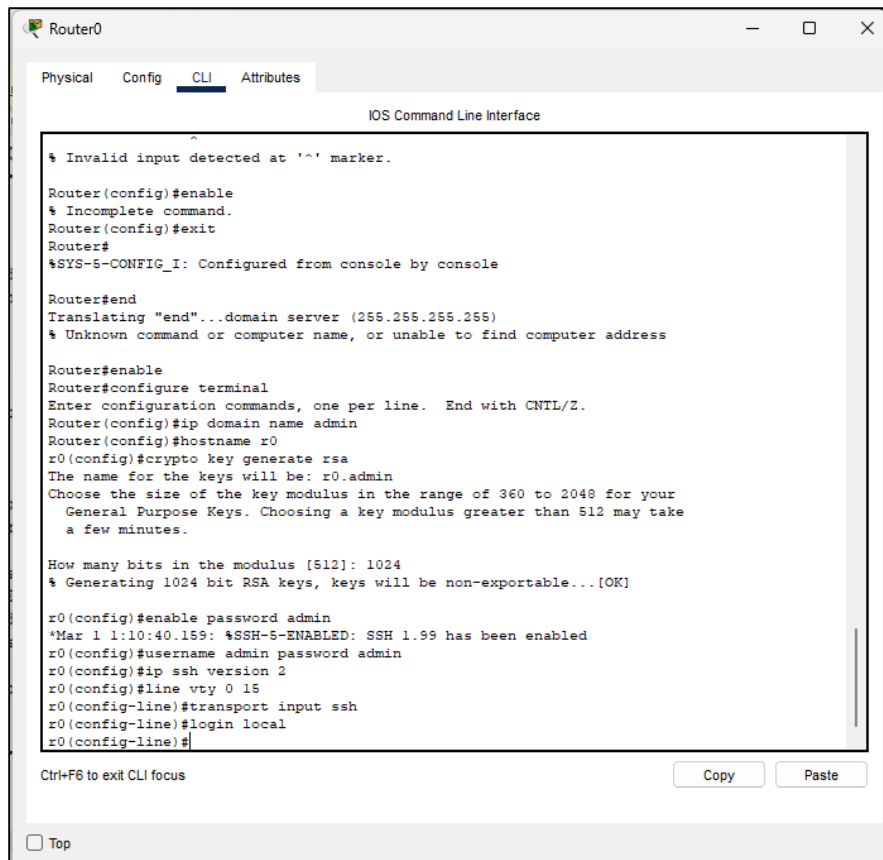
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07. SECURING ROUTERS

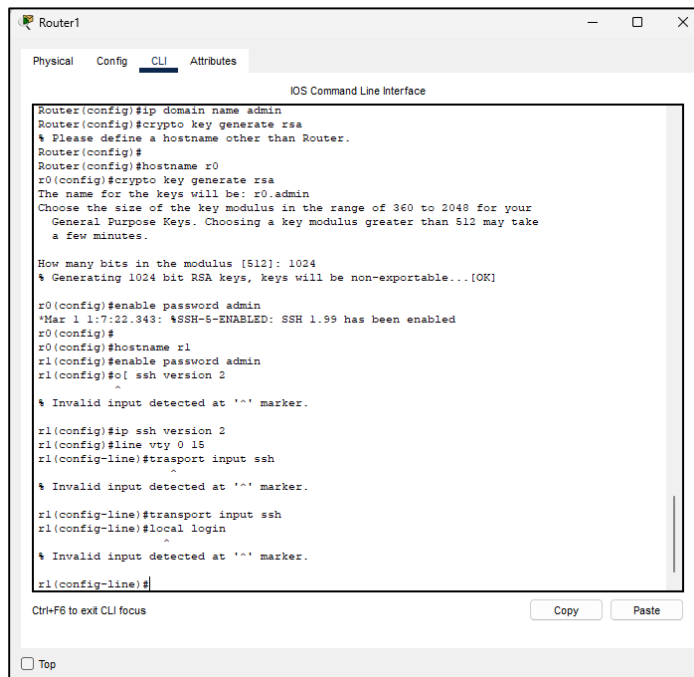
Routers are also secured with ssh (Secure Shell). Routers and their assigned passwords are mentioned below:

Routers Name	Passwords
Router 0	SSH (admin)
Router 1	SSH (admin)
Router 2	SSH (admin)

Router 0



Router 1



Router 2

```
Router2
Physical Config CLI Attributes
IOS Command Line Interface

Router>enable
Router#configure t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip domain name admin
Router(config)#hostname r2
r2(config)#crypto key generate rsa
The name for the keys will be: r2.admin
Choose the size of the key modulus in the range of 360 to 2048 for your
General Purpose Keys. Choosing a key modulus greater than 512 may take
a few minutes.

How many bits in the modulus [512]: 1024
% Generating 1024 bit RSA keys, keys will be non-exportable...[OK]

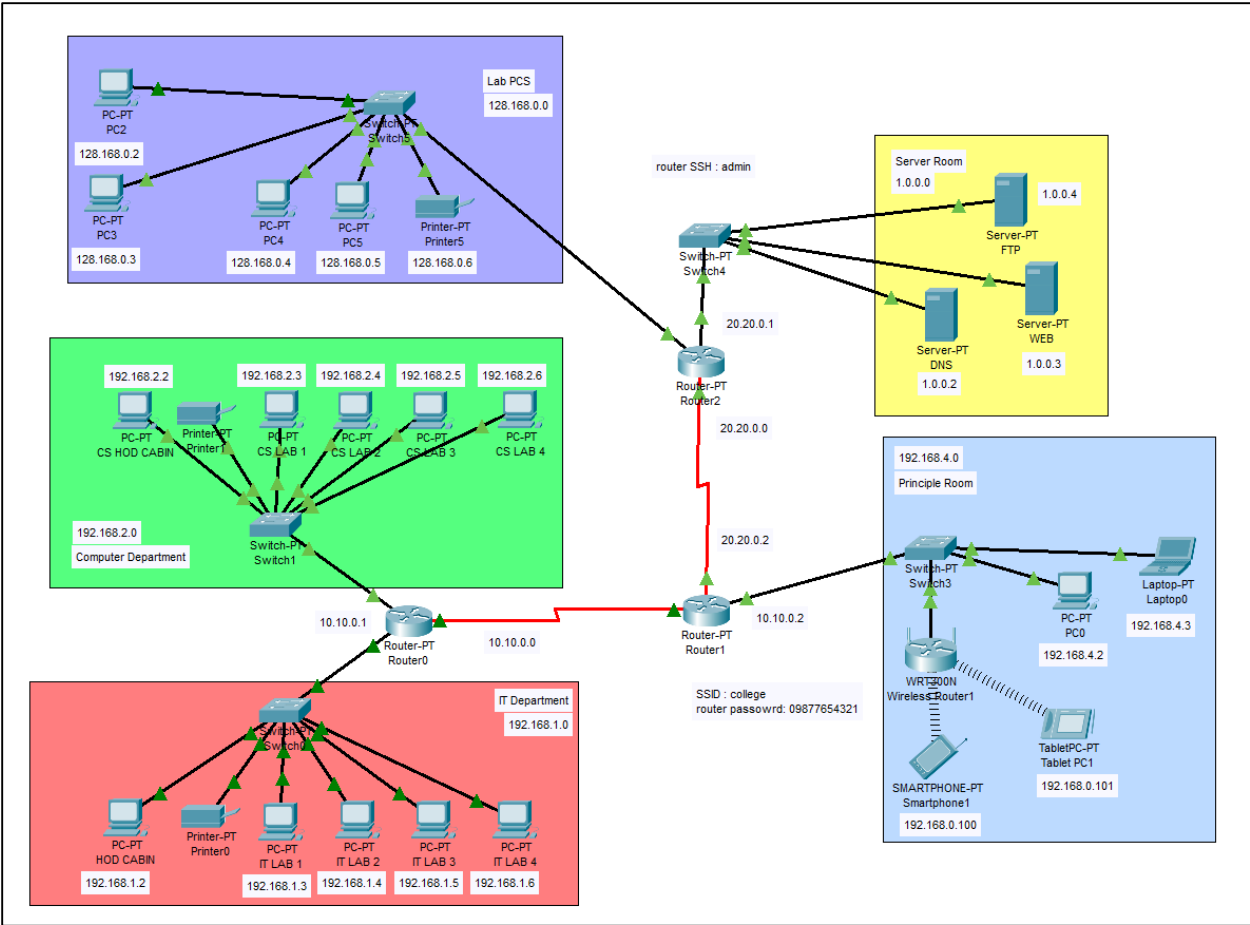
r2(config)#enable password admin
*Mar 1 1:13:31.243: %SSH-5-ENABLED: SSH 1.99 has been enabled
r2(config)#username admin password admin
r2(config)#ip ssh version2
^
% Invalid input detected at '^' marker.

r2(config)#ip ssh version 2
r2(config)#line vty 0 15
r2(config-line)#transport input ssh
r2(config-line)#login local
r2(config-line)#

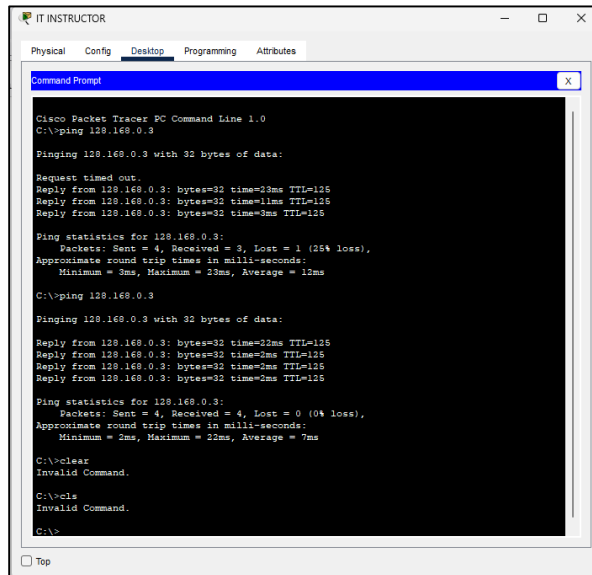
Ctrl+F6 to exit CLI focus
Copy Paste
Top
```

08. DESIGN, PING TEST, SIMULATION

Network Design



Ping test



IT INSTRUCTOR

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 128.168.0.3

Pinging 128.168.0.3 with 32 bytes of data:

Request timed out.
Reply from 128.168.0.3: bytes=32 time=23ms TTL=125
Reply from 128.168.0.3: bytes=32 time=21ms TTL=125
Reply from 128.168.0.3: bytes=32 time=3ms TTL=125

Ping statistics for 128.168.0.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 23ms, Average = 12ms

C:\>ping 128.168.0.3

Pinging 128.168.0.3 with 32 bytes of data:

Reply from 128.168.0.3: bytes=32 time=22ms TTL=125
Reply from 128.168.0.3: bytes=32 time=2ms TTL=125
Reply from 128.168.0.3: bytes=32 time=2ms TTL=125
Reply from 128.168.0.3: bytes=32 time=2ms TTL=125

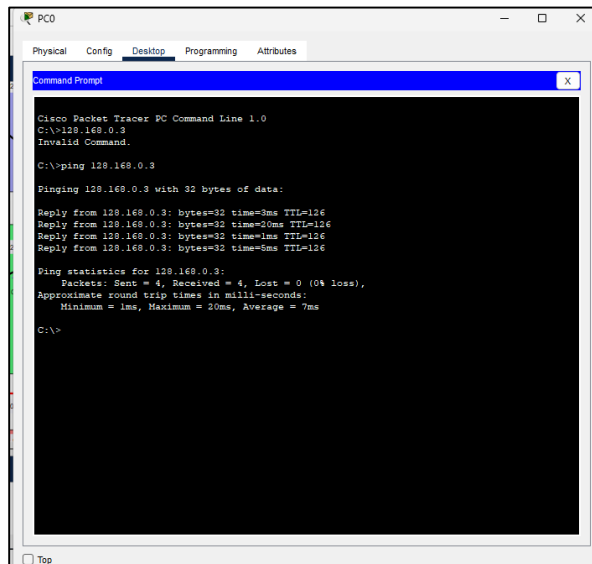
Ping statistics for 128.168.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 22ms, Average = 7ms

C:\>clear
Invalid Command.

C:\>cls
Invalid Command.

C:\>
```

☐ Top



PCO

Physical Config Desktop Programming Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>128.168.0.3
Invalid Command.

C:\>ping 128.168.0.3

Pinging 128.168.0.3 with 32 bytes of data:

Reply from 128.168.0.3: bytes=32 time=3ms TTL=126
Reply from 128.168.0.3: bytes=32 time=20ms TTL=126
Reply from 128.168.0.3: bytes=32 time=21ms TTL=126
Reply from 128.168.0.3: bytes=32 time=5ms TTL=126

Ping statistics for 128.168.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 20ms, Average = 7ms

C:\>
```

☐ Top

Simulation

File Edit Options View Tools Extensions Window Help

Logical Physical x: 1195, y: 302

Root 01:08:30

Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device
	0.902	Switch1	CS LAB 2
	0.902	Switch5	PC4
	0.903	PC4	Switch5
	0.904	--	Switch5
	0.904	Switch5	PC2
	0.904	--	Switch5

Reset Simulation ☒ Constant Delay Captured to: 0.904 s

Play Controls

Event List Filters - Visible Events

ACL Filter, ARP, BGP, Bluetooth, CAPWAP, CDP, DHCP, DHCPv6, DNS, DTP, EAPOL, EIGRP, EIGRPv6, FTP, H.323, HSRP, HSRPv6, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, IoT, IoT TCP, LACP, LLDP, NDP, NETFLOW, NTP, OSPF, OSPFv6, Rstp, POP3, PPP, PPPoE, FTP, RADIUS, REP, RIP, RIPv2, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, USB, VTP

Edit Filters Show All/None

Time: 00:00:48.521 PLAY CONTROLS

Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
	Successful	PC2	PC4	ICMP		0.000	N	0	(edit)
	Successful	PC2	PC4	ICMP		0.900	N	1	(edit)

09. SUMMARY

The outcome of the proposed system will be a fail-safe backbone network infrastructure which meets the requirements for readily available access to information and security of the private network and ensures optimized productivity when telecommunication services are accessed. The installed equipment allowed to organize high-speed wired and wireless Internet access throughout the whole complex of hospital buildings as well as providing transfer of all types of data throughout the single optimized network.

10. REFERENCES

1. Sun, L., Wu, J., Zhang, Y., & Yin, H. (2013, April). "Comparison between physical devices and simulator software for Cisco network technology teaching". In Computer Science & Education (ICCSE), 2013 8th International Conference on (pp. 1357-1360). IEEE
2. Roberto Minerva Abiy Biru, "Towards a Definition of the Internet of Things" IEEE IOT Initiative white paper.
3. "Design and Simulation of Local Area Network Using Cisco Packet Tracer". The International Journal of Engineering and Science (IJES) || Volume || 6 || Issue || 10 || Pages || PP 63- 77 || 2017 || ISSN (e): 2319 – 1813 ISSN (p): 2319 – 1805.
4. Qin, X. U. E. "Simulation Experimental Teaching of Computer Network Based on Packet Tracer [J]." Research and Exploration in Laboratory 2 (2010): 57-59.
5. Current, John R., Charles S. ReVelle, and Jared L. Cohon. "The hierarchical network design problem." European Journal of Operational Research 27.1 (1986): 57-66.