

Bus Depot Station Network Design
Virtual Cybersecurity Internship 2021 Report
Submitted
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Centre of Excellence
Cybersecurity & Networking

Duration 6 Weeks Virtual Internship

By

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DECLARATION

I hereby declare that the Project Report entitled “**Bus Depot Station Network Design**” under the course name “**AICTE Virtual Cybersecurity Internship**” in Department of “Information Technology” of “ABES ENGINEERING COLLEGE” is an authentic record of my own work carried out under the supervision of **MR. KRISHNA VIR SINGH**

Dated:

Signature of student:

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This to certify that the above statements made by the candidate are true and correct to the best of my knowledge.

Signature of Supervisor

ACKNOWLEDGEMENT

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I also take the opportunity to acknowledge the contribution of team members of Centre of Excellence: Cybersecurity & Networking for their full support and assistance during the development of the project.

I also do not like to miss the opportunity to acknowledge the motivation of the Information Technology Department and ABES Engineering College to provide us the opportunity to undergo AICTE Virtual Cybersecurity Internship at the Centre of Excellence: Cybersecurity & Networking.

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ABSTRACT

Cyber Security Plays an important role in the field of information technology. Securing the information has become one of the biggest challenges in the present day. Whenever we think about cyber security the first thing that comes to our mind is “cyber crimes” which are increasing immensely day by day. Various Governments and companies are taking many measures in order to prevent these cybercrimes. Besides various measures cyber security is still a very big concern to many.

Network Security protects your network and data from breaches, intrusions and other threats. This is a vast and overarching term that describes hardware and software solutions as well as processes or rules and configurations relating to network use, accessibility, and overall threat protection.

A good network security system helps businesses reduce the risk of falling victim to data theft and sabotage. Network security helps protect your workstations from harmful spyware. It also ensures that shared data is kept secure.

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CHAPTER 1

COURSE DESCRIPTION

Begin preparing for a networking career with this introduction to how networks operate. This first course in the 3-course CCNA series introduces architectures, models, protocols, and networking elements – functions needed to support the operations and priorities of Fortune 500 companies to small innovative retailers. You'll even get the chance to build simple local area networks (LANs). Developing a working knowledge of IP addressing schemes, foundational network security, you'll be able to perform basic configurations for routers and switches. No prerequisites required. After completing all three CCNA courses, you are ready to take the CCNA Certification.

You'll Learn These Core Skills:

Build simple LANs, perform basic configurations for routers and switches, and implement IPv4 and IPv6 addressing schemes.

Configure routers, switches, and end devices to provide access to local and remote network resources and to enable end-to-end connectivity between remote devices . Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer . Configure and troubleshoot connectivity a small network using security best practices. Designed for Distance Learning

A distance learning option is available for this course. Lab activities can be completed with Packet Tracer if lab equipment is not available.

CHAPTER 2

INTRODUCTION

2.1 Aim of the Project: To design a secure network for Bus Depot Station.

2.2 Objective of the Project:

- Simulate the typical network architecture for "Bus Depot Network" on packet tracer tool, wherein End User can book the ticket by accessing Bus Depot website/Application via their own devices (Desktop/Laptop/Mobile).
- Demonstrate the concept of IP addressing, VLAN segmentation, CIDR, WLAN using various network devices like Core Switch (L3), Access Switches, routers, WLAN, Access points, servers and endpoints (Desktops/Laptops/Mobile devices)

2.3 Scope of the Project:

Creating the following:

- Separate segments for WEB, APP and DB
- Separate User segments for various IT and NON-IT department like Billing, Accounts, Admin etc.
- ISP connectivity to Web Server for End user to connect to website/application.

- WLAN and Wireless access points.

2.4 Future Scope of the Project:

Use of Network Firewall to restrict and filter both inbound and outbound traffic from the network. Also to restrict the access and traffic flow in the internal network. Use NAT rules to translate the private (not globally unique) addresses in the internal network into legal addresses (Public IP), before packets are forwarded to another network.

CHAPTER 3

DESCRIPTION

A bus garage, also known as a bus depot, bus base or bus barn, is a facility where buses are stored and maintained. In many conurbations, bus garages are on the site of former car barns or tram sheds, where trams (streetcars) were stored, and the operation transferred to buses. In other areas, garages were built to replace horsebus yards or on virgin sites when populations were not as high as now.

- We need to simulate the typical network architecture for "Bus Depot Network" on packet tracer tool, wherein End User can book the ticket by accessing Bus Depot website/Application via their own devices (Desktop/Laptop/Mobile).
- Demonstrate the concept of IP addressing, VLAN segmentation, CIDR, WLAN using various network devices like Core Switch (L3), Access Switches, routers, WLAN, Access points, servers and endpoints (Desktops/Laptops/Mobile devices).

CHAPTER 4

TOOL DESCRIPTION

Tool Name: Packet Tracer

4.1 Introduction to Packet Tracer: Packet Tracer is a cross-platform visual simulation tool designed by Cisco Systems that allows users to create network topologies and imitate modern computer networks. The software allows users to simulate the configuration of Cisco routers and switches using a simulated command line interface. Packet Tracer makes use of a drag and drop user interface, allowing users to add and remove simulated network devices as they see fit. The software is mainly focused towards Certified Cisco Network Associate Academy students as an educational tool for helping them learn fundamental CCNA concepts.

4.2 Different tools in Packet Tracer:

4.2.1 Network Devices

a. Switch:

A network switch is networking hardware that connects devices on a computer network by using packet switching to receive and forward data to the destination device. It is a multiport network bridge that uses MAC addresses to forward data at the data link layer (layer 2) of the OSI model.

b. Multi-Layer Switch:

Multilayer switches support Switch Virtual Interfaces (SVIs), logical interfaces that can perform routing. They behave like a physical interface of a router: they have an IP address, and they insert a connected route into the routing table. However, they are completely virtual.

c. Router:

A router is a networking device that forwards data packets between computer networks. Routers perform the traffic directing functions on the Internet. Data sent through the internet, such as a web page or email, is in the form of data packets. A packet is typically forwarded from one router to another router through the networks that constitute an internetwork (e.g., the Internet) until it reaches its destination node.

d. Wireless Access Point:

wireless access point (WAP), or more generally just access point (AP), is a networking hardware device that allows other Wi-Fi devices to connect to a wired network. As a standalone device, the AP may have a wired connection to a router, but, in a wireless router, it can also be an integral component of the router itself. An AP is differentiated from a hotspot which is a physical location where Wi-Fi access is available.

4.2.2 Cables

a. Straight-Through Cable:

Straight-through cable is a type of twisted pair copper wire cable for local area network (LAN) use for which the RJ-45 connectors at each end have the same pinout (i.e., arrangement of conductors). Straight-through cable is also commonly referred to as patch cable.

b. Crossover Cable:

A crossover cable is a type of twisted pair copper wire cable for LANs (local area network) in which the wires on the cable are crossed over so that the receive

signal pins on the RJ-45 connector on one end are connected to the transmit signal pins on the RJ-45 connector on the other end.

4.2.3 End Devices

a. PC (Personal Computer):

A personal computer (PC) is a multi-purpose computer whose size, capabilities, and price make it feasible for individual use. Personal computers are intended to be operated directly by an end user, rather than by a computer expert or technician. Unlike large, costly minicomputers and mainframes, time-sharing by many people at the same time is not used with personal computers.

b. Laptop:

A laptop, laptop computer, or notebook computer is a small, portable personal computer (PC) with a screen and alphanumeric keyboard. These typically have a "clamshell" form factor, typically having the screen mounted on the inside of the upper lid and the keyboard on the inside of the lower lid, although 2-in-1 PCs with a detachable keyboard are often marketed as laptops or as having a "laptop mode." Laptops are folded shut for transportation, and thus are suitable for mobile use. Its name comes from lap, as it was deemed practical to be placed on a person's lap when being used. Today, laptops are the used in a variety of settings, such as at work, in education, for playing games, web browsing, for personal multimedia, and general home computer use.

c. Mobile Phone:

A mobile phone, cellular phone, cell phone, cellphone, handpone, or hand phone, sometimes shortened to simply mobile, cell or just phone, is a portable telephone that can make and receive calls over a radio frequency link while the user is moving within a telephone service area. The radio frequency link establishes a connection to the switching systems of a mobile phone operator, which provides access to the public switched telephone network (PSTN).

d. Server:

A server is a piece of computer hardware or software (computer program) that provides functionality for other programs or devices, called "clients". This architecture is called the client–server model. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client. A single server can serve multiple clients, and a single client can use multiple servers. A client process may run on the same device or may connect over a network to a server on a different device. Typical servers are database servers, file servers, mail servers, print servers, web servers, game servers, and application servers.

CHAPTER 5

IMPLEMENTATION AND RESULTS

5.1 Implementation:

By using Packet Tracer, the following network is created for Bus Depot System.

5.1.1 Segmentation:

There are 10 segments in the network topology, which are as follows:

Segment-1: WLAN

It is created in VLAN 1.

IP Address ranges from 192.168.1.1 to 192.168.1.255

Segment-2: Admin Management

It is created in VLAN 2.

IP Address ranges from 192.168.2.1 to 192.168.2.255

Segment-3: Account Department

It is created in VLAN 3.

IP Address ranges from 192.168.3.1 to 192.168.3.255

Segment-4: Reservation Department

It is created in VLAN 4.

IP Address ranges from 192.168.4.1 to 192.168.4.255

Segment-5: Billing Department

It is created in VLAN 5.

IP Address ranges from 192.168.5.1 to 192.168.5.255

Segment-6: Database Server

It is created in VLAN 6.

IP Address ranges from 192.168.6.1 to 192.168.6.255

Segment-7: Web Server

It is created in VLAN 7.

IP Address ranges from 192.168.7.1 to 192.168.7.255

Segment-8: Support Server

It is created in VLAN 8.

IP Address ranges from 192.168.8.1 to 192.168.8.255

Segment-9: App Server

It is created in VLAN 9.

IP Address ranges from 192.168.9.1 to 192.168.9.255

Segment-10: L3 Switch connection to Router

IP Address ranges from 192.168.10.1 to 192.168.10.255

Segment-11: Outside Network

IP Address ranges from 192.168.11.1 to 192.168.11.255

5.1.2 Commands Used:

a. Basic configuration:

1. enable
2. configure terminal
3. hostname
4. enable secret password
5. service password-encryption
6. banner motd

b. VLans Command:

1. int fa0/0
2. switchport mode access
3. switch access vlan
4. ip routing
5. ip add 192.168.1.0 255.255.255.0
6. no shutdown

c. Checking Connectivity

ping ip address

5.2 Screenshots of the Result:

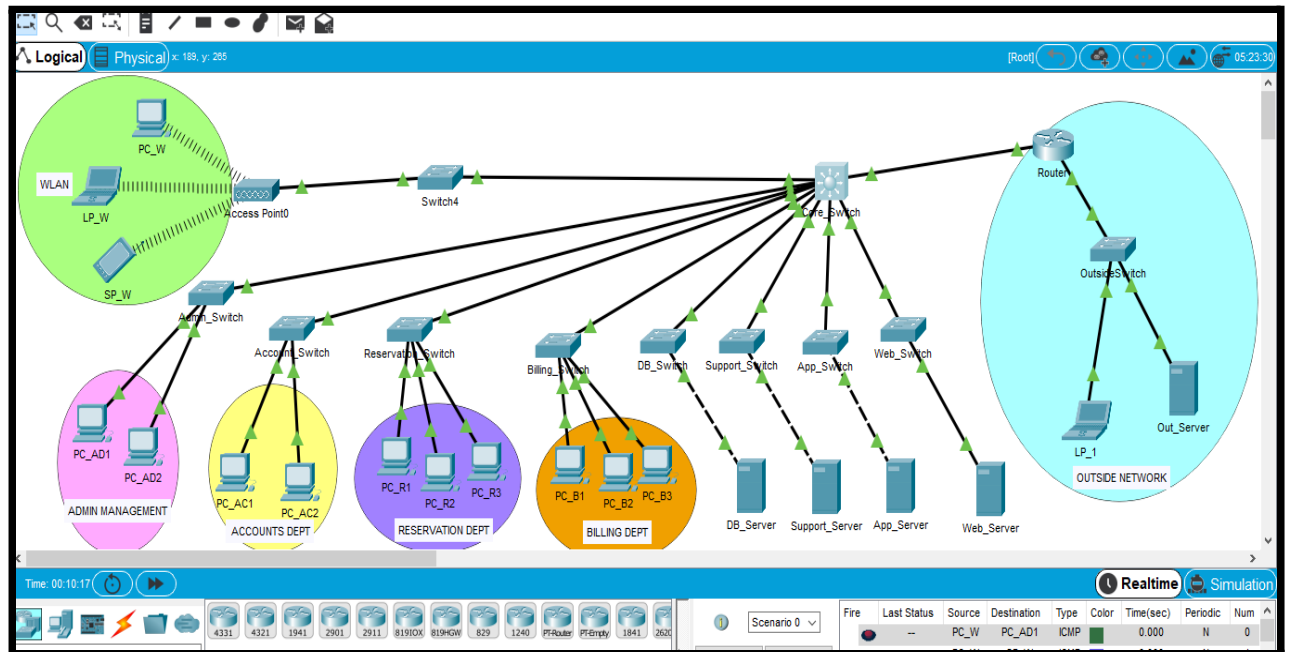


Figure-1: Complete Network Design

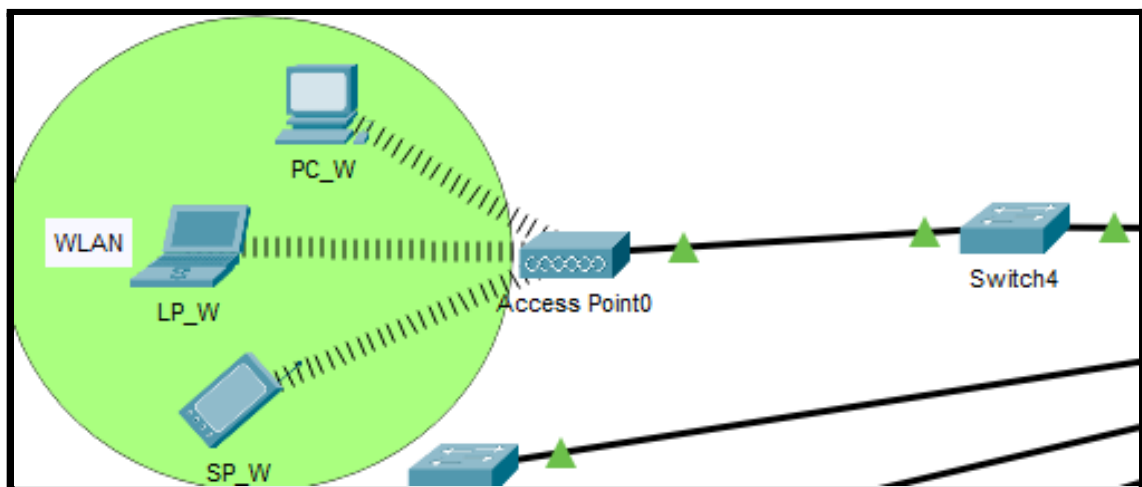


Figure-2: WLAN

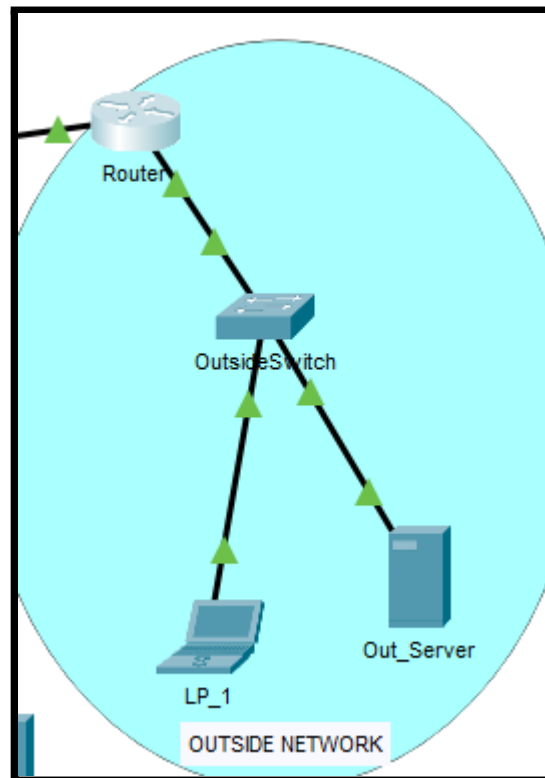


Figure-3: Outside Network

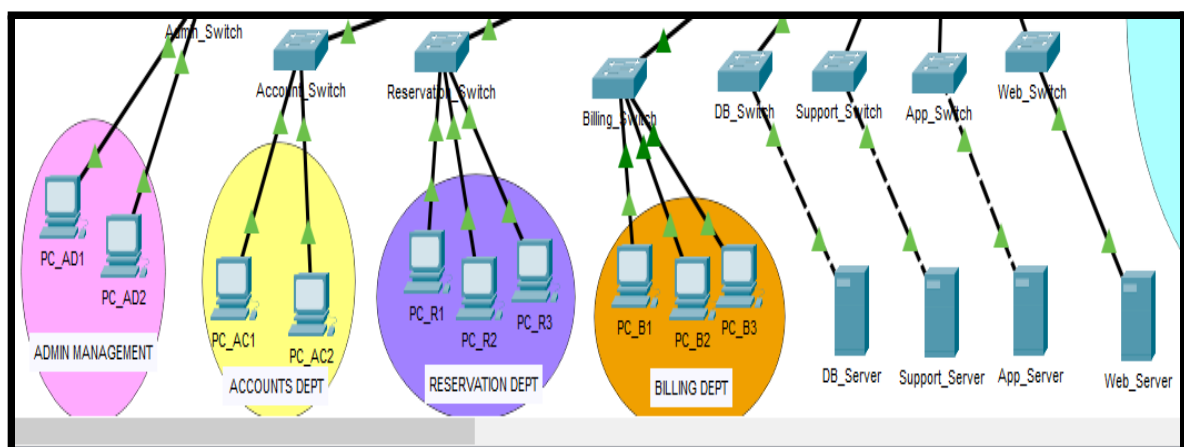
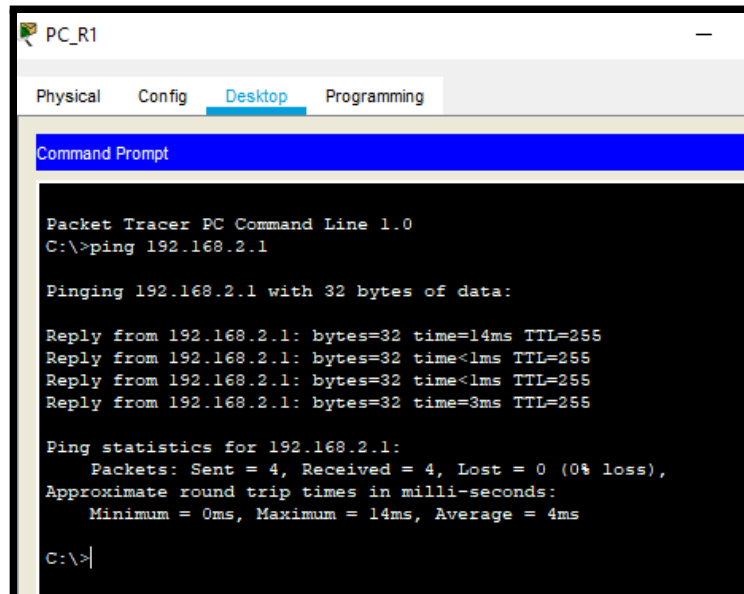


Figure-4: Inside Network



The screenshot shows a Packet Tracer PC window for PC_R1. The 'Desktop' tab is selected, and the 'Command Prompt' application is open. The command prompt displays the output of a 'ping 192.168.2.1' command. The output shows four successful replies with varying round-trip times (14ms, 1ms, 1ms, 3ms) and a TTL of 255. The ping statistics indicate 4 packets sent, 4 received, and 0% loss, with an average round-trip time of 4ms.

```
PC_R1
Physical Config Desktop Programming
Command Prompt
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.1

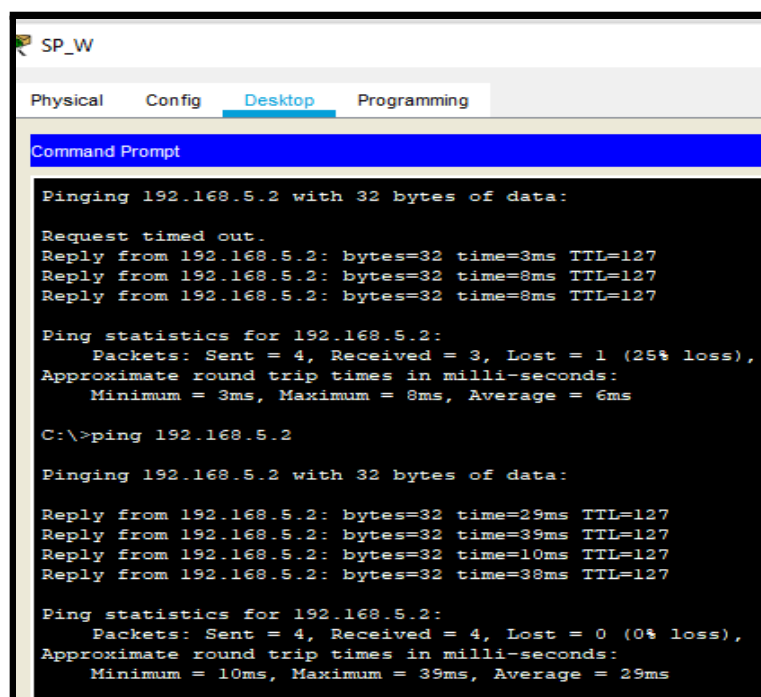
Pinging 192.168.2.1 with 32 bytes of data:

Reply from 192.168.2.1: bytes=32 time=14ms TTL=255
Reply from 192.168.2.1: bytes=32 time<1ms TTL=255
Reply from 192.168.2.1: bytes=32 time<1ms TTL=255
Reply from 192.168.2.1: bytes=32 time=3ms TTL=255

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 14ms, Average = 4ms

C:\>|
```

Figure-5: Pinging from Reservation Department PC - “PC_R1” to Admin Management PC- “PC_AD1”



The screenshot shows a Packet Tracer Smart Device window for SP_W. The 'Desktop' tab is selected, and the 'Command Prompt' application is open. The command prompt displays the output of two 'ping 192.168.5.2' commands. The first attempt results in a 'Request timed out.' followed by three successful replies with round-trip times of 3ms, 8ms, and 8ms. The statistics show 4 packets sent, 3 received, and 25% loss. The second attempt shows four successful replies with round-trip times of 29ms, 39ms, 10ms, and 38ms. The statistics show 4 packets sent, 4 received, and 0% loss.

```
SP_W
Physical Config Desktop Programming
Command Prompt

Pinging 192.168.5.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.5.2: bytes=32 time=3ms TTL=127
Reply from 192.168.5.2: bytes=32 time=8ms TTL=127
Reply from 192.168.5.2: bytes=32 time=8ms TTL=127

Ping statistics for 192.168.5.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 8ms, Average = 6ms

C:\>ping 192.168.5.2

Pinging 192.168.5.2 with 32 bytes of data:

Reply from 192.168.5.2: bytes=32 time=29ms TTL=127
Reply from 192.168.5.2: bytes=32 time=39ms TTL=127
Reply from 192.168.5.2: bytes=32 time=10ms TTL=127
Reply from 192.168.5.2: bytes=32 time=38ms TTL=127

Ping statistics for 192.168.5.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 10ms, Maximum = 39ms, Average = 29ms
```

Figure-6: Pinging from WLAN Smart Device - “SP_W” to Billing Department PC- “PC_B1”

The screenshot shows a Windows Command Prompt window titled "LP_1". The window has tabs for "Physical", "Config", "Desktop" (which is selected), and "Programming". The Command Prompt displays the output of a ping command to 192.168.4.2. The first attempt shows a "Request timed out." followed by three successful replies. The second attempt shows four successful replies. The ping statistics for 192.168.4.2 are shown at the end of each attempt.

```
LP_1
Physical Config Desktop Programming
Command Prompt

Pinging 192.168.4.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.4.2: bytes=32 time=3ms TTL=126
Reply from 192.168.4.2: bytes=32 time=13ms TTL=126
Reply from 192.168.4.2: bytes=32 time=11ms TTL=126

Ping statistics for 192.168.4.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 13ms, Average = 9ms

C:\>ping 192.168.4.2

Pinging 192.168.4.2 with 32 bytes of data:

Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=12ms TTL=126
Reply from 192.168.4.2: bytes=32 time=3ms TTL=126
Reply from 192.168.4.2: bytes=32 time=13ms TTL=126

Ping statistics for 192.168.4.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 13ms, Average = 7ms

C:\>
```

Figure-7: Pinging from Outside Network Laptop “LP 1” to Reservation Department PC - “PC-R1”

The screenshot shows the Core_Switch CLI interface. The window has tabs for "Physical", "Config", and "CLI" (which is selected). The interface displays the "IOS Command Line Interface" and prompts the user to press RETURN to get started. It then shows the "Authorized Access Only on CoreSwitch!!" message and the "User Access Verification" section. The user is prompted to enter a password, and the prompt changes from "Core_Switch>" to "Core_Switch#" after the password is entered.

```
Core_Switch
Physical Config CLI
IOS Command Line Interface

Press RETURN to get started.

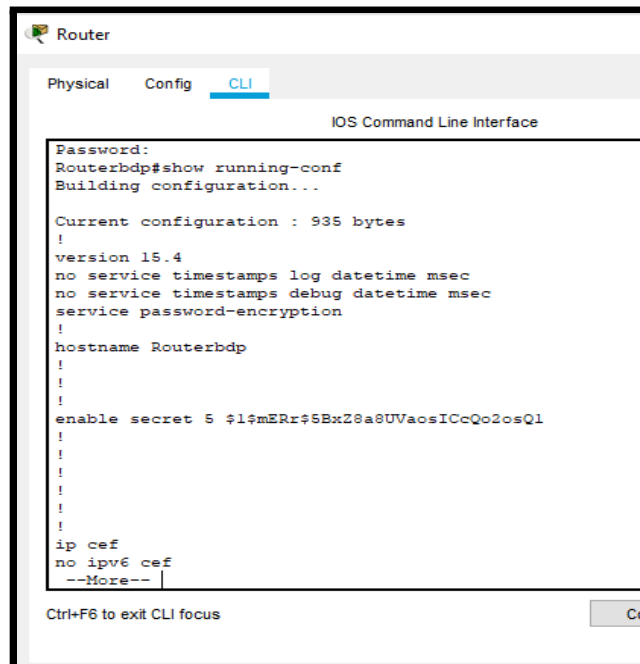
Authorized Access Only on CoreSwitch!!

User Access Verification

Password:
Core_Switch>en
Password:
Password:
Core_Switch#

Ctrl+F6 to exit CLI focus
```

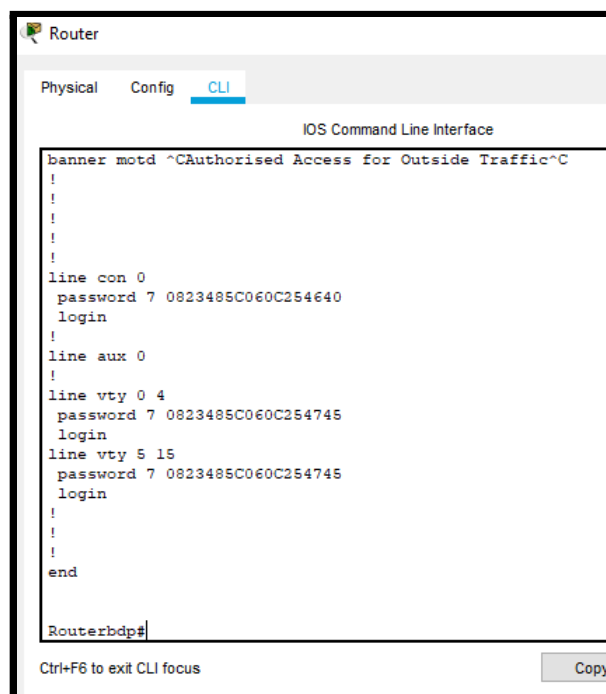
Figure-8: Basic Configuration



```
Router
Physical Config CLI
IOS Command Line Interface
Password:
Routerbdp#show running-conf
Building configuration...

Current configuration : 935 bytes
!
version 15.4
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
!
hostname Routerbdp
!
!
!
enable secret 5 $1$mERr$5BxZ8a8UVaosICcQo2osQ1
!
!
!
!
!
ip cef
no ipv6 cef
--More--
```

Figure-9: enable secret password



```
Router
Physical Config CLI
IOS Command Line Interface
banner motd ^CAuthorised Access for Outside Traffic^C
!
!
!
!
!
line con 0
password 7 0823485C060C254640
login
!
line aux 0
!
!
line vty 0 4
password 7 0823485C060C254745
login
line vty 5 15
password 7 0823485C060C254745
login
!
!
!
end
Routerbdp#
```

Figure-10: All password are encrypted

CONCLUSION

Network security is an important field that is getting more and more attention as the internet expands. The security threats and internet protocol should be analyzed to determine the necessary security technology. The security technology consists of mostly software based, as well as various hardware devices. In addition, network Security consists of the provisions made in an underlying computer network infrastructure, policies adopted by the network administrator to protect the network and the network-accessible resources from unauthorized access and the effectiveness (or lack) of these measures combined together.

REFERENCES

- www.netacad.com
- Fundamentals of Network Security
 - Eric Maiwald