Design and Implementation of End to End Secured Campus Area Network

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Project Guide
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Introduction

- Campus Area Network (CAN) is a group of interconnected Local Area Networks (LAN) within a limited geographical area like school campus, university campus, military bases, or organizational campuses and corporate buildings.
- Example of CAN : Let's think about a university where university networks interconnect academic building, admission building, library, account section, examination section, placement section etc of an institution when connected with each other combine to form Campus Area Network (CAN).

Motivation:

- The core motivation behind developing this project is to maximize security on campus in the era of ever increasing data and various threats and attacks associated to it.
- As college data is very crucial when it comes to any level of the campus network so to prevent any privacy breach of any entity a secured network is very much necessary.
- With the Pandemic, Things going virtual and studying/working from home has become the new normal, the security aspect must go hand in hand to ensure smooth functioning of life on virtual campus.
- To prevent malicious attacks which has potential to hamper the life of a student or faculty

Literature Survey

Publisher	Year	Author	Title	Summary	Gaps Identified	Problem Solved
IJRTE	2019	Mugdha Sharma, Chirag Pupreja, Akash Arora	Design and Implementation of University Network	This paper presents the design of campus area network using Bus topology	There are various topologies for designing a network which were quite expensive.	In the current network we have used bus topology as it is a cost effective

Literature Survey

Publisher	Year	Author	Title	Summary	Gaps Identified	Problems Solved
IJETTCS	2014	S. Sudharsan, M. Naga Srinivas, G. Sai Shabareesh, P.Kiran Rao	Campus Network Security And Management	This paper presents the design of campus area network using star topology	Inter department Communication was not possible.	In the current network we have used VLANs for inter department communication using InterVLAN Routinng

Literature Survey

Publisher	Year	Author	Title	Summary	Gaps Identified	Problems Solved
IJPAM	2017	G.Michael	Design And Implementation Of A Secure Campus Network	This paper represented the current network security of the campus network, analyzes security threats to campus network and represented the ways to solve it.	There were various network attacks due to which campus area was not secured.	By making hierarchical network design, the network could resist most of network attacks and hence security was improved

Literature Survey

Publisher	Year	Author	Title	Summary	Gaps Identified	Problems Solved
Researchgate	2011	Lalita Kumari, Swapan Debbar ma, Radhey Shyam	Security Problems in Campus Network and Its Solutions	This paper represents the current security status of the campus network and to analyze security threats to campus network	As campus area network is vast and due to its complex network there are many network security issues which needs to be resolved	Using Firewall technology, VLAN, encryption technology, VPN, multiple operating system at server side enchances network security

Problem Statement

- Campus network faces the security challenges which are influenced by network infrastructure.
- Secured network will guard valuable data and information of an organization from security attacks associated with network.
- To maintain data privacy and campus integrity the campus network needs to have secure network design to protect from different types of threats and attacks.

Objectives

- Design of Secured Robust Campus Area Network.
- Creation of VLANs, OSPFs, ACLs and implementing firewall for internal and external security of network.
- For security of the network, we will identify the threats which can happen in a campus area network and analyze them.
- Validation of Small network using Hardware Setup.

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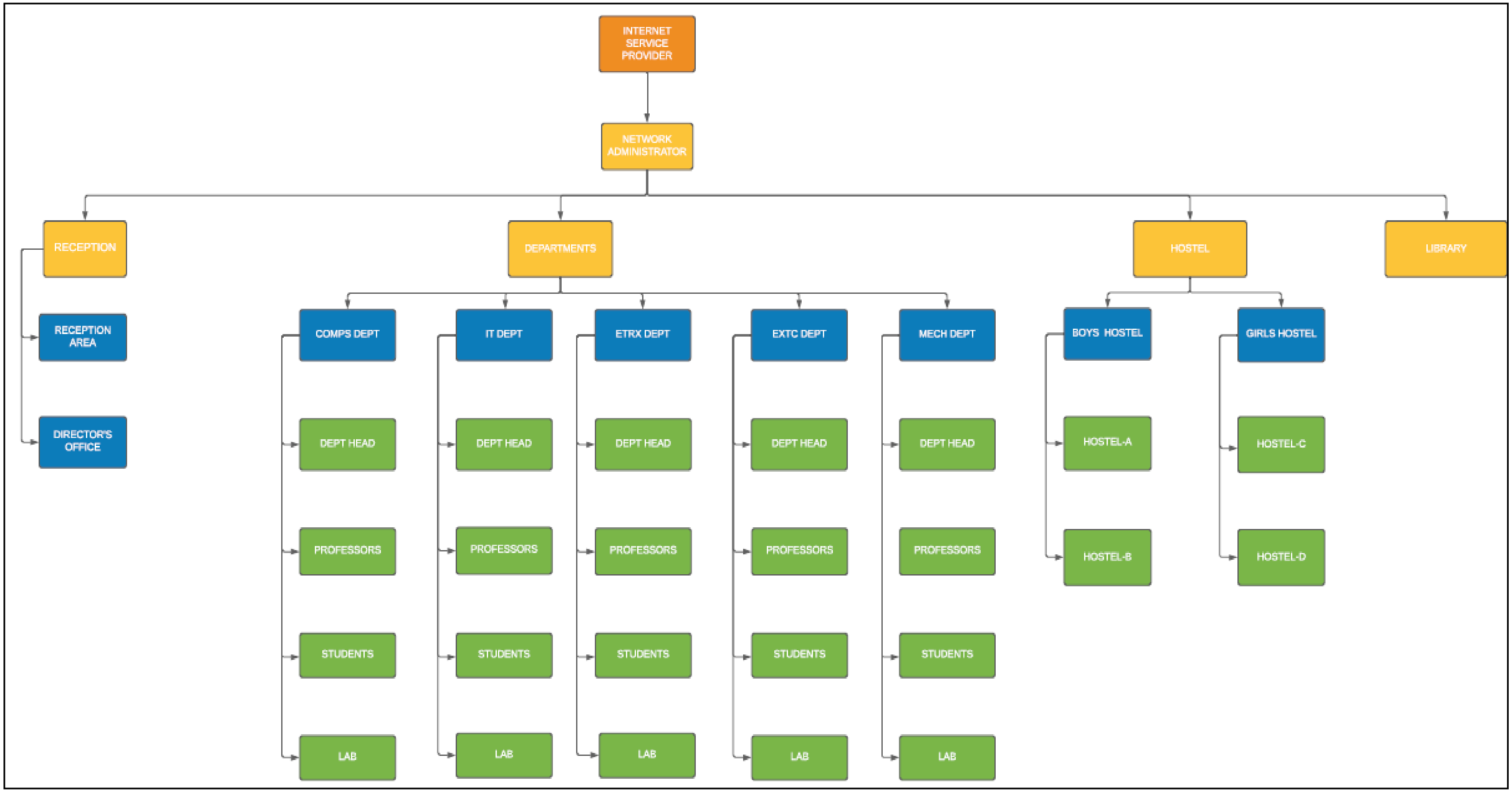
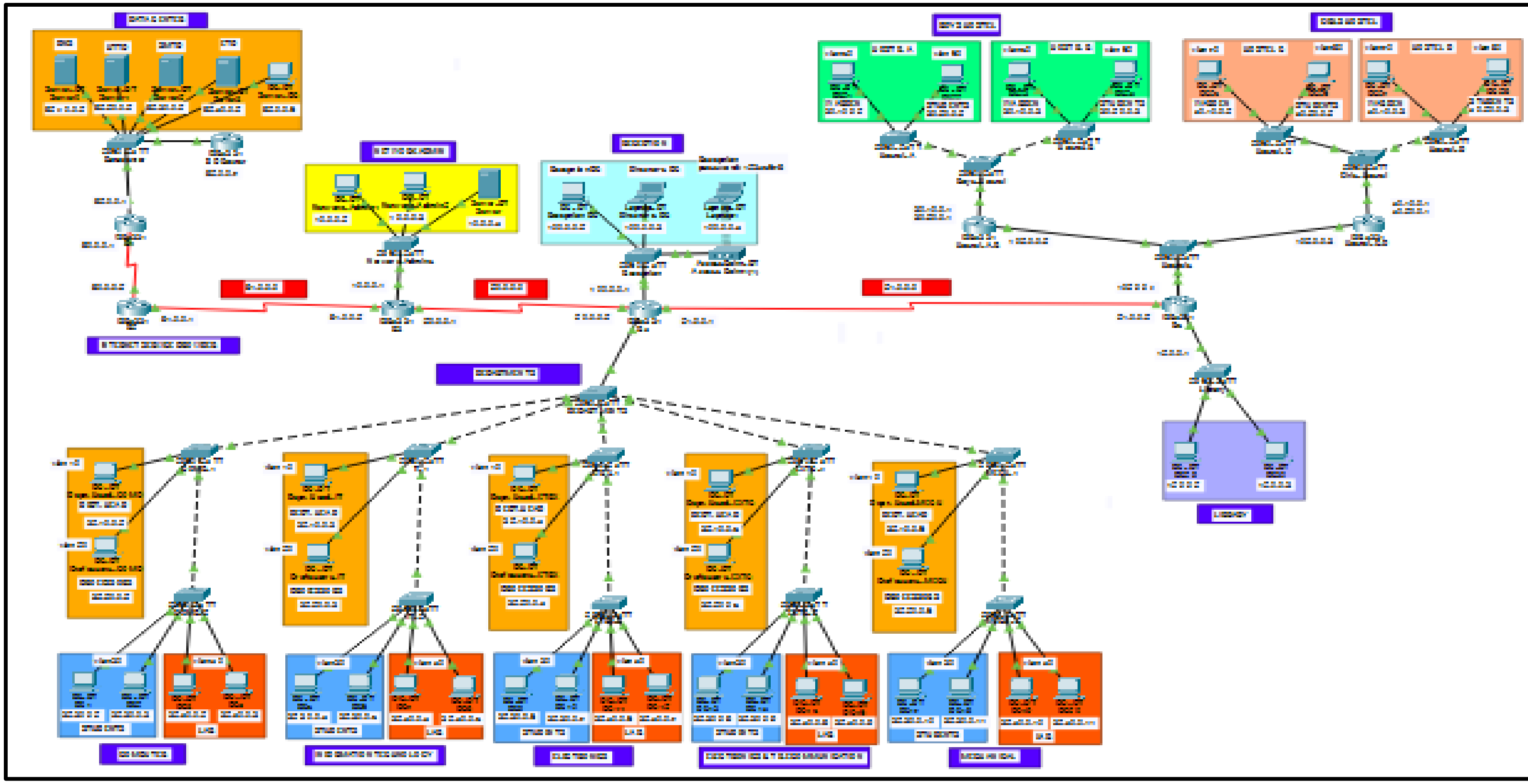
Flowchart



Network Topology



Methodology

1) Virtual LANs (VLANs)

- Created vlans for Dept. Head, Professors, Students and lab for Each of the 5 Departments.
- Created vlans for Boys Hostel (Hostel-A, Hostel-B) and Girls Hostel (Hostel-C, Hostel-D).
- In Boys Hostel, anyone can communicate within Hostel-A,B
- In Girls Hostel, anyone can communicate within Hostel-C,D

Methodology

2) InterVLAN Routing (Router on stick method)

- Inter VLAN routing is a process in which we make different virtual LANs communicate with each other irrespective of where the VLANs are present (on same switch or different switch).
- Inter Vlan Routing can be achieved through a layer-3 device i.e. Router or layer-3 Switch. When the Inter VLAN Routing is done through Router it is known as Router on a stick.

3) SSH Configuration on Network Admin's Router and Switch

Demonstration

Results

From Computer Department: Dept. Head can communicate with professors, students, lab of Computer Department and can also communicate with other department's Dept. head, professors, students and lab

Dept. Head-COMP

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 32.20.0.2

Pinging 32.20.0.2 with 32 bytes of data:

Reply from 32.20.0.2: bytes=32 time<1ms TTL=127
Reply from 32.20.0.2: bytes=32 time<1ms TTL=127
Reply from 32.20.0.2: bytes=32 time=1ms TTL=127
Reply from 32.20.0.2: bytes=32 time<1ms TTL=127

Ping statistics for 32.20.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
C:\>ping 32.30.0.2

Pinging 32.30.0.2 with 32 bytes of data:

Reply from 32.30.0.2: bytes=32 time<1ms TTL=127
Reply from 32.30.0.2: bytes=32 time<1ms TTL=127
Reply from 32.30.0.2: bytes=32 time=35ms TTL=127
Reply from 32.30.0.2: bytes=32 time<1ms TTL=127

Ping statistics for 32.30.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 35ms, Average = 8ms

C:\>ping 32.40.0.2

Pinging 32.40.0.2 with 32 bytes of data:

Reply from 32.40.0.2: bytes=32 time<1ms TTL=127
Reply from 32.40.0.2: bytes=32 time=1ms TTL=127
Reply from 32.40.0.2: bytes=32 time<1ms TTL=127
Reply from 32.40.0.2: bytes=32 time=3ms TTL=127

Ping statistics for 32.40.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 3ms, Average = 1ms
```

Results

Dept. Head-COMP

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
C:\>ping 32.40.0.4

Pinging 32.40.0.4 with 32 bytes of data:

Reply from 32.40.0.4: bytes=32 time<1ms TTL=127
Reply from 32.40.0.4: bytes=32 time=1ms TTL=127
Reply from 32.40.0.4: bytes=32 time<1ms TTL=127
Reply from 32.40.0.4: bytes=32 time<1ms TTL=127

Ping statistics for 32.40.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
C:\>ping 32.10.0.3

Pinging 32.10.0.3 with 32 bytes of data:

Reply from 32.10.0.3: bytes=32 time<1ms TTL=128
Reply from 32.10.0.3: bytes=32 time<1ms TTL=128
Reply from 32.10.0.3: bytes=32 time<1ms TTL=128
Reply from 32.10.0.3: bytes=32 time<1ms TTL=128

Ping statistics for 32.10.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 32.20.0.3

Pinging 32.20.0.3 with 32 bytes of data:

Reply from 32.20.0.3: bytes=32 time<1ms TTL=127
Reply from 32.20.0.3: bytes=32 time<1ms TTL=127
Reply from 32.20.0.3: bytes=32 time<1ms TTL=127
Reply from 32.20.0.3: bytes=32 time<1ms TTL=127

Ping statistics for 32.20.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Results

Professors-COMP

Physical | Config | Desktop | Programming | Attributes

Command Prompt

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 32.30.0.2

Pinging 32.30.0.2 with 32 bytes of data:

Reply from 32.30.0.2: bytes=32 time=1ms TTL=127
Reply from 32.30.0.2: bytes=32 time=1ms TTL=127
Reply from 32.30.0.2: bytes=32 time=1ms TTL=127
Reply from 32.30.0.2: bytes=32 time<1ms TTL=127

Ping statistics for 32.30.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
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C:\>ping 32.40.0.3

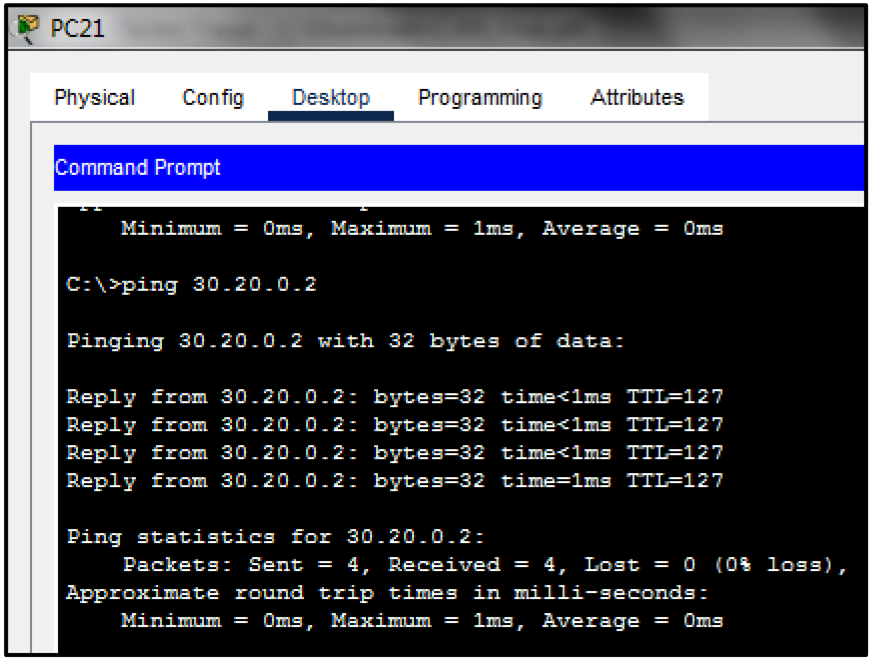
Pinging 32.40.0.3 with 32 bytes of data:

Reply from 32.40.0.3: bytes=32 time=1ms TTL=127
Reply from 32.40.0.3: bytes=32 time<1ms TTL=127
Reply from 32.40.0.3: bytes=32 time<1ms TTL=127
Reply from 32.40.0.3: bytes=32 time<1ms TTL=127

Ping statistics for 32.40.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

Results

From Hostel-A: Warden from Hostel-A can communicate with students of Hostel-A and also warden, students of Hostel-B




```
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 30.20.0.2

Pinging 30.20.0.2 with 32 bytes of data:

Reply from 30.20.0.2: bytes=32 time<1ms TTL=127
Reply from 30.20.0.2: bytes=32 time<1ms TTL=127
Reply from 30.20.0.2: bytes=32 time<1ms TTL=127
Reply from 30.20.0.2: bytes=32 time=1ms TTL=127

Ping statistics for 30.20.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
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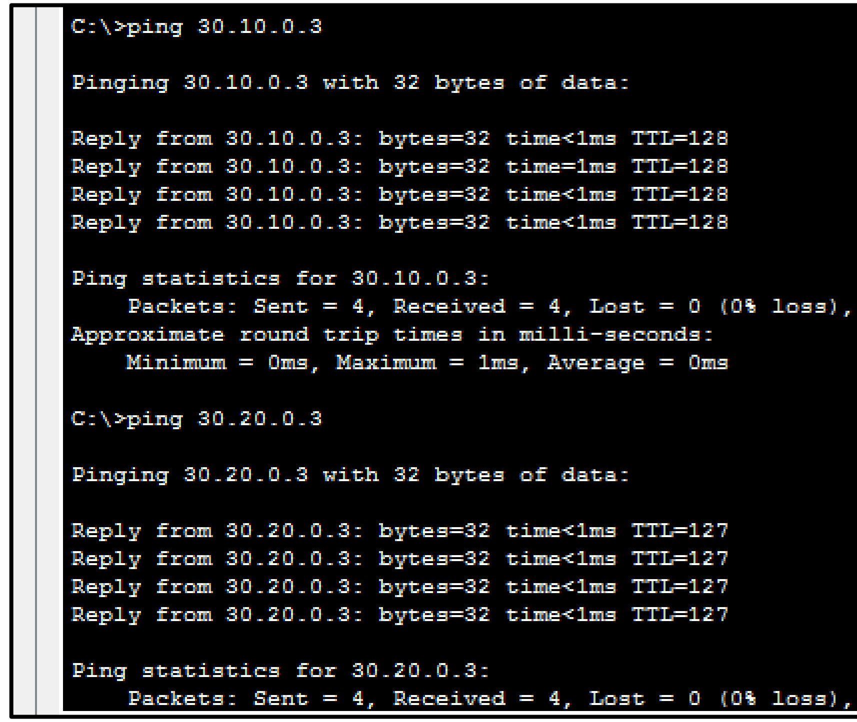

```
C:\>ping 30.10.0.3

Pinging 30.10.0.3 with 32 bytes of data:

Reply from 30.10.0.3: bytes=32 time<1ms TTL=128
Reply from 30.10.0.3: bytes=32 time=1ms TTL=128
Reply from 30.10.0.3: bytes=32 time<1ms TTL=128
Reply from 30.10.0.3: bytes=32 time<1ms TTL=128

Ping statistics for 30.10.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 30.20.0.3

Pinging 30.20.0.3 with 32 bytes of data:

Reply from 30.20.0.3: bytes=32 time<1ms TTL=127
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Reply from 30.20.0.3: bytes=32 time<1ms TTL=127
Reply from 30.20.0.3: bytes=32 time<1ms TTL=127

Ping statistics for 30.20.0.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

Conclusion

- The network is fully featured with ISP, Data Center, Network administration, interconnection of various departments, Hostels and library.
- Network architecture and its security are necessary for any organization.
- Maintenance of high efficiency of campus network is main problem that need to be resolved.

Future Work

- Creating OSPFs, ACLs and implementing ASA firewall
- Limiting bandwidth and access to internet to specific users in the network
- Conduct a survey at data center to learn about possible attacks and disaster recovery and thereby implementing it on mininet software
- Identify and analyze threats and take preventive measures
- Validation of Small network using Hardware Setup.

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THANK YOU