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CS2120 COMPUTER NETWORKS

Mini Project Report

University Networking

Submitted

By

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CERTIFICATE

Certified that the CS2120 Computer Networks Mini Project work titled University Networking is carried out by Bhumika G (1RVU23CSE111), Aniketh Chakravarthy S (1RVU23CSE057), Bhuvana S (1RVU23CSE118) who are bonafide students of the School of Computer Science and Engineering, RV University, Bengaluru, during the year 2024–25. It is certified that all corrections/ suggestions from all the continuous internal evaluations have been incorporated into the project and in this report.

Dr./ Prof. Dr. Rashmi S

Faculty Guide

Dr. Sudhakar K. N

Program Director

1. Problem statement

With increasing reliance on digital infrastructure within educational campuses, there is a pressing requirement for a secure, well-designed, and scalable campus network to serve academic and administrative functions with minimal disruption. Universities tend to struggle with network overload, inefficient interdepartmental communication, lack of access to central resources, and security issues through unsegmented networks. The project intends to model an extensive university campus network on Cisco Packet Tracer with the use of vital networking devices like routers, switches, PCs, printers, and dedicated servers. With the use of Virtual LANs (VLANs), the network is logically divided to increase performance, eliminate unnecessary traffic, and make data more secure. The objective is to create a durable network design that will provide uncompromised access to web, email services, facilitate departmental separation, and offer an expandable framework for future growth.

2. Introduction

In the modern era of digital technology, educational institutions rely significantly on scalable and resilient network infrastructures to facilitate their academic and administrative processes. As more and more reliance is being placed on online learning platforms, communication tools, and data-based services, universities need to ensure that their networks are efficient and secure. This project aims to design and simulate a university campus network that fulfills these expanding requirements using Cisco Packet Tracer.

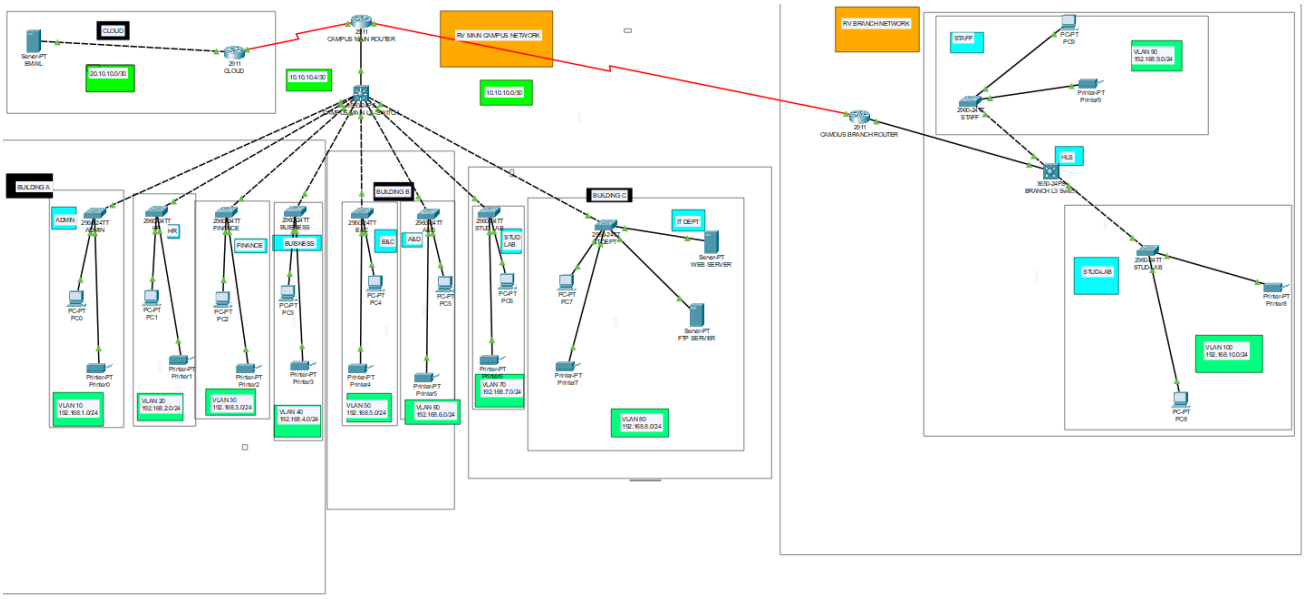
The virtual network is a representative university setup with several departments, staff offices, student workstations, and centralized facilities. For ensuring uninterrupted access to essential resources like web and email services, the network is structured with a topology that ensures reliability, manageability, and scalability. The network also facilitates smooth communication between departments while ensuring effective utilization of resources.

One of the most important features that have been incorporated in this project is Virtual Local Area Networks (VLANs). VLANs enable logical partitioning of the network into departments or functions, which enables the reduction of broadcast traffic, improves security, and enhances overall performance. Partitioning ensures each department works in its own secure network space without losing the ability to communicate with other departments when needed.

The simulation also includes important networking protocols and services like Dynamic Host Configuration Protocol (DHCP) for IP addressing on the fly, and Domain Name System (DNS) for resolving hostnames. Additionally, the support for web and email servers proves how central services can be served and accessed optimally within a campus network. Routers and switches are also configured to support inter-VLAN communication and packet forwarding.

Through the simulation of this network, the project intends to show an actual-world method of resolving typical networking issues universities encounter. It emphasizes the need for careful network planning and exposes students to relevant industry technologies and practices, setting a solid groundwork for future networking projects and career applications.

3 Network Diagram



4. Configuration setup

PC0

- IP Address: 192.168.1.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.1.1
- DNS Server: 192.168.1.1

PC1

- IP Address: 192.168.2.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.2.1
- DNS Server: 192.168.2.1

PC2

- IP Address: 192.168.3.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.3.1
- DNS Server: 192.168.3.1

PC3

- IP Address: 192.168.4.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.4.1
- DNS Server: 192.168.4.1

PC4

- IP Address: 192.168.5.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.5.1
- DNS Server: 192.168.5.1

PC5

- IP Address: 192.168.6.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.6.1
- DNS Server: 192.168.6.1

PC6

- IP Address: 192.168.7.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.7.1
- DNS Server: 192.168.7.1

PC7

- IP Address: 192.168.8.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.8.1
- DNS Server: 192.168.8.1

PC8

- IP Address: 192.168.10.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.10.1
- DNS Server: 192.168.10.1

PC9

- IP Address: 192.168.9.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.9.1
- DNS Server: 192.168.9.1

Router 0

- Hostname: Router
- Device name: Campus Main Router
- Interfaces:

  Serial0/1/0:

  - IP Address: 10.10.10.5
  - Subnet Mask:255.255.255.252

  Serial0/1/1:

  - IP Address: 10.10.10.1
  - Subnet Mask:255.255.255.252

- Routing Enabled: Yes

Router 1

- Hostname: Router
- Device name: Cloud
- Interfaces:

  GigabitEthernet0/0:

  - IP Address: 20.0.0.1
  - Subnet Mask:255.255.255.252

  Serial0/1/0:

  - IP Address: 10.10.10.6
  - Subnet Mask:255.255.255.252

- Routing Enabled: Yes

Router 2

- Hostname: Router
- Device name: Campus Branch Router
- Interfaces:

  Serial0/2/0:

  - IP Address: 10.10.10.2
  - Subnet Mask:255.255.255.252

- Routing Enabled: Yes

Switch0

```
Device Name: CAMPUS MAIN L3 -SWITCH
Device Model: 3560-24PS
Hostname: Switch

Port                Link   VLAN   IP Address         IPv6 Address                              MAC Address
FastEthernet0/1     Up     --     <not set>          <not set>                                 0040.0B16.7B01
FastEthernet0/2     Up     10     <not set>          <not set>                                 0040.0B16.7B02
FastEthernet0/3     Up     20     <not set>          <not set>                                 0040.0B16.7B03
FastEthernet0/4     Up     30     <not set>          <not set>                                 0040.0B16.7B04
FastEthernet0/5     Up     40     <not set>          <not set>                                 0040.0B16.7B05
FastEthernet0/6     Up     50     <not set>          <not set>                                 0040.0B16.7B06
FastEthernet0/7     Up     60     <not set>          <not set>                                 0040.0B16.7B07
FastEthernet0/8     Up     70     <not set>          <not set>                                 0040.0B16.7B08
FastEthernet0/9     Up     80     <not set>          <not set>                                 0040.0B16.7B09
FastEthernet0/10    Down   1      <not set>          <not set>                                 0040.0B16.7B0A
FastEthernet0/11    Down   1      <not set>          <not set>                                 0040.0B16.7B0B
FastEthernet0/12    Down   1      <not set>          <not set>                                 0040.0B16.7B0C
FastEthernet0/13    Down   1      <not set>          <not set>                                 0040.0B16.7B0D
FastEthernet0/14    Down   1      <not set>          <not set>                                 0040.0B16.7B0E
FastEthernet0/15    Down   1      <not set>          <not set>                                 0040.0B16.7B0F
FastEthernet0/16    Down   1      <not set>          <not set>                                 0040.0B16.7B10
FastEthernet0/17    Down   1      <not set>          <not set>                                 0040.0B16.7B11
FastEthernet0/18    Down   1      <not set>          <not set>                                 0040.0B16.7B12
FastEthernet0/19    Down   1      <not set>          <not set>                                 0040.0B16.7B13
FastEthernet0/20    Down   1      <not set>          <not set>                                 0040.0B16.7B14
FastEthernet0/21    Down   1      <not set>          <not set>                                 0040.0B16.7B15
FastEthernet0/22    Down   1      <not set>          <not set>                                 0040.0B16.7B16
FastEthernet0/23    Down   1      <not set>          <not set>                                 0040.0B16.7B17
FastEthernet0/24    Down   1      <not set>          <not set>                                 0040.0B16.7B18
GigabitEthernet0/1  Down   10     <not set>          <not set>                                 0040.0B16.7B19
GigabitEthernet0/2  Down   1      <not set>          <not set>                                 0040.0B16.7B1A
Vlan1               Down   1      <not set>          <not set>                                 0001.C92C.5D8E

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > CAMPUS MAIN L3 -SWITCH
```

Switch 1

Device Name: BRANCH L3 Switch
Device Model: 3650-24PS
Hostname: Switch

Port	Link	VLAN	IP Address	IPv6 Address	MAC Address
GigabitEthernet1/0/1	Up	--	<not set>	<not set>	0001.63D1.6E01
GigabitEthernet1/0/2	Up	90	<not set>	<not set>	0001.63D1.6E02
GigabitEthernet1/0/3	Up	100	<not set>	<not set>	0001.63D1.6E03
GigabitEthernet1/0/4	Down	1	<not set>	<not set>	0001.63D1.6E04
GigabitEthernet1/0/5	Down	1	<not set>	<not set>	0001.63D1.6E05
GigabitEthernet1/0/6	Down	1	<not set>	<not set>	0001.63D1.6E06
GigabitEthernet1/0/7	Down	1	<not set>	<not set>	0001.63D1.6E07
GigabitEthernet1/0/8	Down	1	<not set>	<not set>	0001.63D1.6E08
GigabitEthernet1/0/9	Down	1	<not set>	<not set>	0001.63D1.6E09
GigabitEthernet1/0/10	Down	1	<not set>	<not set>	0001.63D1.6E0A
GigabitEthernet1/0/11	Down	1	<not set>	<not set>	0001.63D1.6E0B
GigabitEthernet1/0/12	Down	1	<not set>	<not set>	0001.63D1.6E0C
GigabitEthernet1/0/13	Down	1	<not set>	<not set>	0001.63D1.6E0D
GigabitEthernet1/0/14	Down	1	<not set>	<not set>	0001.63D1.6E0E
GigabitEthernet1/0/15	Down	1	<not set>	<not set>	0001.63D1.6E0F
GigabitEthernet1/0/16	Down	1	<not set>	<not set>	0001.63D1.6E10
GigabitEthernet1/0/17	Down	1	<not set>	<not set>	0001.63D1.6E11
GigabitEthernet1/0/18	Down	1	<not set>	<not set>	0001.63D1.6E12
GigabitEthernet1/0/19	Down	1	<not set>	<not set>	0001.63D1.6E13
GigabitEthernet1/0/20	Down	1	<not set>	<not set>	0001.63D1.6E14
GigabitEthernet1/0/21	Down	1	<not set>	<not set>	0001.63D1.6E15
GigabitEthernet1/0/22	Down	1	<not set>	<not set>	0001.63D1.6E16
GigabitEthernet1/0/23	Down	1	<not set>	<not set>	0001.63D1.6E17
GigabitEthernet1/0/24	Down	1	<not set>	<not set>	0001.63D1.6E18
GigabitEthernet1/1/1	Down	1	<not set>	<not set>	000D.BD4E.1A01
GigabitEthernet1/1/2	Down	1	<not set>	<not set>	000D.BD4E.1A02
GigabitEthernet1/1/3	Down	1	<not set>	<not set>	000D.BD4E.1A03
GigabitEthernet1/1/4	Down	1	<not set>	<not set>	000D.BD4E.1A04
Vlan1	Down	1	<not set>	<not set>	0001.96D0.DD54

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > BRANCH L3 Switch

Switch 2

Device Name: STAFF
Custom Device Model: 2960 IOS15
Hostname: Switch

Port	Link	VLAN	IP Address	MAC Address
FastEthernet0/1	Up	90	--	0004.9A5D.7901
FastEthernet0/2	Up	90	--	0004.9A5D.7902
FastEthernet0/3	Up	90	--	0004.9A5D.7903
FastEthernet0/4	Down	90	--	0004.9A5D.7904
FastEthernet0/5	Down	90	--	0004.9A5D.7905
FastEthernet0/6	Down	90	--	0004.9A5D.7906
FastEthernet0/7	Down	90	--	0004.9A5D.7907
FastEthernet0/8	Down	90	--	0004.9A5D.7908
FastEthernet0/9	Down	90	--	0004.9A5D.7909
FastEthernet0/10	Down	90	--	0004.9A5D.790A
FastEthernet0/11	Down	90	--	0004.9A5D.790B
FastEthernet0/12	Down	90	--	0004.9A5D.790C
FastEthernet0/13	Down	90	--	0004.9A5D.790D
FastEthernet0/14	Down	90	--	0004.9A5D.790E
FastEthernet0/15	Down	90	--	0004.9A5D.790F
FastEthernet0/16	Down	90	--	0004.9A5D.7910
FastEthernet0/17	Down	90	--	0004.9A5D.7911
FastEthernet0/18	Down	90	--	0004.9A5D.7912
FastEthernet0/19	Down	90	--	0004.9A5D.7913
FastEthernet0/20	Down	90	--	0004.9A5D.7914
FastEthernet0/21	Down	90	--	0004.9A5D.7915
FastEthernet0/22	Down	90	--	0004.9A5D.7916
FastEthernet0/23	Down	90	--	0004.9A5D.7917
FastEthernet0/24	Down	90	--	0004.9A5D.7918
GigabitEthernet0/1	Down	1	--	0004.9A5D.7919
GigabitEthernet0/2	Down	1	--	0004.9A5D.791A
Vlan1	Down	1	<not set>	0040.0B3E.27C0

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > STAFF

Switch 3

```
Device Name: STUD-LAB
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                 Link   VLAN   IP Address          MAC Address
FastEthernet0/1      Up     100    --                  0060.473E.5A01
FastEthernet0/2      Up     100    --                  0060.473E.5A02
FastEthernet0/3      Up     100    --                  0060.473E.5A03
FastEthernet0/4      Down   100    --                  0060.473E.5A04
FastEthernet0/5      Down   100    --                  0060.473E.5A05
FastEthernet0/6      Down   100    --                  0060.473E.5A06
FastEthernet0/7      Down   100    --                  0060.473E.5A07
FastEthernet0/8      Down   100    --                  0060.473E.5A08
FastEthernet0/9      Down   100    --                  0060.473E.5A09
FastEthernet0/10     Down   100    --                  0060.473E.5A0A
FastEthernet0/11     Down   100    --                  0060.473E.5A0B
FastEthernet0/12     Down   100    --                  0060.473E.5A0C
FastEthernet0/13     Down   100    --                  0060.473E.5A0D
FastEthernet0/14     Down   100    --                  0060.473E.5A0E
FastEthernet0/15     Down   100    --                  0060.473E.5A0F
FastEthernet0/16     Down   100    --                  0060.473E.5A10
FastEthernet0/17     Down   100    --                  0060.473E.5A11
FastEthernet0/18     Down   100    --                  0060.473E.5A12
FastEthernet0/19     Down   100    --                  0060.473E.5A13
FastEthernet0/20     Down   100    --                  0060.473E.5A14
FastEthernet0/21     Down   100    --                  0060.473E.5A15
FastEthernet0/22     Down   100    --                  0060.473E.5A16
FastEthernet0/23     Down   100    --                  0060.473E.5A17
FastEthernet0/24     Down   100    --                  0060.473E.5A18
GigabitEthernet0/1   Down   1      --                  0060.473E.5A19
GigabitEthernet0/2   Down   1      --                  0060.473E.5A1A
Vlan1                Down   1      <not set>           0006.2A0D.9E3A

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > STUD-LAB
```

Switch 4

```
Device Name: ADMIN
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                 Link   VLAN   IP Address          MAC Address
FastEthernet0/1      Up     10     --                  0001.96D0.9E01
FastEthernet0/2      Up     10     --                  0001.96D0.9E02
FastEthernet0/3      Up     10     --                  0001.96D0.9E03
FastEthernet0/4      Down   10     --                  0001.96D0.9E04
FastEthernet0/5      Down   10     --                  0001.96D0.9E05
FastEthernet0/6      Down   10     --                  0001.96D0.9E06
FastEthernet0/7      Down   10     --                  0001.96D0.9E07
FastEthernet0/8      Down   10     --                  0001.96D0.9E08
FastEthernet0/9      Down   10     --                  0001.96D0.9E09
FastEthernet0/10     Down   10     --                  0001.96D0.9E0A
FastEthernet0/11     Down   10     --                  0001.96D0.9E0B
FastEthernet0/12     Down   10     --                  0001.96D0.9E0C
FastEthernet0/13     Down   10     --                  0001.96D0.9E0D
FastEthernet0/14     Down   10     --                  0001.96D0.9E0E
FastEthernet0/15     Down   10     --                  0001.96D0.9E0F
FastEthernet0/16     Down   10     --                  0001.96D0.9E10
FastEthernet0/17     Down   10     --                  0001.96D0.9E11
FastEthernet0/18     Down   10     --                  0001.96D0.9E12
FastEthernet0/19     Down   10     --                  0001.96D0.9E13
FastEthernet0/20     Down   10     --                  0001.96D0.9E14
FastEthernet0/21     Down   10     --                  0001.96D0.9E15
FastEthernet0/22     Down   10     --                  0001.96D0.9E16
FastEthernet0/23     Down   10     --                  0001.96D0.9E17
FastEthernet0/24     Down   10     --                  0001.96D0.9E18
GigabitEthernet0/1   Down   1      --                  0001.96D0.9E19
GigabitEthernet0/2   Down   1      --                  0001.96D0.9E1A
Vlan1                Down   1      <not set>           000A.41E7.3141

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > ADMIN
```

Switch 5

```
Device Name: HR
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                Link   VLAN   IP Address          MAC Address
FastEthernet0/1     Up     20     --                  00D0.581D.5301
FastEthernet0/2     Up     20     --                  00D0.581D.5302
FastEthernet0/3     Up     20     --                  00D0.581D.5303
FastEthernet0/4     Down   20     --                  00D0.581D.5304
FastEthernet0/5     Down   20     --                  00D0.581D.5305
FastEthernet0/6     Down   20     --                  00D0.581D.5306
FastEthernet0/7     Down   20     --                  00D0.581D.5307
FastEthernet0/8     Down   20     --                  00D0.581D.5308
FastEthernet0/9     Down   20     --                  00D0.581D.5309
FastEthernet0/10    Down   20     --                  00D0.581D.530A
FastEthernet0/11    Down   20     --                  00D0.581D.530B
FastEthernet0/12    Down   20     --                  00D0.581D.530C
FastEthernet0/13    Down   20     --                  00D0.581D.530D
FastEthernet0/14    Down   20     --                  00D0.581D.530E
FastEthernet0/15    Down   20     --                  00D0.581D.530F
FastEthernet0/16    Down   20     --                  00D0.581D.5310
FastEthernet0/17    Down   20     --                  00D0.581D.5311
FastEthernet0/18    Down   20     --                  00D0.581D.5312
FastEthernet0/19    Down   20     --                  00D0.581D.5313
FastEthernet0/20    Down   20     --                  00D0.581D.5314
FastEthernet0/21    Down   20     --                  00D0.581D.5315
FastEthernet0/22    Down   20     --                  00D0.581D.5316
FastEthernet0/23    Down   20     --                  00D0.581D.5317
FastEthernet0/24    Down   20     --                  00D0.581D.5318
GigabitEthernet0/1  Down   1      --                  00D0.581D.5319
GigabitEthernet0/2  Down   1      --                  00D0.581D.531A
Vlan1               Down   1      <not set>           0006.2A60.D676

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > HR
```

Switch 6

```
Device Name: FINANCE
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                Link   VLAN   IP Address          MAC Address
FastEthernet0/1     Up     30     --                  0060.5CD0.2D01
FastEthernet0/2     Up     30     --                  0060.5CD0.2D02
FastEthernet0/3     Up     30     --                  0060.5CD0.2D03
FastEthernet0/4     Down   30     --                  0060.5CD0.2D04
FastEthernet0/5     Down   30     --                  0060.5CD0.2D05
FastEthernet0/6     Down   30     --                  0060.5CD0.2D06
FastEthernet0/7     Down   30     --                  0060.5CD0.2D07
FastEthernet0/8     Down   30     --                  0060.5CD0.2D08
FastEthernet0/9     Down   30     --                  0060.5CD0.2D09
FastEthernet0/10    Down   30     --                  0060.5CD0.2D0A
FastEthernet0/11    Down   30     --                  0060.5CD0.2D0B
FastEthernet0/12    Down   30     --                  0060.5CD0.2D0C
FastEthernet0/13    Down   30     --                  0060.5CD0.2D0D
FastEthernet0/14    Down   30     --                  0060.5CD0.2D0E
FastEthernet0/15    Down   30     --                  0060.5CD0.2D0F
FastEthernet0/16    Down   30     --                  0060.5CD0.2D10
FastEthernet0/17    Down   30     --                  0060.5CD0.2D11
FastEthernet0/18    Down   30     --                  0060.5CD0.2D12
FastEthernet0/19    Down   30     --                  0060.5CD0.2D13
FastEthernet0/20    Down   30     --                  0060.5CD0.2D14
FastEthernet0/21    Down   30     --                  0060.5CD0.2D15
FastEthernet0/22    Down   30     --                  0060.5CD0.2D16
FastEthernet0/23    Down   30     --                  0060.5CD0.2D17
FastEthernet0/24    Down   30     --                  0060.5CD0.2D18
GigabitEthernet0/1  Down   1      --                  0060.5CD0.2D19
GigabitEthernet0/2  Down   1      --                  0060.5CD0.2D1A
Vlan1               Down   1      <not set>           0001.9627.7330

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > FINANCE
```

Switch 7

```
Device Name: BUISNESS
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                Link   VLAN   IP Address         MAC Address
FastEthernet0/1     Up     1      --                 00E0.F7D1.BE01
FastEthernet0/2     Up     1      --                 00E0.F7D1.BE02
FastEthernet0/3     Up     1      --                 00E0.F7D1.BE03
FastEthernet0/4     Down   1      --                 00E0.F7D1.BE04
FastEthernet0/5     Down   1      --                 00E0.F7D1.BE05
FastEthernet0/6     Down   1      --                 00E0.F7D1.BE06
FastEthernet0/7     Down   1      --                 00E0.F7D1.BE07
FastEthernet0/8     Down   1      --                 00E0.F7D1.BE08
FastEthernet0/9     Down   1      --                 00E0.F7D1.BE09
FastEthernet0/10    Down   1      --                 00E0.F7D1.BE0A
FastEthernet0/11    Down   1      --                 00E0.F7D1.BE0B
FastEthernet0/12    Down   1      --                 00E0.F7D1.BE0C
FastEthernet0/13    Down   1      --                 00E0.F7D1.BE0D
FastEthernet0/14    Down   1      --                 00E0.F7D1.BE0E
FastEthernet0/15    Down   1      --                 00E0.F7D1.BE0F
FastEthernet0/16    Down   1      --                 00E0.F7D1.BE10
FastEthernet0/17    Down   1      --                 00E0.F7D1.BE11
FastEthernet0/18    Down   1      --                 00E0.F7D1.BE12
FastEthernet0/19    Down   1      --                 00E0.F7D1.BE13
FastEthernet0/20    Down   1      --                 00E0.F7D1.BE14
FastEthernet0/21    Down   1      --                 00E0.F7D1.BE15
FastEthernet0/22    Down   1      --                 00E0.F7D1.BE16
FastEthernet0/23    Down   1      --                 00E0.F7D1.BE17
FastEthernet0/24    Down   1      --                 00E0.F7D1.BE18
GigabitEthernet0/1  Down   1      --                 00E0.F7D1.BE19
GigabitEthernet0/2  Down   1      --                 00E0.F7D1.BE1A
Vlan1               Down   1      <not set>          0040.0BE7.3469

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > BUISNESS
```

Switch 8

```
Device Name: E&C
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                Link   VLAN   IP Address         MAC Address
FastEthernet0/1     Up     50     --                 0006.2A9A.A201
FastEthernet0/2     Up     50     --                 0006.2A9A.A202
FastEthernet0/3     Up     50     --                 0006.2A9A.A203
FastEthernet0/4     Down   50     --                 0006.2A9A.A204
FastEthernet0/5     Down   50     --                 0006.2A9A.A205
FastEthernet0/6     Down   50     --                 0006.2A9A.A206
FastEthernet0/7     Down   50     --                 0006.2A9A.A207
FastEthernet0/8     Down   50     --                 0006.2A9A.A208
FastEthernet0/9     Down   50     --                 0006.2A9A.A209
FastEthernet0/10    Down   50     --                 0006.2A9A.A20A
FastEthernet0/11    Down   50     --                 0006.2A9A.A20B
FastEthernet0/12    Down   50     --                 0006.2A9A.A20C
FastEthernet0/13    Down   50     --                 0006.2A9A.A20D
FastEthernet0/14    Down   50     --                 0006.2A9A.A20E
FastEthernet0/15    Down   50     --                 0006.2A9A.A20F
FastEthernet0/16    Down   50     --                 0006.2A9A.A210
FastEthernet0/17    Down   50     --                 0006.2A9A.A211
FastEthernet0/18    Down   50     --                 0006.2A9A.A212
FastEthernet0/19    Down   50     --                 0006.2A9A.A213
FastEthernet0/20    Down   50     --                 0006.2A9A.A214
FastEthernet0/21    Down   50     --                 0006.2A9A.A215
FastEthernet0/22    Down   50     --                 0006.2A9A.A216
FastEthernet0/23    Down   50     --                 0006.2A9A.A217
FastEthernet0/24    Down   50     --                 0006.2A9A.A218
GigabitEthernet0/1  Down   1      --                 0006.2A9A.A219
GigabitEthernet0/2  Down   1      --                 0006.2A9A.A21A
Vlan1               Down   1      <not set>          0000.0C4A.9634

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > E&C
```

Switch 9

```
Device Name: STUD LAB
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                 Link   VLAN   IP Address         MAC Address
FastEthernet0/1      Up     70     --                 00E0.B0C0.4201
FastEthernet0/2      Up     70     --                 00E0.B0C0.4202
FastEthernet0/3      Up     70     --                 00E0.B0C0.4203
FastEthernet0/4      Down   70     --                 00E0.B0C0.4204
FastEthernet0/5      Down   70     --                 00E0.B0C0.4205
FastEthernet0/6      Down   70     --                 00E0.B0C0.4206
FastEthernet0/7      Down   70     --                 00E0.B0C0.4207
FastEthernet0/8      Down   70     --                 00E0.B0C0.4208
FastEthernet0/9      Down   70     --                 00E0.B0C0.4209
FastEthernet0/10     Down   70     --                 00E0.B0C0.420A
FastEthernet0/11     Down   70     --                 00E0.B0C0.420B
FastEthernet0/12     Down   70     --                 00E0.B0C0.420C
FastEthernet0/13     Down   70     --                 00E0.B0C0.420D
FastEthernet0/14     Down   70     --                 00E0.B0C0.420E
FastEthernet0/15     Down   70     --                 00E0.B0C0.420F
FastEthernet0/16     Down   70     --                 00E0.B0C0.4210
FastEthernet0/17     Down   70     --                 00E0.B0C0.4211
FastEthernet0/18     Down   70     --                 00E0.B0C0.4212
FastEthernet0/19     Down   70     --                 00E0.B0C0.4213
FastEthernet0/20     Down   70     --                 00E0.B0C0.4214
FastEthernet0/21     Down   70     --                 00E0.B0C0.4215
FastEthernet0/22     Down   70     --                 00E0.B0C0.4216
FastEthernet0/23     Down   70     --                 00E0.B0C0.4217
FastEthernet0/24     Down   70     --                 00E0.B0C0.4218
GigabitEthernet0/1   Down   1      --                 00E0.B0C0.4219
GigabitEthernet0/2   Down   1      --                 00E0.B0C0.421A
Vlan1                Down   1      <not set>          000D.BD89.28B4

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > STUD LAB
```

Switch 10

```
Device Name: IT-DEPT
Custom Device Model: 2960 IOS15
Hostname: Switch

Port                 Link   VLAN   IP Address         MAC Address
FastEthernet0/1      Up     80     --                 0002.4AD3.CB01
FastEthernet0/2      Up     80     --                 0002.4AD3.CB02
FastEthernet0/3      Up     80     --                 0002.4AD3.CB03
FastEthernet0/4      Up     80     --                 0002.4AD3.CB04
FastEthernet0/5      Up     80     --                 0002.4AD3.CB05
FastEthernet0/6      Down   80     --                 0002.4AD3.CB06
FastEthernet0/7      Down   80     --                 0002.4AD3.CB07
FastEthernet0/8      Down   80     --                 0002.4AD3.CB08
FastEthernet0/9      Down   80     --                 0002.4AD3.CB09
FastEthernet0/10     Down   80     --                 0002.4AD3.CB0A
FastEthernet0/11     Down   80     --                 0002.4AD3.CB0B
FastEthernet0/12     Down   80     --                 0002.4AD3.CB0C
FastEthernet0/13     Down   80     --                 0002.4AD3.CB0D
FastEthernet0/14     Down   80     --                 0002.4AD3.CB0E
FastEthernet0/15     Down   80     --                 0002.4AD3.CB0F
FastEthernet0/16     Down   80     --                 0002.4AD3.CB10
FastEthernet0/17     Down   80     --                 0002.4AD3.CB11
FastEthernet0/18     Down   80     --                 0002.4AD3.CB12
FastEthernet0/19     Down   80     --                 0002.4AD3.CB13
FastEthernet0/20     Down   80     --                 0002.4AD3.CB14
FastEthernet0/21     Down   80     --                 0002.4AD3.CB15
FastEthernet0/22     Down   80     --                 0002.4AD3.CB16
FastEthernet0/23     Down   80     --                 0002.4AD3.CB17
FastEthernet0/24     Down   80     --                 0002.4AD3.CB18
GigabitEthernet0/1   Down   1      --                 0002.4AD3.CB19
GigabitEthernet0/2   Down   1      --                 0002.4AD3.CB1A
Vlan1                Down   1      <not set>          000A.414A.8678

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > IT-DEPT
```

Server0

```
Device Name: EMAIL
Device Model: Server-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     20.0.0.2/30        <not set>                                 0090.2B21.B150

Gateway: 20.0.0.1
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > EMAIL
```

Server 1

```
Device Name: WEB SERVER
Device Model: Server-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 0090.0CEB.EC74

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > WEB SERVER
```

Server 2

```
Device Name: FTP SERVER
Device Model: Server-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 0002.4AE3.5630

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Main Wiring Closet > Rack > FTP SERVER
```

Printer0

```
Device Name: Printer0
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 00D0.580C.3E2D

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer0
```

Printer1

```
Device Name: Printer1
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 000C.CF61.0774

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer1
```

Printer 2

```
Device Name: Printer2
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 0002.4A15.A3EC

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer2
```

Printer 3

```
Device Name: Printer3
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 00E0.8FB1.8575

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer3
```

Printer 4

```
Device Name: Printer4
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 00D0.58B7.4095

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer4
```

Printer 5

```
Device Name: Printer5
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 0001.C938.B711

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer5
```

Printer 6

```
Device Name: Printer6
Device Model: Printer-PT

Port            Link   IP Address         IPv6 Address                              MAC Address
FastEthernet0   Up     <not set>          <not set>                                 0040.0BBA.ABD9

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer6
```

Printer 7

```
Device Name: Printer7
Device Model: Printer-PT

Port            Link   IP Address          IPv6 Address                            MAC Address
FastEthernet0   Up     <not set>           <not set>                               0060.3E42.DCC0

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer7
```

Printer 8

```
Device Name: Printer8
Device Model: Printer-PT

Port            Link   IP Address          IPv6 Address                            MAC Address
FastEthernet0   Up     <not set>           <not set>                               0001.9750.2331

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer8
```

Printer 9

```
Device Name: Printer9
Device Model: Printer-PT

Port            Link   IP Address          IPv6 Address                            MAC Address
FastEthernet0   Up     <not set>           <not set>                               0060.4708.289A

Gateway: <not set>
DNS Server: <not set>
Line Number:  <not set>

Physical Location: Intercity > Home City > Corporate Office > Printer9
```

5. Working

1. Centralized Core Router

- At the center is a core router that:
    - Connects all building networks.
    - Performs Inter-VLAN routing, allowing different departments (HR, Admin, Finance, etc.) to communicate.

2. Buildings and Departments (LANs & VLANs)

Each building (e.g., Building A, B, C, etc.) hosts:

- Departments: HR, Admin, R&D, Finance, etc.
- Connected through switches to PCs.
- Assigned VLANs and subnets to isolate traffic:
    - Ex: VLAN 10: `192.168.10.0/24` (HR), VLAN 20: `192.168.20.0/24` (Finance)
- This segmentation provides:
    - Better traffic management.
    - Security (one department can’t access another unless allowed).
    - Reduced broadcast traffic.

3. DMZ (Demilitarized Zone)

- Contains public-facing services (Web Server, DNS, Email).

- Isolated in VLAN 99: `192.168.99.0/24`.
- Only accessible from the internal network or internet through strict access rules.
- Prevents direct access to the internal network from outside.

4. Internet & VPN Connections

- The red line represents a link to external networks, connected through firewalls or edge routers.
- Two main remote links:
    - RV Main Campus Network – connects central systems.
    - RV Branch Networks – connects remote office/branch via VPN or WAN.
- External access goes through the DMZ for service hosting or VPN gateway for secure employee remote access.

5. Security Measures

- VLANs: Isolate departments logically.
- Inter-VLAN Routing: Controlled by the router.
- DMZ: Shields internal systems from public threats.
- VPN: Secures remote access to internal systems.
- Private IP Subnets: Prevent direct internet exposure.

6. DHCP – Dynamic Host Configuration Protocol

Purpose: Automatically assigns IP addresses to devices (PCs, printers, etc.) in each VLAN.

- Each VLAN can have a DHCP server.

- Devices in each department/building send a DHCP Discover broadcast.
- The DHCP server assigns an IP, subnet mask, default gateway, and DNS.

7. RIP – Routing Information Protocol

Purpose: Dynamically shares routing information between routers.

- RIP (specifically RIP v2 for classless routing) runs on core routers and remote routers (e.g., RV BRANCH NETWORKS, DMZ Edge Router).
- Each router advertises its connected networks/subnets.
- Other routers learn about these networks dynamically and update their routing tables.

8. Data Flow:

Internal Communication (HR to Finance):

1. HR PC boots → sends DHCP Discover.
2. DHCP server (central or local) assigns IP from VLAN 10 subnet.
3. PC wants to access Finance PC (VLAN 20).
4. Packet sent to switch → router → routed using inter-VLAN logic.
5. RIP ensures all routers have updated paths to each subnet.

Remote Branch Access via VPN:

1. Branch PC gets IP via DHCP.
2. Branch router advertises its subnet via RIP.
3. Core router learns about branch networks and vice versa.
4. Communication happens using RIP-learned paths.

5. Results

Ping Test: Branch to Main Campus

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.9.2

Pinging 192.168.9.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.9.2: bytes=32 time<1ms TTL=127
Reply from 192.168.9.2: bytes=32 time<1ms TTL=127
Reply from 192.168.9.2: bytes=32 time<1ms TTL=127

Ping statistics for 192.168.9.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.4.2

Pinging 192.168.4.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=1ms TTL=126
Reply from 192.168.4.2: bytes=32 time=1ms 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 = 1ms, Maximum = 1ms, Average = 1ms
```

Ping Test: Branch to Cloud Server

```
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>ping 20.0.0.2

Pinging 20.0.0.2 with 32 bytes of data:

Reply from 20.0.0.2: bytes=32 time=21ms TTL=125
Reply from 20.0.0.2: bytes=32 time=2ms TTL=125
Reply from 20.0.0.2: bytes=32 time=24ms TTL=125
Reply from 20.0.0.2: bytes=32 time=16ms TTL=125

Ping statistics for 20.0.0.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 24ms, Average = 15ms
```

Ping Test: Inter-Branch Communication

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.9.2

Pinging 192.168.9.2 with 32 bytes of data:

Reply from 192.168.9.2: bytes=32 time=3ms TTL=126
Reply from 192.168.9.2: bytes=32 time=1ms TTL=126
Reply from 192.168.9.2: bytes=32 time=10ms TTL=126
Reply from 192.168.9.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.9.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 3ms

C:\>ping 192.168.10.2

Pinging 192.168.10.2 with 32 bytes of data:

Reply from 192.168.10.2: bytes=32 time=14ms TTL=126
Reply from 192.168.10.2: bytes=32 time=24ms TTL=126
Reply from 192.168.10.2: bytes=32 time=3ms TTL=126
Reply from 192.168.10.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.10.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 24ms, Average = 10ms
```

6. Conclusion

In this project, we had designed and simulated a university-level network infrastructure that linked the main campus, branch offices, and outside cloud services with Cisco Packet Tracer. The configuration included setting up routers, switches, VLANs, DHCP, DNS, and routing protocols like RIP to have a well-designed and secured system. With successful ping tests, we confirmed smooth communication throughout the complete architecture. This project mirrors actual networking procedures, fulfilling critical requirements such as departmental segregation, branch connection, and remote service accessibility. It is practically applicable in constructing intelligent educational campuses and can be further extended by incorporating security policies, wireless networks, and automated monitoring systems for proactive management.