University Management System Project Report

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Section: 4-C | 4-C

Overview:

The University Management System project is designed to manage the network infrastructure of a university consisting of a main campus and a branch campus. The project is implemented using Cisco Packet Tracer and involves the configuration of routers, switches, VLANs, DHCP, and RIP routing protocols.

Abstract:

The University Management System project aims to establish an efficient and organized network infrastructure for a university with a main and branch campus. Implemented using Cisco Packet Tracer, the project encompasses the configuration of routers, switches, VLANs, DHCP, and RIP routing protocols. This report details the network architecture, configuration steps, and the evaluation of network performance.

Introduction

This project focuses on designing a comprehensive network management system for a university, ensuring seamless connectivity and communication between various departments across the main and branch campuses. The primary objective is to enhance network efficiency, security, and scalability using advanced networking protocols and configurations.

Body:

Network Architecture

Main Campus:

The main campus is divided into two buildings: Building A and Building B.

Building A:

- **Departments:**
    1. Admin
    2. Business
    3. Finance
    4. HR
- **Network Devices:**
    - Each department has its own switch connected to a Layer 3 switch.
    - Each department includes:
        - 1 PC
        - 1 Printer

Building B:

- **Departments:**
    1. Student Lab
    2. IT
- **Network Devices:**
    - Each department has its own switch connected to a Layer 3 switch.
    - Each department includes:
        - 1 PC
        - 1 Printer

Branch Campus:

- **Network Devices:**
    - The branch campus router is connected to a Layer 3 switch.
    - The Layer 3 switch connects to two switches:
        - Staff
        - Student Lab
    - Each of these switches is connected to:

- 1 PC
- 1 Printer

Interconnection

- The main campus router and branch campus router are connected through a serial DCE link.

Network Configuration

1. **DHCP Protocol:**
    - DHCP is configured to dynamically assign IP addresses to devices within the network, ensuring efficient IP management.
    - The routers and layer three switches are connected with each other through gigabit ethernet.
    - Each switch of the department is connected with layer 3 switch through copper cross over cable.
    - The pcs and printers are connected with the routers with copper straight through cable.
2. **Inter-VLAN Routing:**
    - VLANs are implemented to segment the network into different broadcast domains, improving security and reducing traffic.
    - Inter-VLAN routing is configured on the Layer 3 switch to enable communication between different VLANs.
3. **VLAN Configuration:**
    - Different VLANs are assigned to each department to segregate network traffic.
    - VLAN IDs and names are defined as follows:
        - VLAN 10: Admin
        - VLAN 20: Business
        - VLAN 30: Finance
        - VLAN 40: HR
        - VLAN 50: Student Lab
        - VLAN 60: IT
        - VLAN 70: Staff (Branch Campus)

- VLAN 80: Student Lab (Branch Campus)

4. **RIP Routing:**
    - RIP (Routing Information Protocol) is configured on the routers to manage routing information between the main campus and branch campus.
    - RIP enables dynamic routing, ensuring efficient route updates and management between the routers.

Evaluation

The network was evaluated based on the following criteria:

- **Connectivity:** All devices within each VLAN were able to communicate with each other and access the network resources as intended. The inter-VLAN routing enabled seamless communication between different VLANs.
- **Performance:** The implementation of VLANs significantly reduced broadcast traffic, enhancing the overall performance of the network. The DHCP protocol ensured efficient IP address management, reducing the administrative burden.
- **Scalability:** The network design allows for easy scalability. New departments or devices can be added without major reconfiguration, making it adaptable to future needs.
- **Security:** VLAN segmentation provided an additional layer of security by isolating departmental traffic. Inter-VLAN routing was controlled and monitored to prevent unauthorized access.

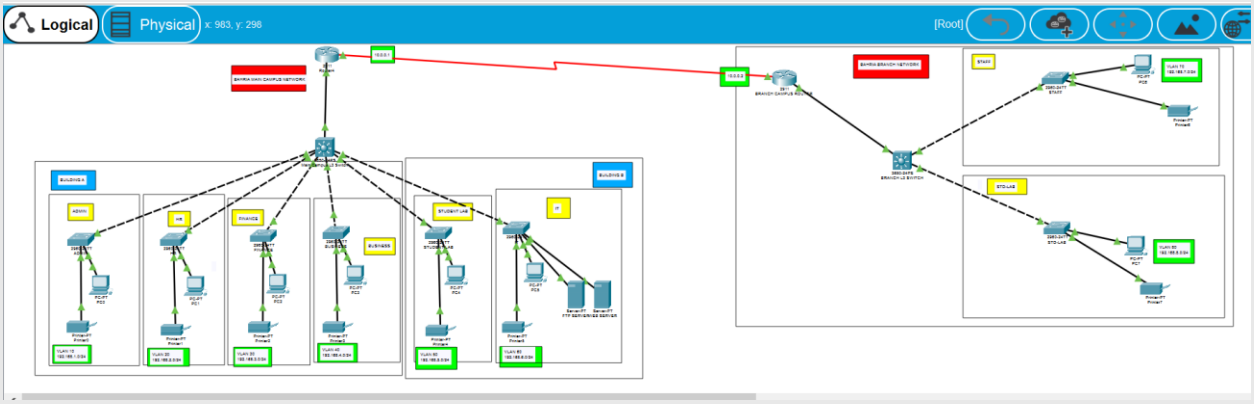
Conclusion

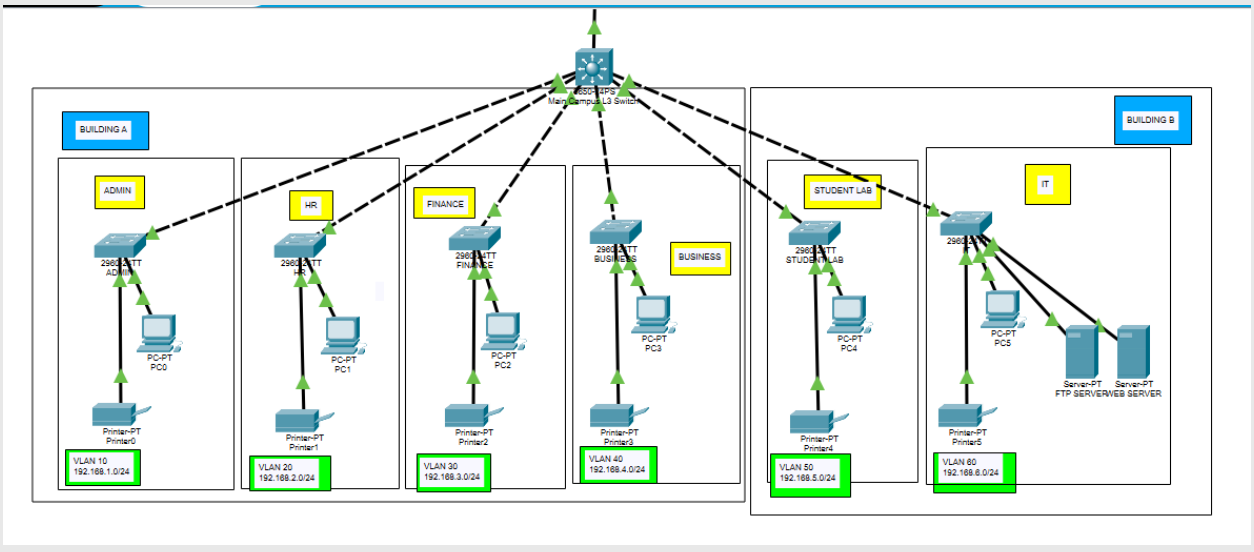
The University Management System project successfully demonstrated the effective use of advanced networking techniques to manage a complex network infrastructure. By implementing DHCP, VLANs, inter-VLAN routing, and RIP routing protocols, the network achieved improved performance, security, and scalability. The project provides a robust framework for managing university networks and can be adapted to meet future requirements.

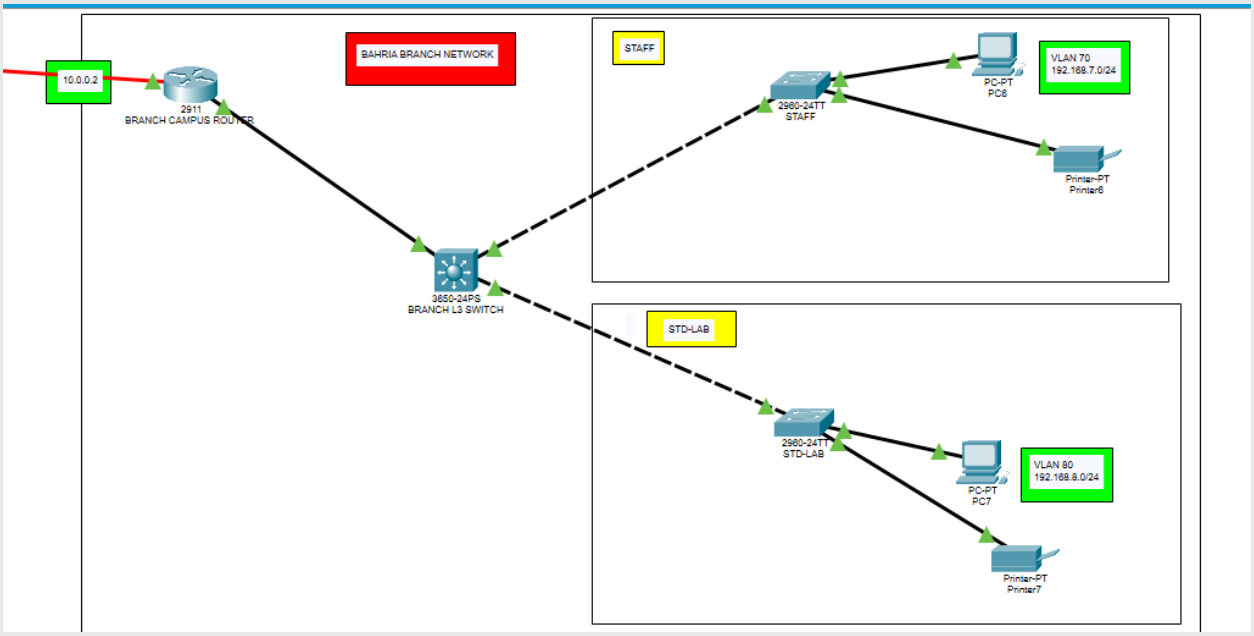
References

1. Cisco Packet Tracer Documentation.
2. Cisco Networking Academy, "Introduction to Networks v7.0 (ITN)".
3. Todd Lammle, "CompTIA Network+ Study Guide".
4. Wendell Odom, "CCNA 200-301 Official Cert Guide".

Screenshots







Making a trunk port so that all VLANS can be transported to the router:

- **For Main Campus Trunk port:**

```
Switch>
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int gig1/0/1
Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up

Switch(config-if)#
Switch(config-if)#exit
Switch(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
Switch(config)#
Switch(config)#
Switch(config)#
Switch(config)#
```

- **For Branch Campus Trunk port:**

```
Switch>
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#int gig1/0/1
Switch(config-if)#switchport trunk encapsulation dot1q
                                                  ^
% Invalid input detected at '^' marker.

Switch(config-if)#switchport trunk encapsulation dot1q
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet1/0/1, changed state to up

Switch(config-if)#
Switch(config-if)#ex
Switch(config)#
Switch(config)#
Switch(config)#do wr
Building configuration...
Compressed configuration from 7383 bytes to 3601 bytes[OK]
[OK]
Switch(config)#
Switch(config)#
```

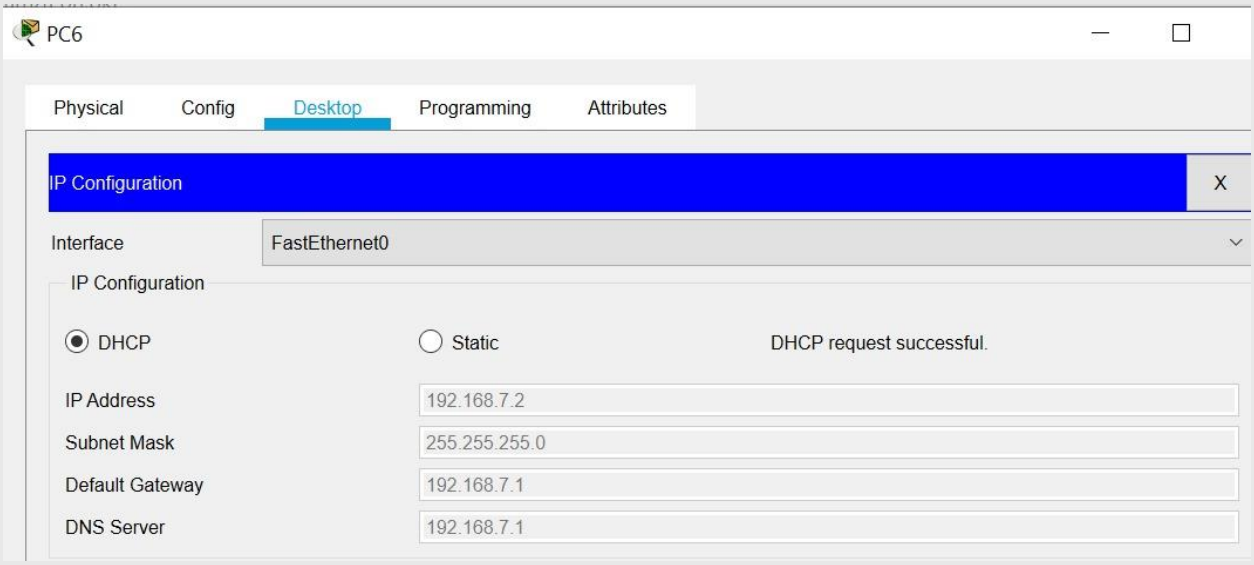
Inter- VLAN routing and DHCP server configuration:

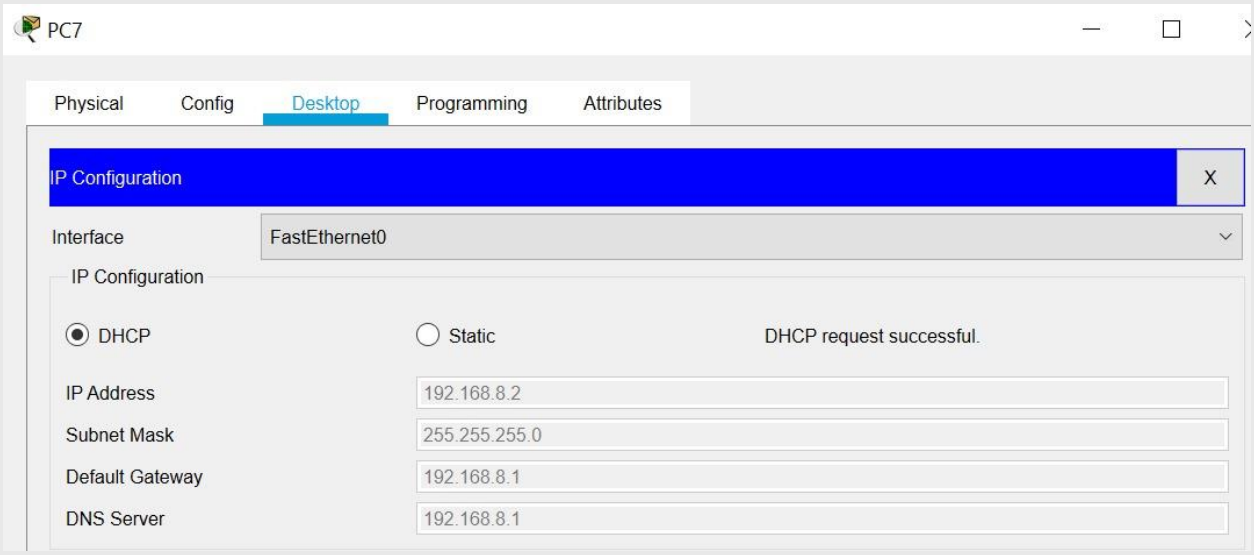
Inter-VLAN routing on branch campus switch:

```
Router>
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#
Router(config)#int gig0/0.70
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.70, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.70, changed state to up

Router(config-subif)#
Router(config-subif)#encapsulation dot1q 70
Router(config-subif)#ip add 192.168.7.1 255.255.255.0
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#exit
Router(config)#
Router(config)#
Router(config)#int gig0/0.80
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.80, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.80, changed state to up

Router(config-subif)#
Router(config-subif)#encapsulation dot1q 80
Router(config-subif)#ip add 192.168.8.1 255.255.255.0
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#exit
```

DHCP CONFIGURATION:

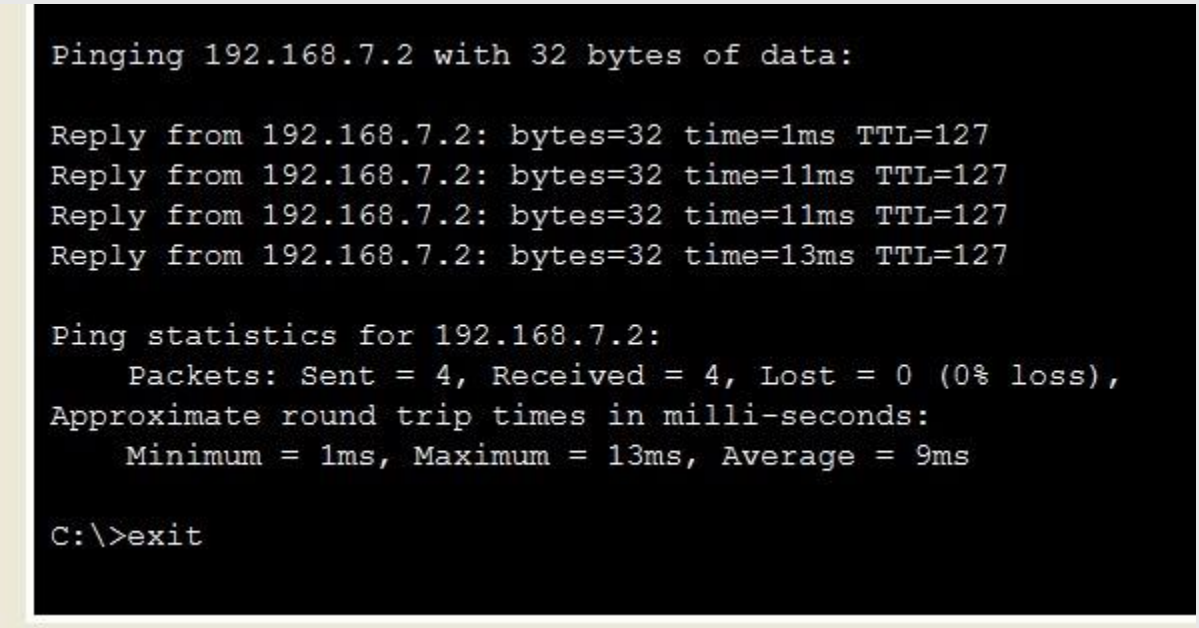
```
Router(config)#
Router(config)#
Router(config)#service dhcp
Router(config)#dhcp pool STAFF-pool
                ^
% Invalid input detected at '^' marker.

Router(config)# ip dhcp pool STAFF-pool
Router(dhcp-config)#network 192.168.7.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.7.1
Router(dhcp-config)#dns-server 192.168.7.1
Router(dhcp-config)#ex
Router(config)#do wr
Building configuration...
[OK]
Router(config)#ip dhcp pool STD-LAB-pool
Router(dhcp-config)#network 192.168.8.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.8.1
Router(dhcp-config)#dns-server 192.168.8.1
Router(dhcp-config)#ex
Router(config)#do wr
Building configuration...
[OK]
```





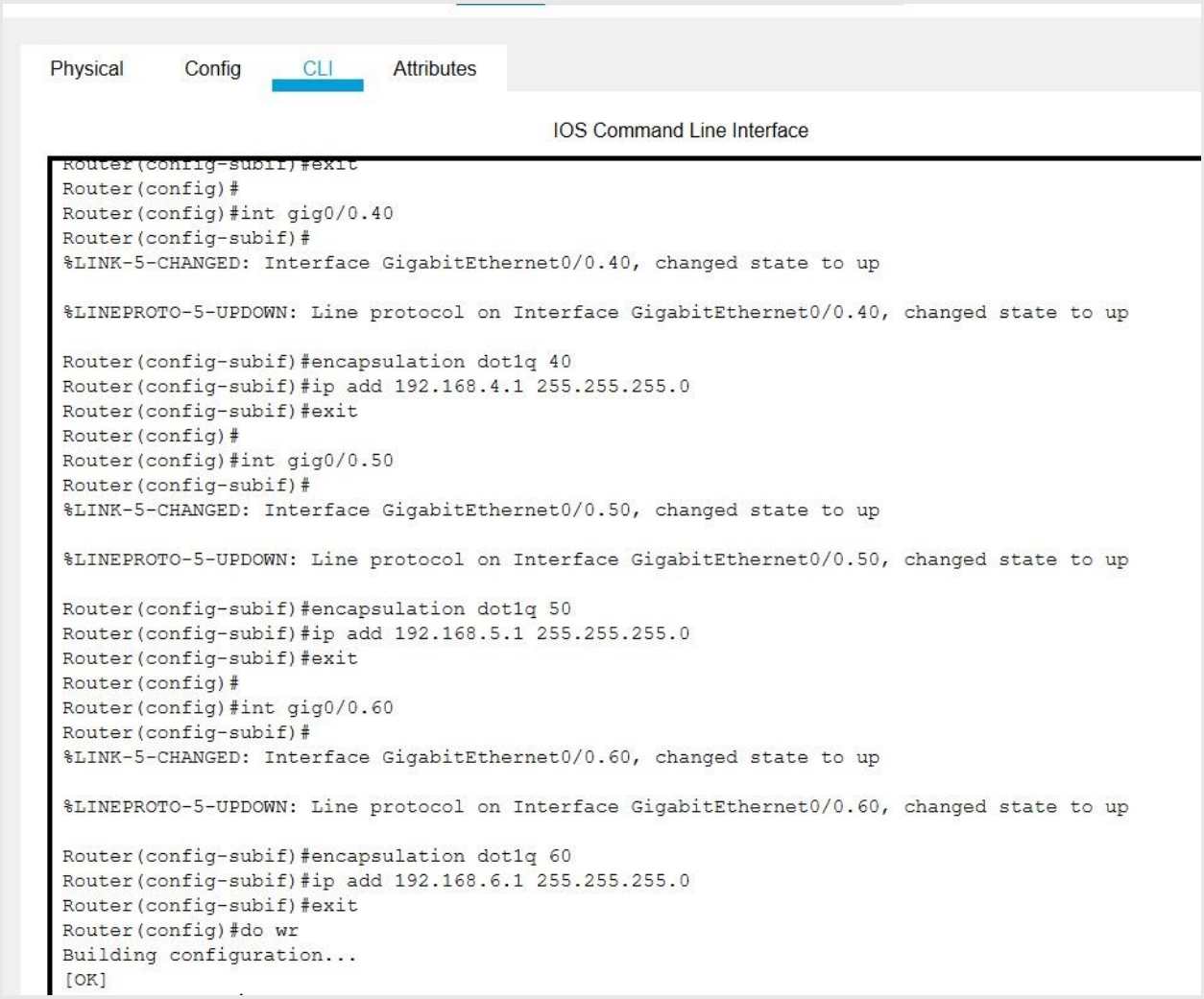

```
Router>
Router>show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.7.2      0006.2A5C.668E           --                     Automatic
192.168.8.2      0050.0F24.6D6C           --                     Automatic
Router>
```

Pinging STD-LAB dep pc with staff dep pc for verifying inter-VLAN config:



Inter-VLAN routing on main campus switch:

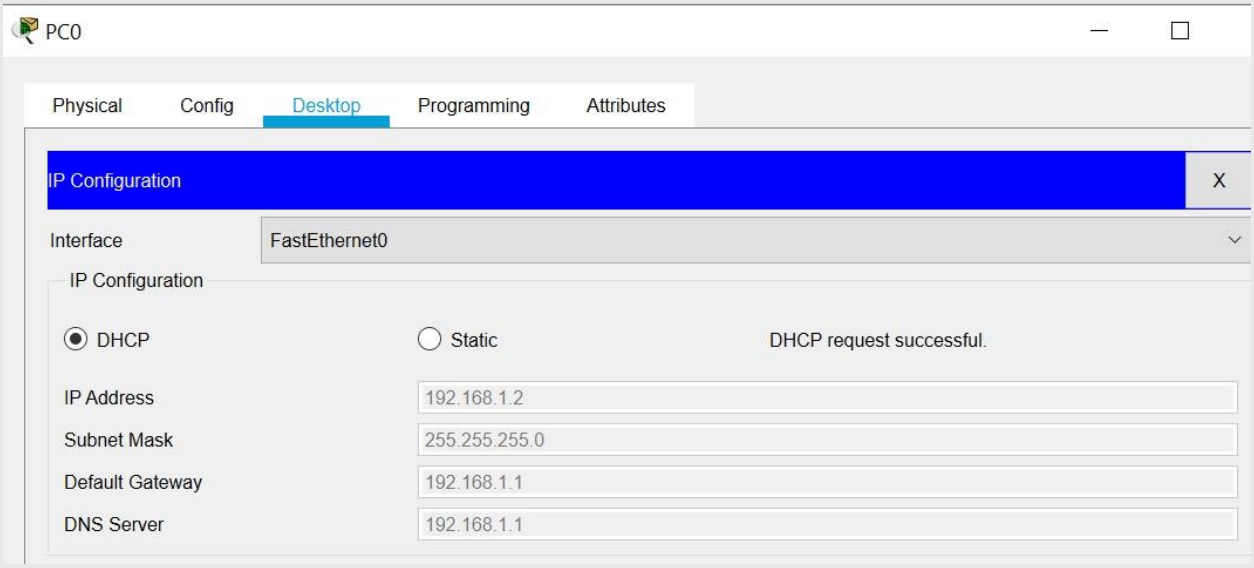
```
Router>
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int gig0/0.10
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.10, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.10, changed state to up

Router(config-subif)#encapsulation dot1q 10
Router(config-subif)#ip add 192.168.1.1 255.255.255.0
Router(config-subif)#exit
Router(config)#
Router(config)#int gig0/0.20
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.20, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.20, changed state to up

Router(config-subif)#encapsulation dot1q 20
Router(config-subif)#ip add 192.168.2.1 255.255.255.0
Router(config-subif)#exit
Router(config)#
Router(config)#int gig0/0.30
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.30, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.30, changed state to up

Router(config-subif)#encapsulation dot1q 30
Router(config-subif)#ip add 192.168.3.1 255.255.255.0
Router(config-subif)#
Router(config-subif)#exit
```

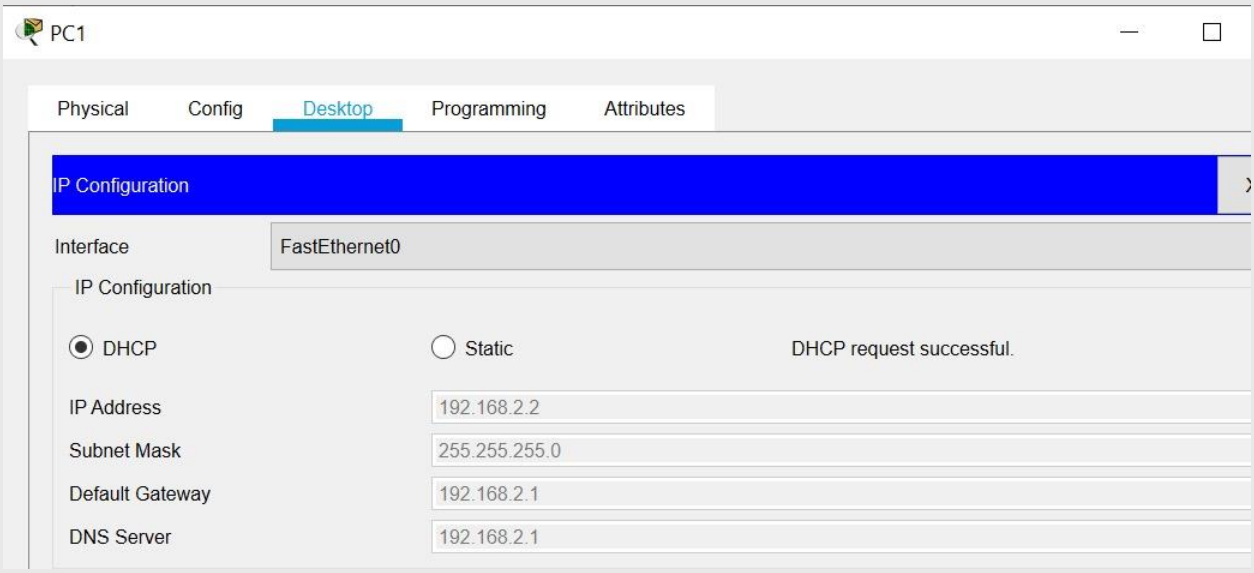

Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config-subif)#exit
Router(config)#
Router(config)#int gig0/0.40
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.40, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.40, changed state to up
Router(config-subif)#encapsulation dot1q 40
Router(config-subif)#ip add 192.168.4.1 255.255.255.0
Router(config-subif)#exit
Router(config)#
Router(config)#int gig0/0.50
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.50, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.50, changed state to up
Router(config-subif)#encapsulation dot1q 50
Router(config-subif)#ip add 192.168.5.1 255.255.255.0
Router(config-subif)#exit
Router(config)#
Router(config)#int gig0/0.60
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.60, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.60, changed state to up
Router(config-subif)#encapsulation dot1q 60
Router(config-subif)#ip add 192.168.6.1 255.255.255.0
Router(config-subif)#exit
Router(config)#do wr
Building configuration...
[OK]

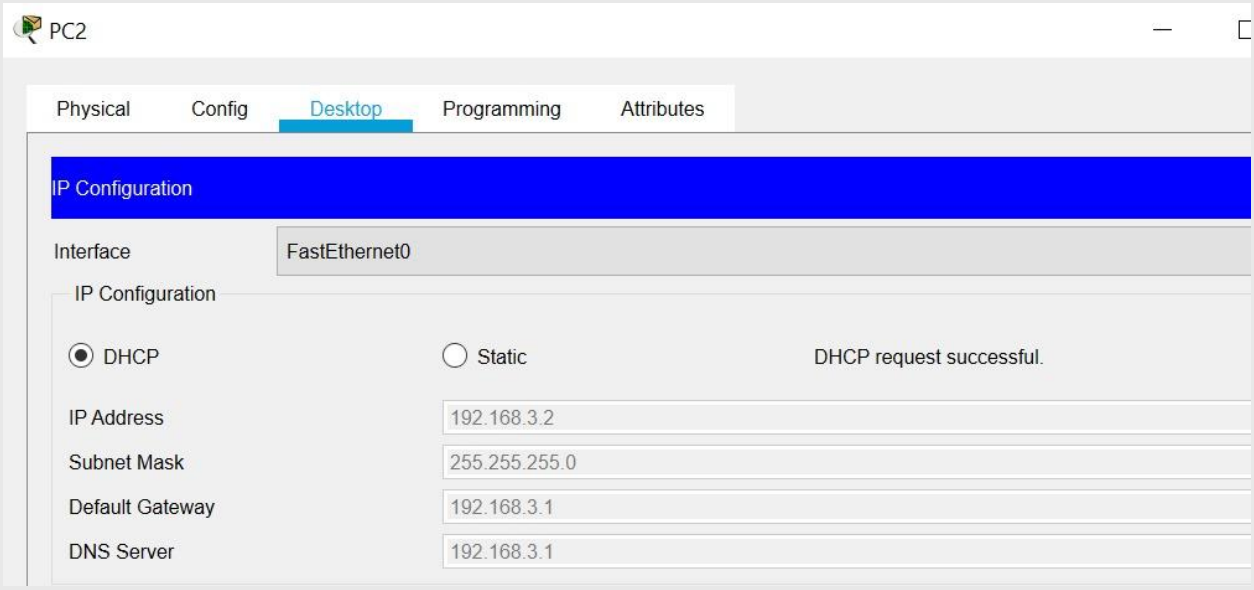
DHCP CONFIGURATION:

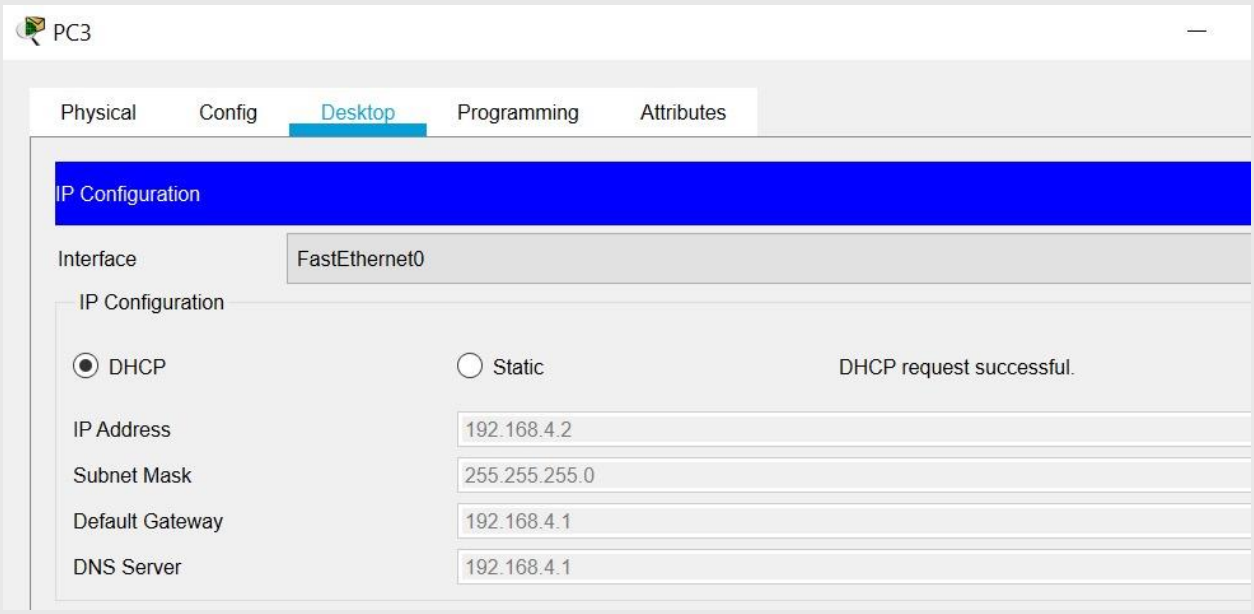
```
Router(config)#
Router(config)#service dhcp
Router(config)#ip dhcp pool ADMIN-pool
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#dns-server 192.168.1.1
Router(dhcp-config)#exit
Router(config)#
Router(config)#ip dhcp pool HR-pool
Router(dhcp-config)#network 192.168.2.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.2.1
Router(dhcp-config)#dns-server 192.168.2.1
Router(dhcp-config)#exit
Router(config)#ip dhcp pool FINANCE-pool
Router(dhcp-config)#network 192.168.3.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.3.1
Router(dhcp-config)#dns-server 192.168.3.1
Router(dhcp-config)#exit
Router(config)#ip dhcp pool BUSINESS-pool
Router(dhcp-config)#network 192.168.4.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.4.1
Router(dhcp-config)#dns-server 192.168.4.1
Router(dhcp-config)#exit
```

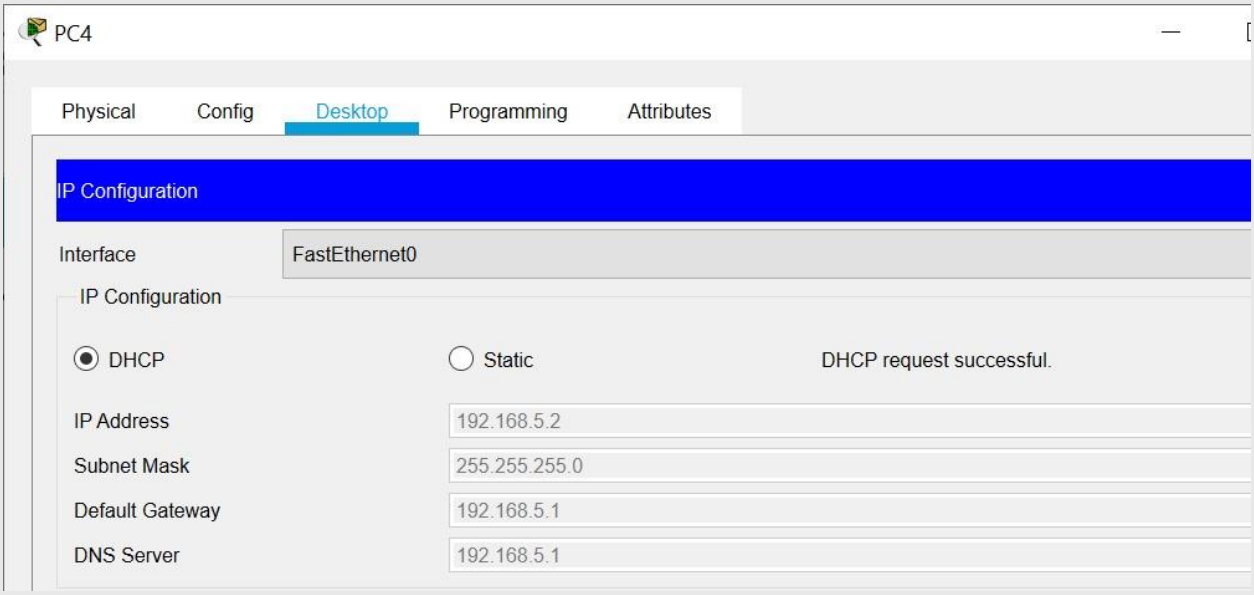
```
Router(config)#ip dhcp pool STUDENTLAB-pool
Router(dhcp-config)#network 192.168.5.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.5.1
Router(dhcp-config)#dns-server 192.168.5.1
Router(dhcp-config)#exit
Router(config)#ip dhcp pool IT-pool
Router(dhcp-config)#network 192.168.6.0 255.255.255.0
Router(dhcp-config)#default-router 192.168.6.1
Router(dhcp-config)#dns-server 192.168.6.1
Router(dhcp-config)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

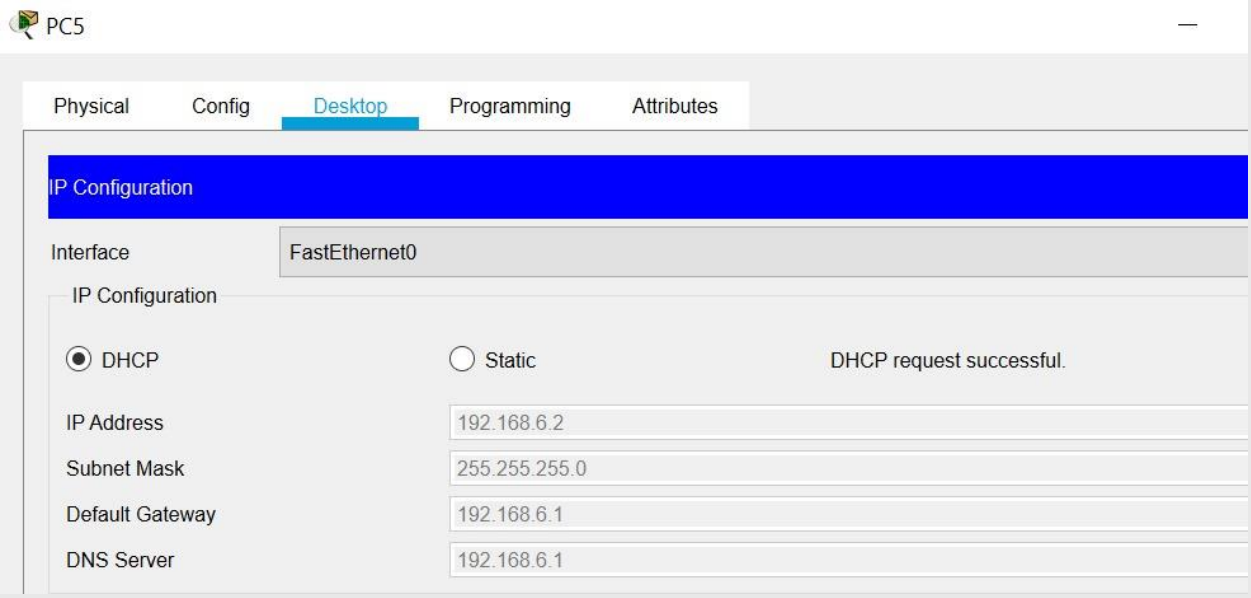



PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
IP Address
192.168.2.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.2.1
DNS Server
192.168.2.1


PC2
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
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
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
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
Physical
Config
Desktop
Programming
Attributes
IP Configuration
Interface
FastEthernet0
IP Configuration
DHCP
Static
DHCP request successful.
IP Address
192.168.5.2
Subnet Mask
255.255.255.0
Default Gateway
192.168.5.1
DNS Server
192.168.5.1




```
Router#
Router#show ip dhcp binding
IP address       Client-ID/              Lease expiration        Type
                 Hardware address
192.168.1.2      0060.2F19.A22A           --                     Automatic
192.168.2.2      0060.3E29.0045           --                     Automatic
192.168.3.2      0060.4722.0342           --                     Automatic
192.168.4.2      0001.6327.1682           --                     Automatic
192.168.5.2      0030.A3EC.E52A           --                     Automatic
192.168.6.2      0002.170C.9322           --                     Automatic
Router#
```

Pinging pc of admin with It dep for verifying inter-VLAN config:

```
C:\>ping 192.168.6.2

Pinging 192.168.6.2 with 32 bytes of data:

Reply from 192.168.6.2: bytes=32 time<1ms TTL=127
Reply from 192.168.6.2: bytes=32 time=10ms TTL=127
Reply from 192.168.6.2: bytes=32 time=3ms TTL=127
Reply from 192.168.6.2: bytes=32 time=13ms TTL=127

Ping statistics for 192.168.6.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 13ms, Average = 6ms
```

RIP Routing:

Main Campus:

```
Router>
Router>
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 192.168.1.0
Router(config-router)#network 192.168.2.0
Router(config-router)#network 192.168.3.0
Router(config-router)#network 192.168.4.0
Router(config-router)#network 192.168.5.0
Router(config-router)#network 192.168.6.0
Router(config-router)#eixt
                     ^
% Invalid input detected at '^' marker.

Router(config-router)#exit
Router(config)#do wr
Building configuration...
[OK]
Router(config)#
```

Branch Campus:

```
Router>
Router>
Router>
Router>
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 192.168.7.0
Router(config-router)#network 192.168.8.0
Router(config-router)#network 10.0.0.0
Router(config-router)#exit
Router(config)#do wr
Building configuration...
[OK]
Router(config)#
```

VLANS connectivity:

Branch Campus:

```
VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig1/0/4, Gig1/0/5, Gig1/0/6, Gig1/0/7
                                                Gig1/0/8, Gig1/0/9, Gig1/0/10, Gig1/0/11
                                                Gig1/0/12, Gig1/0/13, Gig1/0/14, Gig1/0/15
                                                Gig1/0/16, Gig1/0/17, Gig1/0/18, Gig1/0/19
                                                Gig1/0/20, Gig1/0/21, Gig1/0/22, Gig1/0/23
                                                Gig1/0/24, Gig1/1/1, Gig1/1/2, Gig1/1/3
                                                Gig1/1/4
70   VLAN0070                         active    Gig1/0/2
80   VLAN0080                         active    Gig1/0/3
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
Switch>
```

Main Campus:

```
Switch>show vlan brief

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Gig1/0/8, Gig1/0/9, Gig1/0/10, Gig1/0/11
                                                Gig1/0/12, Gig1/0/13, Gig1/0/14, Gig1/0/15
                                                Gig1/0/16, Gig1/0/17, Gig1/0/18, Gig1/0/19
                                                Gig1/0/20, Gig1/0/21, Gig1/0/22, Gig1/0/23
                                                Gig1/0/24, Gig1/1/1, Gig1/1/2, Gig1/1/3
                                                Gig1/1/4
10   VLAN0010                         active    Gig1/0/2
20   VLAN0020                         active    Gig1/0/3
30   VLAN0030                         active    Gig1/0/4
40   VLAN0040                         active    Gig1/0/5
50   VLAN0050                         active    Gig1/0/6
60   VLAN0060                         active    Gig1/0/7
1002 fddi-default                     active
1003 token-ring-default               active
1004 fddinet-default                  active
1005 trnet-default                    active
Switch>
```

IP Interface Brief:

Main Campus:

```
Router#
Router#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/0.10  192.168.1.1     YES manual up                    up
GigabitEthernet0/0.20  192.168.2.1     YES manual up                    up
GigabitEthernet0/0.30  192.168.3.1     YES manual up                    up
GigabitEthernet0/0.40  192.168.4.1     YES manual up                    up
GigabitEthernet0/0.50  192.168.5.1     YES manual up                    up
GigabitEthernet0/0.60  192.168.6.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/2/0            10.0.0.1        YES manual up                    up
Serial0/2/1            unassigned      YES unset  down                  down
Vlan1                  unassigned      YES unset  administratively down down
Router#
```

Branch Campus:

```
Router>show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     unassigned      YES unset  up                    up
GigabitEthernet0/0.70  192.168.7.1     YES manual up                    up
GigabitEthernet0/0.80  192.168.8.1     YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
GigabitEthernet0/2     unassigned      YES unset  administratively down down
Serial0/1/0            10.0.0.2        YES manual up                    up
Serial0/1/1            unassigned      YES unset  administratively down down
Vlan1                  unassigned      YES unset  administratively down down
Router>
```

Conclusion:

The University Management System project efficiently organizes the network infrastructure of the university, ensuring robust and scalable network management. By implementing DHCP, VLANs, inter-VLAN routing, and RIP routing protocols, the network is optimized for performance, security, and ease of management.