



**INDIVIDUAL ASSIGNMENT  
LANKA  
COMP40001  
NETWORK CONCEPTS AND CYBER SECURITY I**

**COM2423**

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**INSTRUCTION TO CANDIDATES:**

1. Students are advised to underpin their answers with the use of references (cited using the Harvard Name System of Referencing).
2. Late submission will be awarded zero (0) unless Extenuating Circumstances (EC) are upheld.
3. Cases of plagiarism will be penalized
4. Assignment report and the application should be submitted in the form of a zipped folder to the link provided on LMS.

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## 1. Introduction

A thorough network infrastructure plan is necessary to ease Campus ABC's growth and improve communication throughout its Main Campus (HQ), Research and Development Centre, and Kandy Branch. As the focal point, the Main Campus will need improved security, a dedicated server room, and fast internet to support departmental decision-making and coordination, including the Computing School, Business School, and HR. The R&D Centre will need dedicated support for safe storage and high-speed data transport because it focuses on student projects and technical developments. In the meantime, to ensure efficient integration and communication, the Kandy Branch would need to have smooth access to the main campus, even with its hillside location. The implementation of safe, effective communication channels throughout all sites and IP address optimization will be given top priority in the network design.

## 2. Hardware Devices and Network Types Used

### 2.1 Router (Cisco ASR 1002-X)

The Cisco ASR 1002-X router is the ideal choice for our network design due to its 36 Gbps throughput, scalability, redundant power supplies, and integrated services like firewall, IPSec VPN, and deep packet inspection. It can handle traffic loads, accommodate up to 8 million concurrent sessions, and ensure uninterrupted network reliability.

### 2.3 Core switch (Cisco Nexus 93180YC-EX Switch)

An excellent option for the core layer of this network, particularly for linking every department in a branch, is the Cisco Nexus 93180YC-EX switch. Due to its high performance, port capacity, advanced capabilities, redundancy features, compatibility, speed, and scalability, it is the perfect choice for guaranteeing a stable, dependable core network. This move offers the framework required to support a modern enterprise's technical improvements and organizational ambitions.

## 2.4 Distribution switch (Cisco Catalyst 9500-48Y4C switch)

Our network has chosen the Cisco Catalyst 9500-48Y4C switch as its distribution switch because of its outstanding performance, high port density, advanced redundancy features, broad VLAN compatibility, fast connectivity, and scalability. By making this decision, we can be sure that our distribution layer will be strong, dependable, and able to handle both present and future network demands.

## 2.5 Access switch (Cisco Catalyst 9400-48Y4C switch)

Our network's access switch is the Cisco Catalyst 9400-48Y4C switch, which we selected for its outstanding performance, large port capacity, strong VLAN capabilities, compatibility with a variety of hardware devices, fast connectivity, and scalability. By making this choice, we can make sure that our network architecture can support growing needs in the future while also meeting present demands.

## 2.5 Sever (Cisco UCS C220 M5 Rack Server)

The Cisco Nexus 93180YC-EX core switch, the Cisco Catalyst 9500-48Y4C distribution switch, the Cisco Catalyst 9400-48Y4C access switch and Cisco ASR 1002-X router are all completely compatible with the Cisco UCS C220 M5 Rack Server. This compatibility includes compliance with industry standards, redundancy features, management integration, and network connectivity. By integrating the UCS C220 M5 server into this network architecture, a high-performing, dependable, and scalable infrastructure that can handle the needs of a contemporary business environment will be guaranteed.

### 3. Tree Topology

Hierarchical Network Design is now considered the best practice industry-wide to design reliable, resilient, scalable, and cost-effective networks. Initially, networks were designed in a Flat Topology where the end devices were connected using Hubs and Switches. To add more devices or more users, more Switches/Hubs were added to the network. This Flat network design would cause a delay in the network if in case the network grows and because of the use of Hubs and Switches it would be difficult for the admins to control and limit the broadcast traffic or filter the undesired traffic in the network.

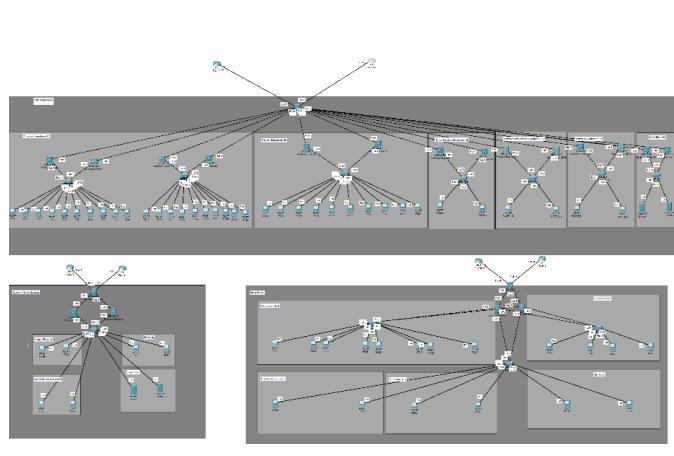
The network is divided into distinct layers. These layers (also known as Tiers) relate to one another in the form of a hierarchy which enables the network to be divided into more manageable blocks and these blocks limit the local traffic to remain local even if it is broadcast traffic. A hierarchical Model can be applied for both LAN and WAN Network design.

GeeksforGeeks (2022) *Hierarchical network design*.

<https://www.geeksforgeeks.org/hierarchical-network-design/>.

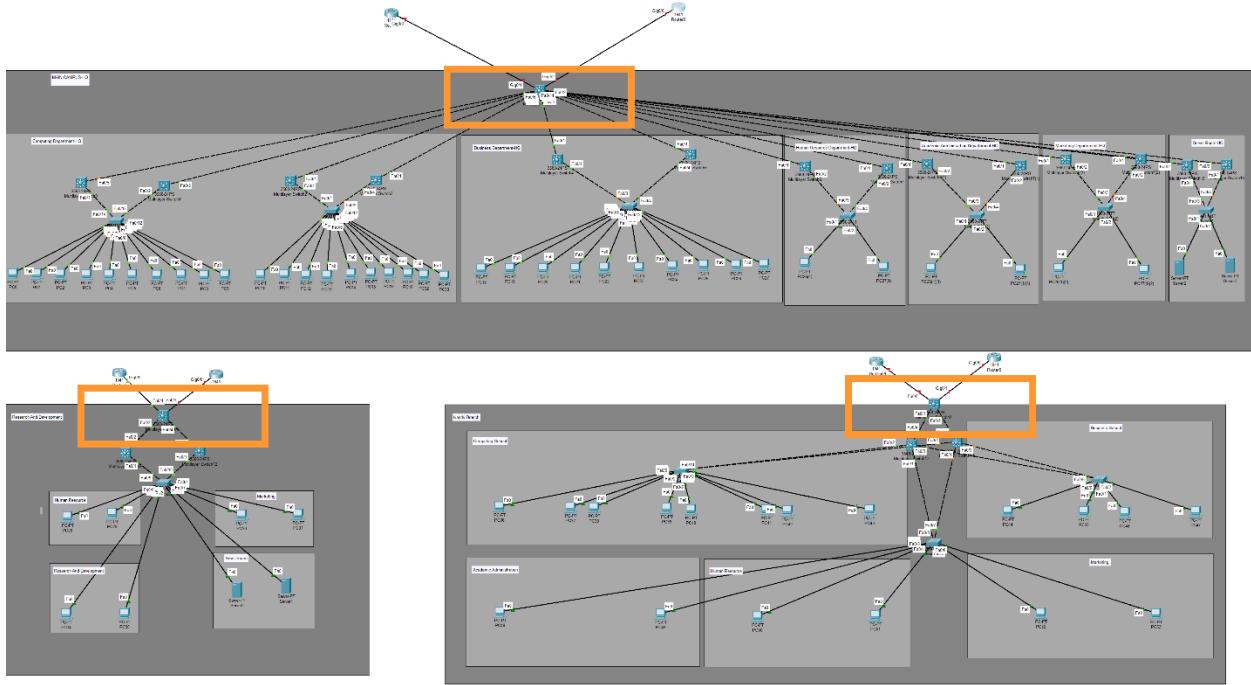
Advantages and Disadvantages of Tree Topology - GeeksforGeeks (no date).

<https://www.geeksforgeeks.org/advantages-and-disadvantages-of-tree-topology/amp/>.



The Network Design is shown in the image above. The hierarchical model is divided into three layers. They are Access Layer, Distribution Layer and Core Layer.

### 3.1 Core Layer

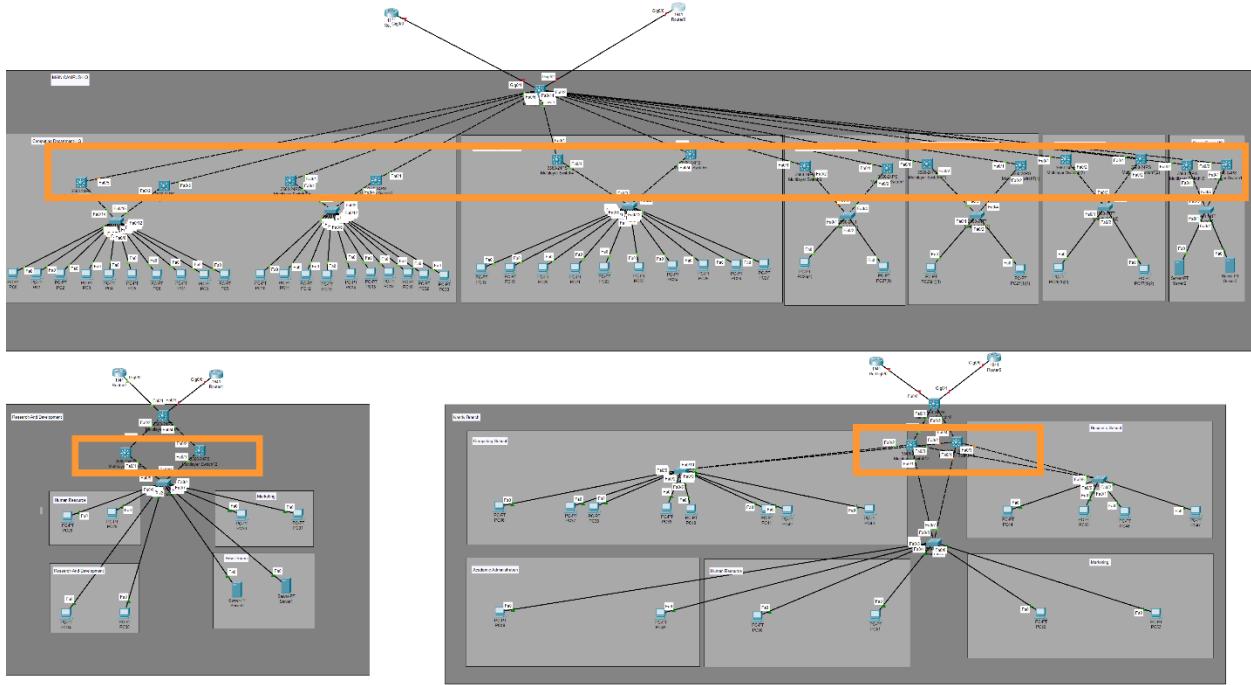


This layer is considered as the Backbone of the network which provides fast transport between the switches present in the Distribution Layer of the network. The Core Layer acts as an aggregation point for multiple networks. The server is Cisco UCS C220 M5 Rack Server, and the Core Switch is Cisco Nexus 93180YC-EX. These devices belong to the Core layer.

- It consists of high-speed network devices responsible for switching packets as fast as possible.
- It provides interconnectivity between the Distribution Layer devices.
- It provides reliability and fault tolerance to maximize performance.
- It also plays a crucial role in avoiding CPU-intensive packet manipulation caused by security services (restrictive ACLs)

This 3-Tier Hierarchical Network Design maximizes performance, scalability, and network availability and minimizes costs.

### 3.1 Distribution Layer



This layer basically provides policy-based connectivity and acts as a boundary between the Access Layer and the Core Layer. Data Filtering and Routing take place in this layer.

The Distribution Layer is mainly responsible for collecting/aggregating data from the Switches of the Access Layer and distributing it to the rest of the network.

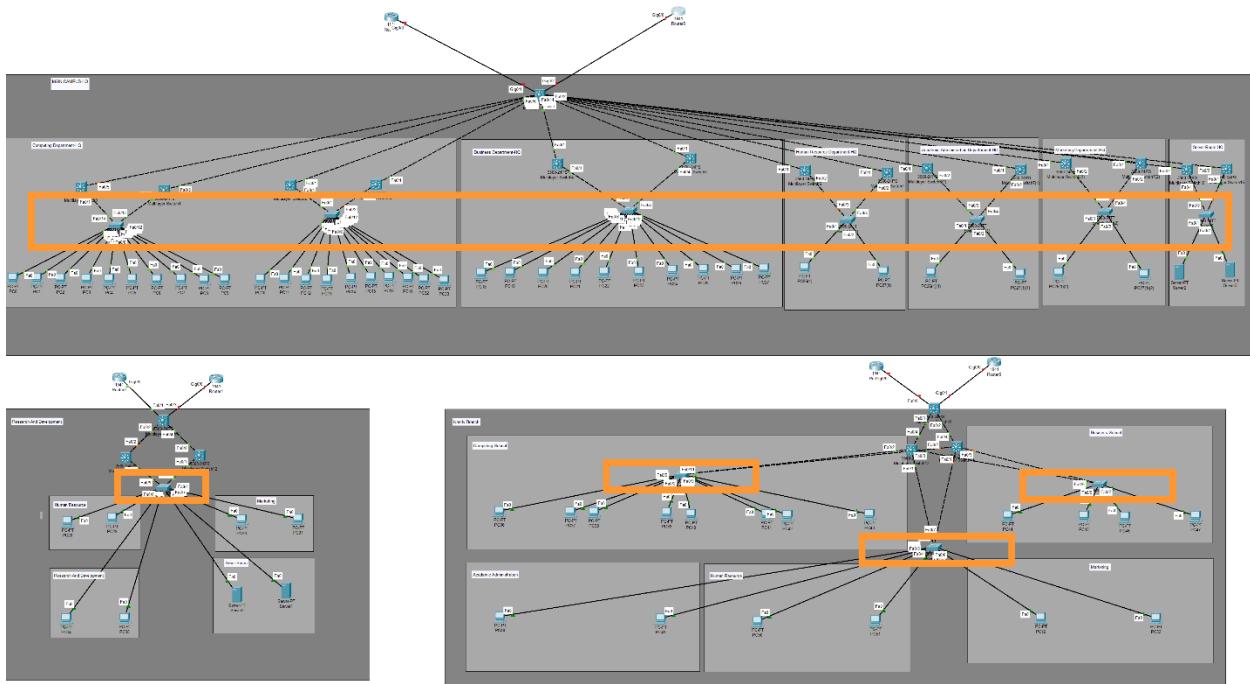
Our Distribution Switch is a Cisco Catalyst 9500-48Y4C switch and it belongs to this layer.

Functions of the Distribution Layer:

- It acts as a border and connector to the Access Layer and the Core Layer.
- It provides policy-based security by using Access Control Lists (ACLs) and filtering.
- The use of routing services (like EIGRP, OSPF, Etc.) also takes place in this layer.
- It provides Redundancy and Load Balancing.

**Provides Redundancy:** This includes redundant links and devices to ensure that if one switch fails, the network can still operate without interruption.

### 3.1 Access Layer



Access Layer is the layer where end nodes are connected to the network. Examples such as PCs and Switches. According to the design this will be the access layer. Our access switch is a Cisco Catalyst 9400-48Y4C switch and it belongs to this layer.

The functions of the Access Layer:

- It provides high-bandwidth connectivity.
- It offers Layer 2 Switching capabilities.
- Plays a crucial role in protecting the network and malicious attacks because of its connection with the endpoints of the network
- Port security

#### 4. Identifying Classless IP Addresses and Their Suitable Class Assignments

Classless IP addressing in conjunction with Variable Length Subnet Masking (VLSM) is a key architectural component in modern networking setups. Its efficiency is crucial because it makes more inventive use of IP address allocation possible. Classless addressing maximizes address utilization by giving network administrators the ability to use network masks that are customized to meet requirements.

Some of the advantages are listed below:

- More IP address allocations.
- More balanced use of IP address ranges.
- More efficient routing.

Private Campus ABC IP Address = 192.192.192.0/20

The IP Address 192.192.192.0/20 has been sub-netted into 7. And the sub-netted IPs are listed below,

192.192.1100 000 0.00000000 = 192.192.192.0/23 Head Quarters

192.192.1100 001 0.00000000 = 192.192.194.0/23 Kandy

192.192.1100 010 0.00000000 = 192.192.196.0/23 R&D

192.192.1100 011 0.00000000 = 192.192.198.0/23 Serial port 1

192.192.1100 100 0.00000000 = 192.192.200.0/23 Serial port 2

192.192.1100 101 0.00000000 = 192.192.202.0/23 Serial port 3

192.192.1100 110 0.00000000 = 192.192.204.0/23 Serial port 4

### **Variable Length Subnet Mask (VLSM)**

- **COLOMBO BRANCH 192.192.9/23**

-COMPUTING 205 IPS SO  $2^8$

192.192.1100000 0. 00000000 (192.192.192.0/24)

Subnet Mask: 255.255.255.0

-BUSINESS 105 IPS SO  $2^7$

192.192.1100000 1. 0 0000000 (192.192.193.0/25)

Subnet Mask: 255.255.255.128

-MARKETING 25 IPS SO  $2^5$

192.192.1100000 1. 1 00 00000 (192.192.193.128/27)

Subnet Mask: 255.255.255.224

-ACADEMIC 13 IPS SO  $2^4$

192.192.1100000 1. 1 01 0 0000 (192.192.193.160/28)

Subnet Mask: 255.255.255.240

-HR 8 IPS SO  $2^3$

192.192.1100000 1. 1 01 1 0 000 (192.192.193.176/29)

Subnet Mask: 255.255.255.248

-SERVER ROOM 7 IPS  $2^3$

192.192.1100000 1. 1 01 1 1 000 (192.192.193.184/29)

Subnet Mask: 255.255.255.248

- **R&D 192.192.196.0/23**

-RESEARCH N DEV 23 IPS SO 2^5

192.192.1100010 0.000 00000 (192.192.196.0/27)

Subnet Mask: 255.255.255.224

-MARKETING 11 IPS SO 2^4

192.192.1100010 0.001 0 0000 (192.192.196.32/28)

Subnet Mask: 255.255.255.240

-SERVER ROOM 7 IPS SO 2^3

192.192.1100010 0.001 1 0 000 (192.192.196.48/29)

Subnet Mask: 255.255.255.248

-HR 6 IPS 2^3

192.192.1100010 0.001 1 1 000 (192.192.196.56/29)

Subnet Mask: 255.255.255.248

- **KANDY 192.192.194.0/23**

-COMPUTING 83 IPS SO 2^7

192.192.1100001 0.0 0000000 (192.192.194.0/25)

Subnet Mask: 255.255.255.128

-BUSINESS 43 IPS SO 2^6

192.192.1100001 0.1 0 000000 (192.192.194.128/26)

Subnet Mask: 255.255.255.192

-ACADEMIC 9 IPS SO 2^4

192.192.1100001 0.1 1 00 0000 (192.192.194.192/28)

Subnet Mask: 255.255.255.240

-MARKETING 7 IPS SO  $2^3$

192.192.1100001 0.1 1 01 0 000 (192.192.194.208/29)

Subnet Mask: 255.255.255.248

-HR 5 IPS SO  $2^3$

192.192.1100001 0.1 1 01 1 000 (192.192.194.216/29)

Subnet Mask: 255.255.255.248

## **SERIAL PORT 1**

4 IPS SO 2<sup>^2</sup>

SERIAL PORT 1 (192.192.198.0/23)

192.192.1100011 0.000000 00 = 192.192.198.0/30

Subnet Mask: 255.255.255.252

## **SERIAL PORT 2**

4 IPS SO 2<sup>^2</sup>

SERIAL PORT 2 (192.192.200.0/2)

192.192.1100100 0.000000 00 = 192.192.200.4/30

Subnet Mask: 255.255.255.252

## **SERIAL PORT 3**

4 IPS SO 2<sup>^2</sup>

SERIAL PORT 3 (192.192.202.0/23)

192.192.1100101 0.000000 00 = 192.192.202.0/30

Subnet Mask: 255.255.255.252

## **SERIAL PORT 4**

4 IPS SO 2<sup>^2</sup>

SERIAL PORT 4 (192.192.204.0/23)

192.192.1100110 0.000000 00 = 192.192.204.0/23

Subnet Mask: 255.255.255.252

## 5. IP Addressing Plan

### 5.1 Main Branch (HQ)

Department	Sub-netted IP	N ee d e d si ze	A llo ca te d siz e	Subnet mask	First usable IP	Last usable IP	Broadcast IP	No of unuse IP
Computing	192.192.192.0/24	205	256	255.255.255.0	192.192.192.1/24	192.192.192.254/24	192.192.192.255/24	51
Business	192.192.193.0/25	105	128	255.255.255.128	192.192.193.1/25	192.192.193.126/25	192.192.193.127/25	23
Marketing	192.192.193.128/27	25	32	255.255.255.224	192.192.193.129/27	192.192.193.254/27	192.192.193.255/27	7
HR	192.192.193.176/29	8	8	255.255.255.248	192.192.193.177/29	192.192.193.254/29	192.192.193.255/29	0
Academic	192.192.193.160/28	13	16	255.255.255.240	192.192.193.161/28	192.192.193.254/28	192.192.193.255/28	3
Server room	192.192.193.184/29	7	8	255.255.255.248	192.192.193.185/29	192.192.193.254/29	192.192.193.255/29	1

## 5.2 Research and Development

<b>Department</b>	<b>Sub-netted IP</b>	<b>Net size</b>	<b>Addressable IP</b>	<b>Subnet mask</b>	<b>First usable IP</b>	<b>Last usable IP</b>	<b>Broadcast IP</b>	<b>No of unused IP</b>
R & D	192.192.19 6.0/27	23	3 2	255,255.255. 224	192.192.19 6.1/27	192.192.196. 30/27	192.192.196. 31/27	9
Marketing	192.192.19 6.32/28	11	1 6	255,255.255. 240	192.192.19 6.33/28	192.192.196. 46/28	192.192.196. 47/28	5
Server room	192.192.19 6.48/29	7	8	255,255.255. 248	192.192.19 6.49/29	192.192.196. 54/29	192.192.196. 55/29	1
HR	192.192.19 6.56/29	6	8	255,255.255. 248	192.192.19 6.57/29	192.192.196. 61/29	192.192.196. 62/29	2

### 5.3 Kandy Branch

<b>Departm ent</b>	<b>Sub-netted IP</b>	<b>Nee ded size</b>	<b>Allo cate d size</b>	<b>Subnet Mask</b>	<b>First usable IP</b>	<b>Last usable IP</b>	<b>Broadcast IP</b>	<b>No of unu sed ip</b>
Computin g	192.192.194.0/25	83	128	255,255.255.1 28	192.192.194. 1/25	192.192.1 94.126/25	192.192.1 94.127/25	45
Business	192.192.194.128/ 26	43	64	255,255.255.1 92	192.192.194. 129/26	192.192.1 94.19026	192.192.1 94.191/26	21
Academic	192.192.194.192/ 28	9	16	255,255.255.2 40	192.192.194. 193/28	192.192.1 94.206/28	192.192.1 94.207/28	7
Marketin g	192.192.194.208/ 29	7	8	255,255.255.2 48	192.192.194. 209/29	192.192.1 94.214/29	192.192.1 94.215/29	1
HR	192.192.194.216/ 29	5	8	255,255.255.2 48	192.192.194. 217/29	192.192.1 94.220/29	192.192.1 94.221/29	3

6. IP addresses of all the end devices.

6.1 Main Branch (HQ)

<b>Host/Device</b>	<b>IP address</b>	<b>Mask</b>	<b>Default Gateway</b>
Computing Department- PC0	192.192.192.19	255,255.255.0	192.192.192.1
Computing Department- PC1	192.192.192.20	255,255.255.0	192.192.192.1
Computing Department- PC2	192.192.192.21	255,255.255.0	192.192.192.1
Computing Department- PC3	192.192.192.22	255,255.255.0	192.192.192.1
Computing Department- PC4	192.192.192.23	255,255.255.0	192.192.192.1
Computing Department- PC5	192.192.192.24	255,255.255.0	192.192.192.1
Computing Department- PC6	192.192.192.25	255,255.255.0	192.192.192.1
Computing Department- PC7	192.192.192.26	255,255.255.0	192.192.192.1
Computing Department- PC8	192.192.192.27	255,255.255.0	192.192.192.1
Computing Department- PC9	192.192.192.28	255,255.255.0	192.192.192.1
Computing Department- PC10	192.192.192.29	255,255.255.0	192.192.192.1
Computing Department- PC11	192.192.192.30	255,255.255.0	192.192.192.1

Computing Department- PC12	192.192.192.31	255,255.255.0	192.192.192.1
Computing Department- PC13	192.192.192.32	255,255.255.0	192.192.192.1
Computing Department- PC14	192.192.192.33	255,255.255.0	192.192.192.1
Computing Department- PC15	192.192.192.34	255,255.255.0	192.192.192.1
Computing Department- PC17	192.192.192.35	255,255.255.0	192.192.192.1
Computing Department- PC16	192.192.192.36	255,255.255.0	192.192.192.1
Business Department- PC18	192.192.193.5	255,255.255.128	192.192.193.1
Business Department- PC19	192.192.193.13	255,255.255.128	192.192.193.1
Business Department- PC20	192.192.193.7	255,255.255.128	192.192.193.1
Business Department- PC21	192.192.193.8	255,255.255.128	192.192.193.1
Business Department- PC22	192.192.193.4	255,255.255.128	192.192.193.1
Business Department- PC23	192.192.193.9	255,255.255.128	192.192.193.1
Business Department- PC24	192.192.193.10	255,255.255.128	192.192.193.1
Business Department- PC25	192.192.193.6	255,255.255.128	192.192.193.1
Business Department- PC26	192.192.193.11	255,255.255.128	192.192.193.1

Business Department- PC27	192.192.193.12	255.255.255.128	192.192.193.1
Human Resource- PC26(1)	192.192.193.181	255.255.255.248	192.192.193.177
Human Resource- PC27(1)	192.192.193.180	255.255.255.248	192.192.193.177
Academic Administration PC26(1)(1)	192.192.193.165	255.255.255.240	192.192.193.161
Academic Administration PC27(1)(1)	192.192.193.164	255.255.255.240	192.192.193.161
Marketing Department PC26(1)(2)	192.192.193.132	255.255.255.244	192.192.193.129
Marketing Department PC27(1)(2)	192.192.193.133	255.255.255.244	192.192.193.129
Sever Room Sever-PT Sever2	192.192.193.188	255.255.255.248	192.192.193.185
Sever Room Sever-PT Sever3	192.192.193.189	255.255.255.248	192.192.193.185

## 6.2 Research & Development Branch

<b>Host/Device</b>	<b>IP address</b>	<b>Mask</b>	<b>Default Gateway</b>
Human-Resource PC28	192.192.196.59	255.255.255.248	192.192.196.57
Human-Resource PC29	192.192.196.58	255.255.255.248	192.192.196.57
Marketing PC30	192.192.196.35	255.255.255.240	192.192.196.33
Marketing PC31	192.192.196.34	255.255.255.240	192.192.196.33
Research& Development PC34	192.192.196.2	255.255.255.224	192.192.196.1
Research& Development PC35	192.192.196.3	255.255.255.224	192.192.196.1
Sever-Room Sever-PT Sever0	192.192.196.50	255.255.255.248	192.192.196.49
Sever-Room Sever-PT Sever1	192.192.196.51	255.255.255.248	192.192.196.49

### 6.3 Kandy Branch

<b>Host/Device</b>	<b>IP address</b>	<b>Mask</b>	<b>Default Gateway</b>
Computing School PC36	192.192.194.2	255.255.255.128	192.192.196.1
Computing School PC37	192.192.194.3	255.255.255.128	192.192.196.1
Computing School PC38	192.192.194.4	255.255.255.128	192.192.196.1
Computing School PC39	192.192.194.5	255.255.255.128	192.192.196.1
Computing School PC40	192.192.194.6	255.255.255.128	192.192.196.1
Computing School PC41	192.192.194.7	255.255.255.128	192.192.196.1
Computing School PC42	192.192.194.8	255.255.255.128	192.192.196.1
Computing School PC43	192.192.194.9	255.255.255.128	192.192.196.1
Business School PC44	192.192.194.130	255.255.255.192	192.192.194.129
Business School PC45	192.192.194.131	255.255.255.192	192.192.194.129
Business School PC46	192.192.194.132	255.255.255.192	192.192.194.129
Business School PC47	192.192.194.133	255.255.255.192	192.192.194.129
Academic Administration PC48	192.192.194.195	255.255.255.240	192.192.194.193
Academic Administration PC49	192.192.194.194	255.255.255.240	192.192.194.193
Human Resource PC50	192.192.194.218	255.255.255.248	192.192.194.217

## 7.Layer 2 Technologies for Network Design: Selection, Evaluation, and Justification

### 7.1 VLAN

A VLAN is a way of logically separating a group of computers into a separate network.

(GeeksforGeeks (2023) *Virtual LAN (VLAN)*. <https://www.geeksforgeeks.org/virtual-lan-vlan/>.)

VLANs offer several features such as:

- Improved network security: VLANs can be used to separate network traffic and limit access to specific network resources. This improves security by preventing unauthorized access to sensitive data and network resources.
- Better network performance: By segregating network traffic into smaller logical networks, VLANs can reduce the amount of broadcast traffic and improve network performance.
- Simplified network management: VLANs allow network administrators to group devices together logically, rather than physically, which can simplify network management tasks such as configuration, troubleshooting, and maintenance.
- Flexibility: VLANs can be configured dynamically, allowing network administrators to quickly and easily adjust network configurations as needed.
- Cost savings: VLANs can help reduce hardware costs by allowing multiple virtual networks to share a single physical network infrastructure.
- Scalability: VLANs can be used to segment a network into smaller, more manageable groups as the network grows and is more complex.

## 7.2 Radio Links

A radio link is an electronic wireless communication system using radio waves that allows the transfer of information between two or more points. The transmitter produces a microwave signal of a certain frequency and power, modulated in a certain way, injects it into the transmission line, usually a coaxial cable, and reaches the antenna, which emits the signal into free space.

The receiver's antenna, which points to that of the transmitter, collects the signal energy and passes it to the transmission line that connects to the receiver, which demodulates and processes it to interpret the information.

Radio Links belong to both Physical Layer (Layer 1) and the Data Link Layer (Layer 2) of the OSI model:

Physical Layer (Layer 1): Handles the actual transmission of data using radio waves.

Data Link Layer (Layer 2): Manages the communication protocols, medium access, and error handling over the radio link.

(Martinez, J. (no date) 'What is a radio link? - JL Martinez - Medium,' *Medium*.

[https://jlmartinez-es.medium.com/what-is-a-radio-link-3b400eca7b3f.\)](https://jlmartinez-es.medium.com/what-is-a-radio-link-3b400eca7b3f.)

### 7.3 Ethernet

Ethernet is a networking technology that includes the protocol, port, cable, and computer chip needed to plug a desktop or laptop into a local area network (LAN) for speedy data transmission via coaxial or fiber optic cables.

Ethernet also transmits data using two components, packets and frames.

The frame contains the sent data payload as well as the following:

- Both the MAC and physical addresses of the sender and recipient
- Error correction data for identifying transmission faults.

(*What Is Ethernet? Definition, Types, and Uses* (no date).

<https://www.spiceworks.com/tech/networking/articles/what-is-etherne...text=Ethernet%20is%20a%20networking%20technology,coaxial%20or%20fiber%20optic%20cables.>)

## 8.Layer 3 Technologies for Network Design: Selection, Evaluation, and Justification

### 8.1VRRP (Virtual Router Redundancy Protocol)

VRRP (Virtual Router Redundancy Protocol) is a standard protocol, like HSRP (Hot Standby Routing Protocol), that's used to create a virtual gateway. VRRP lets LAN hosts leverage local, redundant routing platforms using only the static configuration of one default route on the hosts. This is common for various forms of Ethernet (fast, gigabit, 10-gigabit) and logical interfaces running in an active/passive configuration.

VRRP handles traffic routing. We have performed Redundancy in Distribution Layer Switches and Routers.

(Technologies, Hap. (2024) 'What is VRRP (Virtual Router Redundancy Protocol)?', *HAProxy Technologies*, 9 April. [https://www.haproxy.com/glossary/what-is-vrrp-virtual-router-redundancyprotocol#:~:text=VRRP%20\(Virtual%20Router%20Redundancy%20Protocol\)%20is%20a%20standard%20protocol%2C,default%20route%20on%20the%20hosts.](https://www.haproxy.com/glossary/what-is-vrrp-virtual-router-redundancyprotocol#:~:text=VRRP%20(Virtual%20Router%20Redundancy%20Protocol)%20is%20a%20standard%20protocol%2C,default%20route%20on%20the%20hosts.))

Advantages to using VRRP include:

- Minimizing failover time and bandwidth overhead if a primary router becomes unavailable.
- Minimizing service disruptions during a failover.
- Providing backup for a load-balanced routing solution.
- Addressing failover problems at the router level instead of on the network edge.

(*Virtual Router Redundancy Protocol (VRRP)* (no date).

[https://techhub.hpe.com/eginfolib/networking/docs/switches/K-KA-KB/15-18/5998-8164\\_mrg/content/ch14.html.](https://techhub.hpe.com/eginfolib/networking/docs/switches/K-KA-KB/15-18/5998-8164_mrg/content/ch14.html.)

## 8.2 VPN

As an alternative option we are deploying Intranet VPN.

An intranet VPN is a type of site-to-site VPN that connects different departments or units within the same organization over the internet, creating a private network for internal communication and collaboration. This is useful for organizations that have multiple locations or teams that need to access common resources and applications securely and reliably. An intranet VPN uses the same router-to-router model as a site-to-site VPN, but with additional security and access control measures. The VPN routers or gateways only allow authorized users and devices to access the intranet VPN, and may use firewalls, NAT, or VLANs to segment the network and restrict access to certain resources. Some of the common VPN protocols used for intranet VPNs are IPSec, GRE, and MPLS. (*What are the most common VPN deployment scenarios?* (2023).

[https://www.linkedin.com/advice/0/what-most-common-vpn-deployment-scenarios-cgnyc. \)](https://www.linkedin.com/advice/0/what-most-common-vpn-deployment-scenarios-cgnyc.)

Reasons why VPN belongs to Layer 3:

- Establish secure connections over public networks at the Network Layer.
- Encrypt and encapsulate IP packets for secure transmission.

Main Campus (HQ) to Research and Development Center:

Primary Link: Microwave Radio Link for high-speed, low-latency connectivity, ensuring reliable and fast data transfer for critical operations.

Backup Link: intranet VPN serves as a backup to guarantee ongoing connectivity.

Main Campus (HQ) to Branch (Kandy):

Primary Link: Intranet VPN due to the longer distance unless a clear line of sight is feasible for microwave links. VPN provides a cost-effective and flexible solution.

### 8.3 Spanning Tree Protocol (STP)

Spanning Tree Protocol (STP) is a Layer 2 network protocol used to prevent looping within a network topology. STP was created to avoid the problems that arise when computers exchange data on a local area network (LAN) that contains redundant paths. If the flow of traffic is not carefully monitored and controlled, the data can be caught in a loop that circles around network segments, affecting performance and bringing traffic to a near halt. STP can help prevent bridge looping on LANs that include redundant links. Without STP, it would be difficult to implement that redundancy and still avoid network looping. STP monitors all network links, identifies redundant connections and disables the ports that can lead to looping.

STP prevents bridge looping and the broadcast storms that come with it. Once configured, STP automatically disables certain redundant links and determines which links remain enabled. In this way, a network can be configured with redundant data paths that provide failover services to protect against disaster, without the risk of bridge looping.

STP offers several important benefits:

- Easy to implement and maintain.
- Wide support for bridges and switches.
- Facilitates link redundancy, while simultaneously preventing undesirable loops; and
- Supports the use of backups in case the primary data path becomes unavailable.

Sheldon, R. (2021) *Spanning Tree Protocol (STP)*.

<https://www.techtarget.com/searchnetworking/definition/spanning-tree-protocol>.

## 9.WAN Technologies

Wide Area Network (WAN) technologies enable long-distance connectivity between geographically dispersed locations. 3 WAN technologies that could be used to implement the WAN connections are:

1. Radio Links
2. MPLS (Multiprotocol Label Switching)
3. SD-WAN

### 9.1MPLS (Multiprotocol Label Switching)

Multiprotocol Label Switching, or MPLS, is a networking technology that routes traffic using the shortest path based on “labels,” rather than network addresses, to handle forwarding over private wide area networks. MPLS is scalable, provides better performance and bandwidth, and improves user experience compared to traditional IP routing. But it is costly, difficult to deliver globally and lacks the flexibility to be carrier independent.

(*MPLS / What is multiprotocol label switching* (no date).

[https://www.paloaltonetworks.com/cyberpedia/mpls-what-is-multiprotocol-label-switching#:~:text=MPLS%20Meaning,over%20private%20wide%20area%20networks.\)](https://www.paloaltonetworks.com/cyberpedia/mpls-what-is-multiprotocol-label-switching#:~:text=MPLS%20Meaning,over%20private%20wide%20area%20networks.)

Drawbacks:

- Cost: MPLS is more expensive than regular Internet service.
- Long setup time: Setting up complicated dedicated paths across one or more large networks takes time. label-switched paths must be manually configured by the MPLS vendor or by the organization using MPLS. This makes it difficult for organizations to scale up their networks quickly.
- Lack of encryption: MPLS is not encrypted; any attacker that intercepts packets on MPLS paths can read them in plaintext. Encryption must be set up separately.

- Cloud challenges: Organizations that rely on cloud services may not be able to set up direct network connections to their cloud servers, as they do not have access to the specific servers where their data and applications live.

*What is MPLS (multiprotocol label switching)?* (no date).

<https://www.cloudflare.com/en-gb/learning/network-layer/what-is-mpls/>.

## 9.2SD-WAN (Software-defined wide area network)

A software-defined wide area network (SD-WAN) is a virtual WAN architecture that allows enterprises to leverage any combination of transport services — including MPLS, LTE and broadband internet services — to securely connect users to applications.

An SD-WAN assures consistent application performance and resiliency, automates traffic steering in an application-driven manner based on business intent, improves network security, and simplifies the WAN architecture. An SD-WAN uses a centralized control function to steer traffic securely and intelligently across the WAN and directly to trusted SaaS and IaaS providers. This increases application performance and delivers a high-quality user experience, which increases business productivity and agility and reduces IT costs.

### 9.3 Radio Links

Radio links use microwaves to transmit data wirelessly between locations. Common in areas where laying physical cables is impractical or too expensive.

#### Comparison between MPLS, SD-WAN VS Radio Links

**Higher Cost for MPLS:** MPLS involves higher operational costs due to the need for leased lines and service provider management.

**Complexity:** SD-WAN setup involves the integration of multiple connection types (MPLS, broadband, LTE) and requires specialized hardware and software, potentially leading to higher initial setup costs.

SD-WAN has a virtualized infrastructure and MPLS is hardware-based.

SDxCentral (2023) *SD-WAN vs MPLS: The Pros and Cons of Both Technologies*.

<https://www.sdxcentral.com/networking/sd-wan/definitions/software-defined-sdn-wan/sd-wan-vs-mpls-pros-cons-technologies/>.

**Reliability Issues:** SD-WAN performance is strongly dependent on the quality of the underlying internet connections. In rural places, internet reliability can be a major concern, making radio links more stable.

**Latency and Performance Variability:** Internet-based SD-WAN systems can experience varying latency and performance, which radio links can help to alleviate in remote circumstances.

**Conclusion:** Radio Links are very useful for connecting WANs in situations including remote or difficult geographical areas, rapid deployment requirements, and budget constraints. They provide quick setup, flexible deployment, inexpensive startup expenses, and effective redundancy. While MPLS and SD-WAN provide reliable and high-performance solutions, their higher costs, reliance on physical infrastructure, and extensive setup processes make radio connections a better option in certain situations, particularly where quick, flexible, and cost-effective solutions are preferred.

## 10.Potential Security Risks

### 10.1 Unauthorized access

It occurs when individuals gain access to an organization's networks, systems, applications, data, or devices without permission. This typically involves a network security breach that can compromise network integrity or lead to data loss. Common causes include weak passwords, phishing attacks, and inadequate physical security. To prevent unauthorized access, it's essential to implement strong security measures such as robust password policies, multi-factor authentication, regular software updates, employee training on security awareness, and effective physical security practices.

Blocking unauthorized access plays a central role in preventing data breaches. However, a robust security program uses "defense in depth" – several layers of security defenses, to mitigate attacks long before attackers reach a sensitive system. Additional layers of security include network protection, endpoint protection, and data protection.

Solution:

- Enforce best practices for user passwords.
- Two Factor Authentication
- Monitoring User Activity

## 10.2 Data Interception and Eavesdropping

Eavesdropping can be defined as a type of man-in-the-middle attack in which an individual intercepts, deletes, or modifies data being transmitted in real time between two devices. A phone call, instant message, video chat, fax transmission, and so on are all examples of data.

Eavesdropping can also occur when you share data on an open network without secured or encrypted traffic. The data is transmitted over an open network, allowing an attacker to exploit and intercept a vulnerability using various methods such as transmission links, pickup devices, etc.

Solutions:

- **Encryption:** Implement end-to-end encryption
- **Network Segmentation:** Segment the network into different zones (e.g., VLANs) and apply appropriate security measures for each segment.
- **Secure Protocols:** Use secure communication protocols (e.g., HTTPS) for data transfer.

Singh, A. (2023) *What is eavesdropping: how to prevent it?* - Shiksha Online.

<https://www.shiksha.com/online-courses/articles/eavesdropping-how-to-prevent-it/>.

### 10.3 Malware and Ransomware Attacks

Ransomware is a type of malware that prevents you from accessing your computer (or the data that is stored on it). The computer itself may become locked, or the data on it might be stolen, deleted or encrypted.

(*Mitigating malware and ransomware attacks* (no date).

[https://www.ncsc.gov.uk/guidance/mitigating-malware-and-ransomware-attacks#:~:text=Ransomware%20is%20a%20type%20of,be%20stolen%2C%20deleted%20or%20encrypted. \)](https://www.ncsc.gov.uk/guidance/mitigating-malware-and-ransomware-attacks#:~:text=Ransomware%20is%20a%20type%20of,be%20stolen%2C%20deleted%20or%20encrypted.)

Solutions:

- Adopting a 'defense-in-depth' approach. This means using layers of defense with several mitigations at each layer. You'll have more opportunities to detect malware, and then stop it before it causes real harm to your organization.
- Up-to-date backups
- Filtering to only allow file types you would expect to receive
- Actively inspecting content

11.Packet Tracer Configurations

# **MAIN BRANCH(HQ)**

# **PACKET TRACER**

# **CONFIGURATIONS**

## Main Campus Core Switch: VLAN Configuration and Access Switch Port Assignment

- Created VLANs in Core Switch of Main Campus and assigned all the switchports connected to the access Switch to the correct VLAN

Multilayer Switch0

Physical Config CLI Attributes

IOS Command Line Interface

```
10 Computing-Department      active   Fa0/1
1002 Business-Department    active
1003 tollbooth-department    active
1004 fddiinet-default        active
1005 t1net-default            active
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (1), with Switch FastEthernet0/11 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (50).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).

Switch#
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Business-Department
Switch(config-vlan)#exit
Switch(config)#?
Switch#
$SYS-5-CONFIG_I: Configured from console by console

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int fa0/2
Switch(config-if)#?
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (1), with Switch FastEthernet0/11 (20).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (50).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).

Switch#
Switch(config-if)#switchport mode
Switch(config-if)#switchport mode access
Switch(config-if)#switchport mode access
Switch(config-if)#switchport a
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#?
Switch#
$SYS-5-CONFIG_I: Configured from console by console

Switch#show vlan brief
VLAN Name          Status    Ports
----- -----
1    default        active    Fa0/2, Fa0/4, Fa0/5, Fa0/6,
                           Fa0/7, Fa0/8, Fa0/9, Fa0/10
                           Fa0/11, Fa0/12, Fa0/13, Fa0/14

Copy Paste
 Top
```

Multilayer Switch0

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch>
Switch>
Switch>
Switch>en
Switchconf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan) name Computing-Department
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (1), with Switch FastEthernet0/11 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (50).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/1 (1), with Switch FastEthernet0/19 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).

Switch(config-vlan)#name Computing-Department
Switch(config-vlan)#exit
Switch(config)#int fa0/1
Switch(config-if)#sw
Switch(config-if)#switchport m
Switch(config-if)#switchport mode a
Switch(config-if)#switchport mode access
Switch(config-if)#
Switch(config-if)#
Switch(config-if)#switchport ac
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#z
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vlan brief

VLAN Name                               Status    Ports
----+-----+-----+-----+
1   default                             active   Fa0/2, Fa0/3, Fa0/4, Fa0/5
                                         Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                         Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                         Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                         Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                         Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                         Gig0/2
10  Computing-Department                active   Fa0/1
1002 fddi-default                      active
1003 token-ring-default                active
1004 fdidnet-default                  active
1005 ipxnet-default                   active
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (1), with Switch FastEthernet0/11 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).
```

Top Multilayer Switch0

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch#  
%SYS-5-CONFIG_I: Configured from console by console  
  
Switch#show vlan brief  
  
VLAN Name Status Ports  
---  
1 default active Fa0/3, Fa0/4, Fa0/5, Fa0/6  
Fa0/7, Fa0/8, Fa0/9, Fa0/10  
Fa0/11, Fa0/12, Fa0/13, Fa0/14  
Fa0/15, Fa0/16, Fa0/17, Fa0/18  
Fa0/19, Fa0/20, Fa0/21, Fa0/22  
Fa0/23, Fa0/24, Gig0/1, Gig0/2  
  
10 Computing-Department active Fa0/1  
20 Human-Resource active Fa0/2  
1000 802.1Q-default active  
1003 token-ring-default active  
1004 rdsnet-default active  
1005 trnet-default active  
1006 dsl-default active  
  
Switch#  
Switch#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Switch(config)#  
Switch(config-vlan)#name Human-B  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (60).  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).  
  
Switch(config-vlan)#name Human-Resource  
Switch(config-vlan)#exit  
Switch(config)#int Fa0/3  
Switch(config-if)#switchport  
Switch(config-if)#switchport mode m  
Switch(config-if)#switchport mode a  
Switch(config-if)#switchport access  
Switch(config-if)#switchport access vlan 50  
Switch(config-if)#exit  
Switch(config)#vlan  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).  
  
% Incomplete command.  
Switch(config)#  
Switch(config)#vlan 40  
Switch(config-vlan)#name Academic-Administrator  
Switch(config-vlan)#exit  
Switch(config-if)#int Fa0/4  
Switch(config-if)#exit  
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (1), with Switch FastEthernet0/3 (40).
```

Multilayer Switch0

Physical Config CLI Attributes

IOS Command Line Interface

```

Switch#configure terminal
Switch(config-if)#switchport mode a
Switch(config-if)#switchport mode access
Switch(config-if)#switchport a
Switch(config-if)#switchport access vlan 40
Switch(config-if)#exit
Switch(config)#
Switch(config)#
Switch#config terminal
Switch(config)#vlan 30
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#
Switch(config)#
Switch(config-if)#switchport mo
Switch(config-if)#switchport mode
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (1), with Switch FastEthernet0/3 (30).

% Incomplete command.
Switch(config-if)#mv
Switch(config-if)#switchport mo
Switch(config-if)#switchport mode a
Switch(config-if)#switchport mode access
Switch(config-if)#
Switch(config-if)#switchport a
Switch(config-if)#switchport access vlan 30
Switch(config-if)#exit
Switch(config)#
Switch#
$S13-5-CONFIG_I: Configured from console by console
Switch#
Switch#show vian brief
VLAN Name          Status     Ports
----+-----+-----+
1   default        active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                               Fa0/10, Fa0/11, Fa0/12, Fa0/13
                               Fa0/14, Fa0/15, Fa0/16, Fa0/17
                               Fa0/18, Fa0/19, Fa0/20, Fa0/21
                               Fa0/22, Fa0/23, Fa0/24, Fa0/25
                               Gig0/2
10  Computing-Department  active    Fa0/1
20  Business-Department  active    Fa0/2
30  Marketing          active    Fa0/3
40  Academic-Administration  active    Fa0/4
50  Human-Resource      active    Fa0/3
100 fast-ethernet-default  active
1003 fast-ethernet-default  active
1004 fddint-default      active
1005 tnet-default        active
Switch#
Building configuration...
[OK]
Switch#

```

Top

[Copy](#) [Paste](#)

## Access Switch VLAN Configuration - Computing Department (Main Campus)

- Created Sub-VLANs in access Switch of Main Campus in Computing-Department and assigned all the switchports connected to the device to the correct VLAN

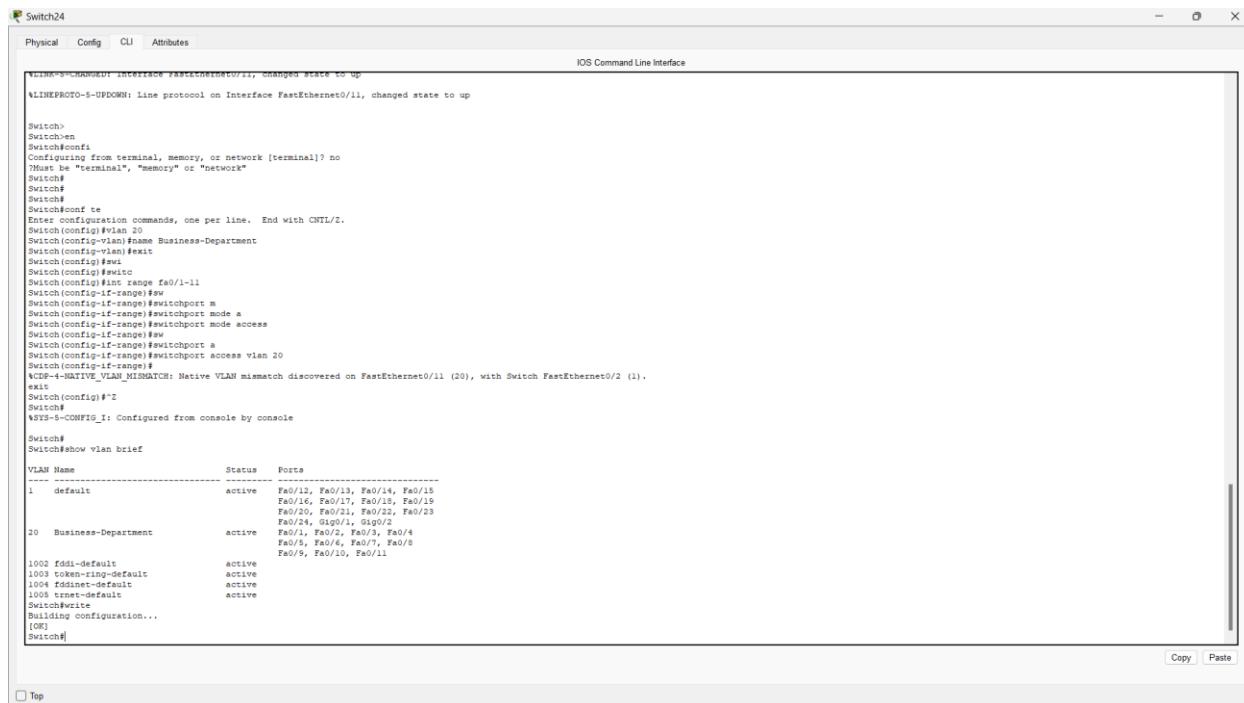
```
Switch#show config
!Line protocol on Interface FastEthernet0/19, changed state to up
!LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/19, changed state to up
!LINK-5-CHANGED: Interface FastEthernet0/19, changed state to up
!LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/19, changed state to up

Switch>
Switch#
Switch#en
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#Name Computing-Department
% Invalid input detected at '^' marker.

Switch(config)#vlan 10
Switch(config-vlan)#Name Computing-Department
Switch(config-vlan)#exit
Switch(config)#range fa0/0-19
Interface range not valid -- command rejected
Switch(config-if-range)#range fa0/1-19
Switch(config-if-range)#exit
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config-if-range)#exit
Switch(config)#Z
Switch#
$S15-5-CONFIG_I: Configured from console by console
Switch#show vian brief
VLAN Name          Status Ports
--- 
1   default         active Fa0/20, Fa0/21, Fa0/22, Fa0/23
Fa0/24, Gi0/1, Fa0/2
10  Computing-Department active Fa0/1, Fa0/2, Fa0/3, Fa0/4
Fa0/5, Fa0/6, Fa0/7, Fa0/8
Fa0/9, Fa0/10, Fa0/11, Fa0/12
Fa0/13, Fa0/14, Fa0/15, Fa0/16
Fa0/17, Fa0/18, Fa0/19
1002 fddi-default   active
1003 token-ring-default active
1004 trnet-default   active
1005 trnet-default   active
Switch#write
Building configuration...
[OK]
Switch#
```

## Access Switch VLAN Configuration - Business Department (Main Campus)

- Created Sub-VLANs in access Switch of Main Campus in Business-Department and assigned all the switchports connected to the device to the correct VLAN



The screenshot shows the Cisco IOS Command Line Interface (CLI) running on a device named "Switch24". The window title is "Switch24" and the tab selected is "CLI". The command entered is "show vlan brief". The output displays the following VLAN information:

VLAN Name	Status	Ports
1 default	active	Fa0/12, Fa0/13, Fa0/14, Fa0/15 Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gig0/1, Gig0/2
20 Business-Department	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11
1002 fddi-default	active	
1003 token-ring-default	active	
1004 ethernet-default	active	
1005 tristate-default	active	

At the bottom of the CLI window, there are "Copy" and "Paste" buttons.

## Access Switch VLAN Configuration – Human Resource Department (Main Campus)

- Created Sub-VLANs in access Switch of Main Campus in Human Resource Department and assigned all the switchports connected to the device to the correct VLAN
  - A VLAN 30 was created in the switch by mistake. After identifying the error, it was removed and a new VLAN was created.

Switch1#

Physical Config CLI Attributes

IOS Command Line Interface

```
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#name ^Z
Switch#
Switch#^Z
Switch#^Z
Switch#show vlan brief
VLAN Name          Status      Ports
-----+-----+-----+
1   default        active     Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                Gig0/1, Gig0/2

90  VLAN9090       active
1002 fddi-default    active
1003 token-ring-default active
1004 fddinet-default  active
1005 trnet-default    active
Switch#^Z
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#no vlan 30
Switch(config)#^Z
Switch#
Switch#^Z
Switch#show vlan brief
VLAN Name          Status      Ports
-----+-----+-----+
1   default        active     Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                Gig0/1, Gig0/2

1002 fddi-default    active
1003 token-ring-default active
1004 fddinet-default  active
1005 trnet-default    active
Switch#^Z
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 50
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#^Z
Switch(config)#int range fa0/1-3
Switch(config-if-range)#^Z
Switch(config-if-range)#switchport mode
```

Switch13(1)

Physical Config CLI Attributes

IOS Command Line Interface

```

Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config)#z
Switch#
*SV3-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vian brief

VLAN Name          Status    Ports
----+-----+-----+
1   default        active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                               Fa0/5, Fa0/6, Fa0/7, Fa0/8
                               Fa0/9, Fa0/10, Fa0/11
                               Fa0/12, Fa0/13, Fa0/14, Fa0/15
                               Fa0/16, Fa0/17, Fa0/18, Fa0/19
                               Fa0/20, Fa0/21, Fa0/22, Fa0/23
                               Fa0/24, Gig0/1, Gig0/2

1002 fddi-default  active
1003 token-ring-default active
1004 fddinet-default  active
1005 tnetm-default   active

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 50
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#exit
Switch(config)#range fa0/1-3
Switch(config-if-range)#switchport mode sv
Switch(config-if-range)#switchport mod
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport a
Switch(config-if-range)#switchport s
Switch(config-if-range)#switchport access vlan 50
Switch(config-if-range)#exit
Switch(config)#z
Switch#
*SV3-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vian brief

VLAN Name          Status    Ports
----+-----+-----+
1   default        active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                               Fa0/8, Fa0/9, Fa0/10, Fa0/11
                               Fa0/12, Fa0/13, Fa0/14, Fa0/15
                               Fa0/16, Fa0/17, Fa0/18, Fa0/19
                               Fa0/20, Fa0/21, Fa0/22, Fa0/23
                               Fa0/24, Gig0/1, Gig0/2

50  Human-Resource  active    Fa0/1, Fa0/2, Fa0/3

1002 fddi-default  active
1003 token-ring-default active

```

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Switch13(1)

Physical Config CLI Attributes

IOS Command Line Interface

```

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 50
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#exit
Switch(config)#range fa0/1-3
Switch(config-if-range)#sv
Switch(config-if-range)#switchport mod
Switch(config-if-range)#switchport mode a
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport a
Switch(config-if-range)#switchport s
Switch(config-if-range)#switchport access vlan 50
Switch(config-if-range)#exit
Switch(config)#z
Switch#
*SV3-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vian brief

VLAN Name          Status    Ports
----+-----+-----+
1   default        active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                               Fa0/8, Fa0/9, Fa0/10, Fa0/11
                               Fa0/12, Fa0/13, Fa0/14, Fa0/15
                               Fa0/16, Fa0/17, Fa0/18, Fa0/19
                               Fa0/20, Fa0/21, Fa0/22, Fa0/23
                               Fa0/24, Gig0/1, Gig0/2

50  Human-Resource  active    Fa0/1, Fa0/2, Fa0/3

1002 fddi-default  active
1003 token-ring-default active
1004 fddinet-default  active
1005 tnetm-default   active

Switch#
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).

Switch#
Switch#write
Building configuration...
[OK]
Switch#
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (50), with Switch FastEthernet0/3 (1).

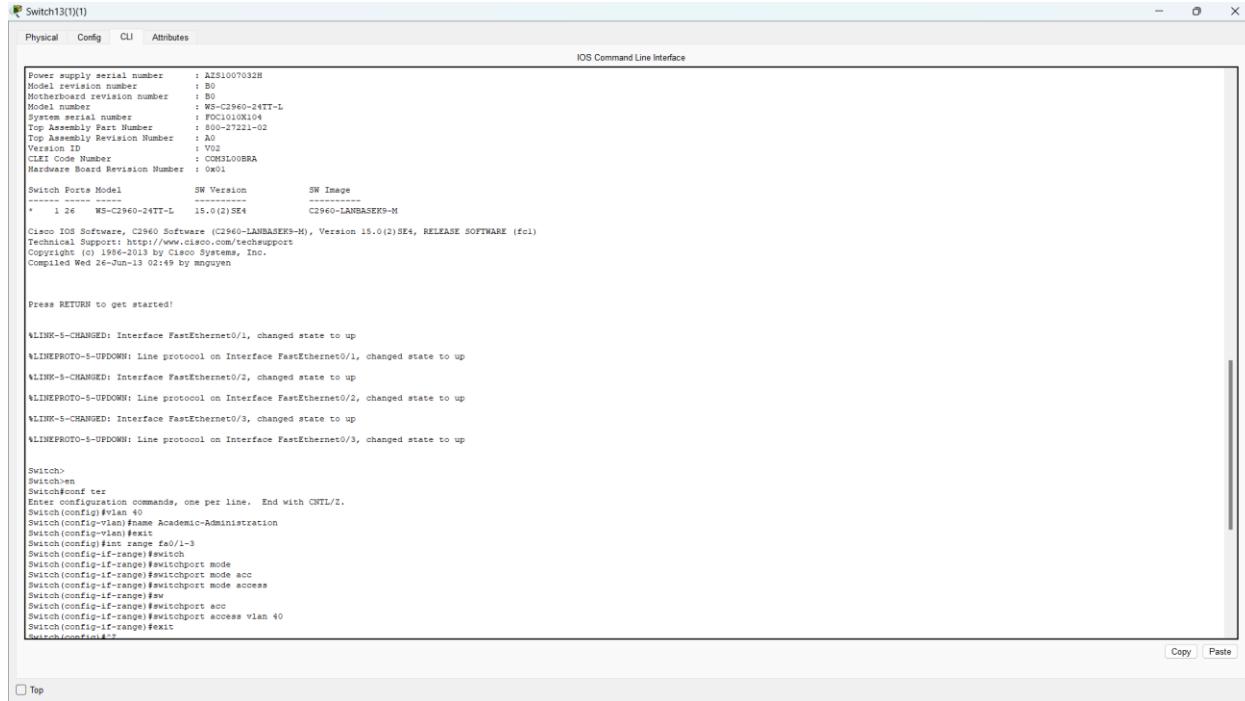
```

Top

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## Access Switch VLAN Configuration – Academic Administration (Main Campus)

- Created Sub-VLANs in access Switch of Main Campus in Academic Administration and assigned all the switchports connected to the device to the correct VLAN



The screenshot shows a Windows-style application window titled "Switch13(1)(1)". The window has tabs at the top: "Physical", "Config", "CLI", and "Attributes". The "CLI" tab is selected, displaying the IOS Command Line Interface.

The CLI output shows the following information:

- System identification:
  - Power supply serial number : A231007032H
  - Model revision number : B0
  - Motherboard revision number : B0
  - Processor number : WS-C2960-24TT-L
  - Processor serial number : F0E02XKJL2
  - Top Assembly Part Number : 800-27221-02
  - Top Assembly Revision Number : A0
  - Version : V1.0
  - Cards Code Number : CONS100BRA
  - Hardware Board Revision Number : 0x01
- Switch Port Model:

SW Version	SW Image
-----	-----
* 1 26 WS-C2960-24TT-L	15.0(2)SE4 C2960-LANBASEK9-M
- Copyright and compilation information:

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE SOFTWARE (fc1)  
Technical Support: <http://www.cisco.com/techsupport>  
Copyright (c) 1986-2013 by Cisco Systems, Inc.  
Compiled Wed Jun 26 02:49 by mnnguyen
- Press RETURN to get started!
- Log messages:

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up  
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up  
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up  
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up  
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up  
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
- Configuration history:

Switch>  
Switch>en  
Switch>conf ter  
Enter configuration commands, one per line. End with CNTL/Z.  
Switch(config)#vlan 40  
Switch(config-vlan)#name Academic-Administration  
Switch(config-vlan)#exit  
Switch(config)#int range fa0/1-3  
Switch(config-if-range)#switchport mode trunk  
Switch(config-if-range)#switchport mode acc  
Switch(config-if-range)#switchport mode access  
Switch(config-if-range)#switchport ecc  
Switch(config-if-range)#switchport access vlan 40  
Switch(config-if-range)#exit  
Switch>

Switch1#1(1)

Physical Config CLI Attributes

IOS Command Line Interface

```
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
*LINH-5-CHANGED: Interface FastEthernet0/3, changed state to up
*LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

Switch#
Switch>en
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vtp vlan 40
Switch(config-vlan)#name Academic-Administration
Switch(config-vlan)#exit
Switch(config)#int range fa0/1-3
Switch(config-if-range)#switchport mode
Switch(config-if-range)#switchport mode acc
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport acc
Switch(config-if-range)#switchport access vlan 40
Switch(config-if-range)#exit
Switch(config)#^Z
Switch#
SYS-5-CONFIG_I: Configured from console by console

Switch#
Switch#show vian brief
VLAN Name          Status      Ports
-----+-----+-----+
1   default        active     Fa0/4, Fa0/5, Fa0/6, Fa0/7
                           Fa0/8, Fa0/9, Fa0/10, Fa0/11
                           Fa0/12, Fa0/13, Fa0/14, Fa0/15
                           Fa0/16, Fa0/17, Fa0/18
                           Fa0/20, Fa0/21, Fa0/22, Fa0/23
                           Fa0/24, Gi0/0/1, Gi0/0/2
                           Fa0/0/1, Fa0/0/2, Fa0/3
40  Academic-Administration    active
1002 fddi-default       active
1003 token-ring-default active
1004 ddnet-default      active
1005 ipxnet-default     active
Switch#
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (40), with Switch FastEthernet0/4 (1).

Switch#write
Building configuration...
[OK]
Switch#
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (40), with Switch FastEthernet0/4 (1).
*CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (40), with Switch FastEthernet0/4 (1).

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```

## Access Switch VLAN Configuration – Marketing Department (Main Campus)

- Created Sub-VLANs in access Switch of Main Campus in Marketing Department and assigned all the switchports connected to the device to the correct VLAN

The image displays two windows of the Cisco IOS Command Line Interface (CLI) running on a Switch. Both windows show the configuration of VLANs and the assignment of specific ports to each VLAN.

**Window 1 (Top):**

```
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

Switch>Switch#en
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#^Z
Switch#
$SIS-3-CONFIG_I: Configured from console by console

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int range fa0/1-3
Switch(config-if-range)#sw
Switch(config-if-range)#switchport m
Switch(config-if-range)#switchport mode a
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport ac
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
Switch(config)#
Switch#
$SIS-3-CONFIG_I: Configured from console by console

Switch#show vlan brief
```

**Window 2 (Bottom):**

```
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up

Switch>Switch#en
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#
Switch#
$SIS-3-CONFIG_I: Configured from console by console

Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int range fa0/1-3
Switch(config-if-range)#sw
Switch(config-if-range)#switchport m
Switch(config-if-range)#switchport mode a
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport ac
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
Switch(config)#
Switch#
$SIS-3-CONFIG_I: Configured from console by console

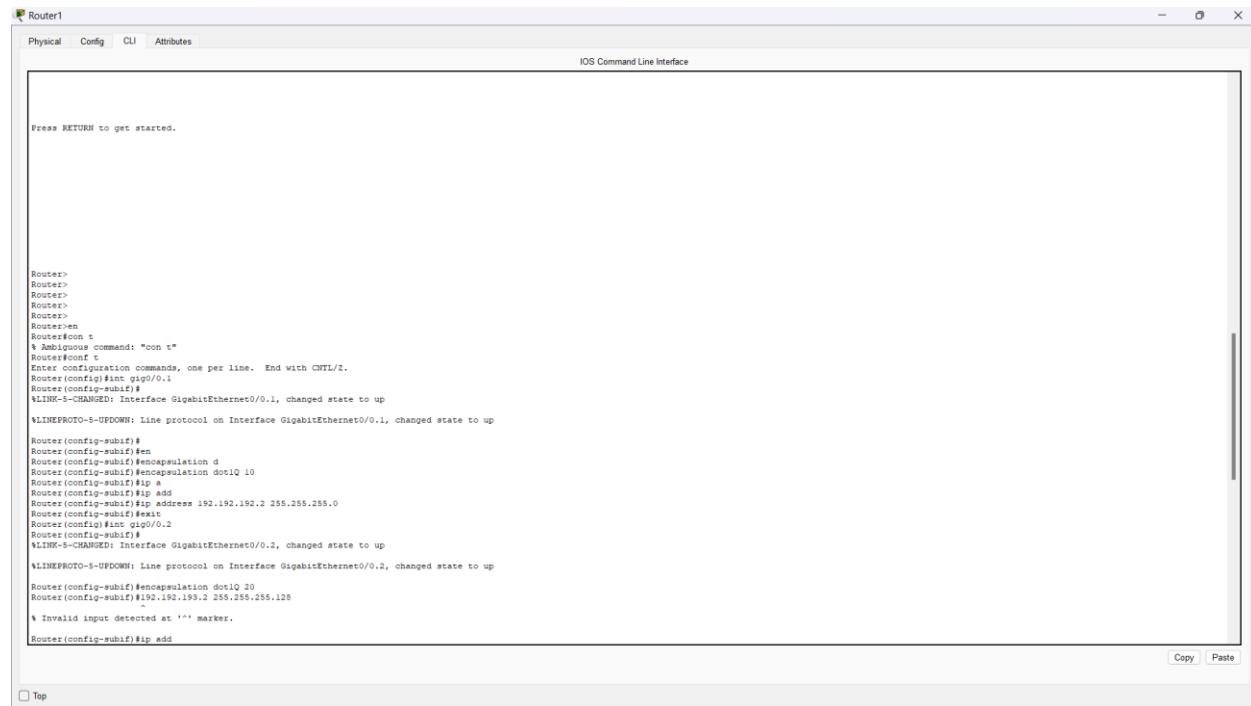
Switch#show vlan brief
```

VLAN Name	Status	Ports
1 default	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/10, Fa0/11, Fa0/12, Fa0/13 Fa0/14, Fa0/15, Fa0/16, Fa0/17, Fa0/18, Fa0/19 Fa0/20, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gi0/0/1, Gi0/0/2
30 Marketing	active	Fa0/1, Fa0/2, Fa0/3
1002 fddi-default	active	
1003 token-ring-default	active	
1004 cabinet-default	active	
1005 trnet-default	active	

## Implementing DOT1Q Trunking for Network Redundancy in HQ Campus

### Main Router of HQ Campus

- Using DOT1Q Trunking Protocol for Managing VLANs and Segmenting Network Traffic on the Main Core Switch



```
Router>
Router>
Router>
Router>
Router>en
Router>en
Router>en t
Router>en t
Router# Ambiguous command: "con t"
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int giga0/0.1
Router(config-subif)#
LINK-5-CHANGED: Interface GigabitEthernet0/0.1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1, changed state to up
Router(config-subif)#
Router(config-subif)#en
Router(config-subif)##encapsulation d
Router(config-subif)##encapsulation dot1Q 10
Router(config-subif)##ip a
Router(config-subif)##ip add
Router(config-subif)##ip address 192.192.192.2 255.255.255.0
Router(config-subif)##exit
Router(config)##exit
Router(config)##giga0/0.2
Router(config-subif)#
LINK-5-CHANGED: Interface GigabitEthernet0/0.2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2, changed state to up
Router(config-subif)##encapsulation dot1Q 20
Router(config-subif)##ip address 192.192.193.2 255.255.255.128
% Invalid input detected at `'' marker.
Router(config-subif)##ip add
```

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2, changed state to up
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.192.193.2 255.255.255.128
% Invalid input detected at `'' marker.

Router(config-subif)#ip add
Router(config-subif)#ip address 192.192.193.2 255.255.255.128
Router(config-subif)#exit
Router(config)#g0/0.3
Router(config-subif)#
%LINK-4-CHANGED: Interface GigabitEthernet0/0.3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.192.193.130 255.255.255.224
Router(config-subif)#exit
Router(config)#g0/0.4
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up
int g0/0.4
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
% 192.192.193.128 overlaps with GigabitEthernet0/0.3
Router(config-subif)#
% ADDRESS 192.192.193.162 255.255.255.240
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.5, changed state to up
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#
Router(config-subif)#
Router(config)#
Router(config)#
Router#*ST3-5-CONFIG_I: Configured from console by console
Router#
Router#
Router#
Router#show ip int brief
Interface          IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  unassigned     YES unset up
GigabitEthernet0/0.1 192.192.192.2  YES manual up
GigabitEthernet0/0.2 192.192.193.2  YES manual up
GigabitEthernet0/0.3 192.192.193.130 YES manual up
GigabitEthernet0/0.4 192.192.193.162 YES manual up
GigabitEthernet0/0.5 192.192.193.178 YES manual up
GigabitEthernet0/1  unassigned     YES unset administratively down down
Serial0/0/0          unassigned     YES unset administratively down down
Serial0/0/1          unassigned     YES unset administratively down down
Vlan1               unassigned     YES unset administratively down down
Router#*site
Building Configuration...
[OK]
Router#
```

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Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up
Router(config-subif)#
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up
Router(config-subif)#encapsulation dot1Q 30
Router(config-subif)#ip address 192.192.193.130 255.255.255.224
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
% 192.192.193.128 overlaps with GigabitEthernet0/0.3
Router(config-subif)#
% ADDRESS 192.192.193.162 255.255.255.240
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up
int g0/0.4
Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
% 192.192.193.128 overlaps with GigabitEthernet0/0.3
Router(config-subif)#
% ADDRESS 192.192.193.162 255.255.255.240
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
Router(config-subif)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0.5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.5, changed state to up
Router(config-subif)#encapsulation dot1Q 50
Router(config-subif)#
Router(config-subif)#
Router(config)#
Router(config)#
Router#*ST3-5-CONFIG_I: Configured from console by console
Router#
Router#
Router#
Router#show ip int brief
Interface          IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  unassigned     YES unset up
GigabitEthernet0/0.1 192.192.192.2  YES manual up
GigabitEthernet0/0.2 192.192.193.2  YES manual up
GigabitEthernet0/0.3 192.192.193.130 YES manual up
GigabitEthernet0/0.4 192.192.193.162 YES manual up
GigabitEthernet0/0.5 192.192.193.178 YES manual up
GigabitEthernet0/1  unassigned     YES unset administratively down down
Serial0/0/0          unassigned     YES unset administratively down down
Serial0/0/1          unassigned     YES unset administratively down down
Vlan1               unassigned     YES unset administratively down down
Router#*site
Building Configuration...
[OK]
Router#
```

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- HSRP Protocol: Designating the Primary Router with Higher Priority

**Router1**

Physical Config CLI Attributes

IOS Command Line Interface

```

Router# 
*Mar 26 04:53:31.192 0.0000000000000000 Router1%H2S0-0-0: %H2S0-0-0: HSRP-6-STATECHANGE: GigabitEthernet0/0.5 Grp 5 State Speak -> Standby
*Mar 26 04:53:31.192 0.0000000000000000 Router1%H2S0-0-0: %H2S0-0-0: HSRP-6-STATECHANGE: GigabitEthernet0/0.5 Grp 5 State Standby -> Active

Router#show standby
GigabitEthernet0/0.1 ~ Group 1
    State is Active
        6 state changes, last state change 01:03:31
        Virtual IP address is 192.192.192.1
        Active virtual MAC address is 0000.0C07.AC01
        Local virtual MAC address is 0000.0C07.AC01 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.182 secs
        Preemption disabled
        Active router is local
        Standby router is local
        Priority 150 (configured 150)
        Group name is hsrp-Gig-1 (default)
GigabitEthernet0/0.2 ~ Group 2
    State is Active
        5 state changes, last state change 01:03:51
        Virtual IP address is 192.192.192.1
        Active virtual MAC address is 0000.0C07.AC02
        Local virtual MAC address is 0000.0C07.AC02 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.281 secs
        Preemption disabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-1 (default)
GigabitEthernet0/0.3 ~ Group 3
    State is Active
        7 state changes, last state change 01:04:06
        Virtual IP address is 192.192.193.1
        Active virtual MAC address is 0000.0C07.AC03
        Local virtual MAC address is 0000.0C07.AC03 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 0.753 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-2 (default)
GigabitEthernet0/0.4 ~ Group 4
    State is Active
        7 state changes, last state change 01:04:09
        Virtual IP address is 192.192.193.129
        Active virtual MAC address is 0000.0C07.AC03
        Local virtual MAC address is 0000.0C07.AC03 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.571 secs
        Preemption disabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-2 (default)
GigabitEthernet0/0.5 ~ Group 5
    State is Active
        4 state changes, last state change 01:05:06
        Virtual IP address is 192.192.193.161
        Active virtual MAC address is 0000.0C07.AC04
        Local virtual MAC address is 0000.0C07.AC04 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 1.624 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-4 (default)
GigabitEthernet0/0.6 ~ Group 6
    State is Active
        4 state changes, last state change 01:05:17
        Virtual IP address is 192.192.193.177
        Active virtual MAC address is 0000.0C07.AC05
        Local virtual MAC address is 0000.0C07.AC05 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.352 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-5 (default)
Router#show standby
Router#
```

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**Router1**

Physical Config CLI Attributes

IOS Command Line Interface

```

GigabitEthernet0/0.2 ~ Group 2
    State is Active
        5 state changes, last state change 01:04:06
        Virtual IP address is 192.192.193.1
        Active virtual MAC address is 0000.0C07.AC02
        Local virtual MAC address is 0000.0C07.AC02 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 0.753 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-2 (default)
GigabitEthernet0/0.3 ~ Group 3
    State is Active
        7 state changes, last state change 01:04:09
        Virtual IP address is 192.192.193.129
        Active virtual MAC address is 0000.0C07.AC03
        Local virtual MAC address is 0000.0C07.AC03 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.571 secs
        Preemption disabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-2 (default)
GigabitEthernet0/0.4 ~ Group 4
    State is Active
        6 state changes, last state change 01:05:06
        Virtual IP address is 192.192.193.161
        Active virtual MAC address is 0000.0C07.AC04
        Local virtual MAC address is 0000.0C07.AC04 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 1.624 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-4 (default)
GigabitEthernet0/0.5 ~ Group 5
    State is Active
        4 state changes, last state change 01:05:17
        Virtual IP address is 192.192.193.177
        Active virtual MAC address is 0000.0C07.AC05
        Local virtual MAC address is 0000.0C07.AC05 (vl default)
        Hello time 3 sec, hold time 10 sec
        Next hello sent in 2.352 secs
        Preemption enabled
        Active router is local
        Standby router is unknown
        Priority 150 (configured 150)
        Group name is hsrp-Gig-5 (default)
Router#show standby
Router#
```

Top

**Router1**

Physical Config CLI Attributes

IOS Command Line Interface

```

Router#show standby
GigabitEthernet0/5 - Group 5
  State is Active
    4 state changes, last state change 01:06:05
    Virtual IP address is 192.192.193.177
    Active virtual MAC address is 0000.0C07.AC05
    Local virtual MAC address is 0000.0C07.AC05 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.392 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-5 (default)
Router#
Router#
Router#
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gig0/0.2
Router(config-subif)#standby 1 ip
Router(config-subif)#exit
Router(config)#
Router(config)#
Router#
$S3-5-CONFIG_I: Configured from console by console

Router#
Router#show standby
GigabitEthernet0/0.1 - Group 1
  State is Active
    6 state changes, last state change 01:03:31
    Virtual IP address is 192.192.192.1
    Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.635 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-1 (default)
GigabitEthernet0/0.2 - Group 2
  State is Active
    5 state changes, last state change 01:04:06
    Virtual IP address is 192.192.193.1
    Active virtual MAC address is 0000.0C07.AC02
    Local virtual MAC address is 0000.0C07.AC02 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.497 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-2 (default)
$S3-5-CONFIG_I: Configured from console by console

Router#show standby
GigabitEthernet0/0.1 - Group 1
  State is Active
    6 state changes, last state change 01:03:31
    Virtual IP address is 192.192.192.1
    Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.635 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-1 (default)
GigabitEthernet0/0.2 - Group 2
  State is Active
    5 state changes, last state change 01:04:06
    Virtual IP address is 192.192.193.1
    Active virtual MAC address is 0000.0C07.AC02
    Local virtual MAC address is 0000.0C07.AC02 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.497 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-2 (default)
GigabitEthernet0/0.3 - Group 3
  State is Active
    7 state changes, last state change 01:05:09
    Virtual IP address is 192.192.193.129
    Active virtual MAC address is 0000.0C07.AC03
    Local virtual MAC address is 0000.0C07.AC03 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.716 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-3 (default)
GigabitEthernet0/0.4 - Group 4
  State is Active
    6 state changes, last state change 01:05:32
    Virtual IP address is 192.192.193.16
    Active virtual MAC address is 0000.0C07.AC04
    Local virtual MAC address is 0000.0C07.AC04 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.359 secs
    Preemption enabled
    Active router is local
$S3-5-CONFIG_I: Configured from console by console

```

Top

**Router1**

Physical Config CLI Attributes

IOS Command Line Interface

```

Router(config)#
$S3-5-CONFIG_I: Configured from console by console

Router#
Router#show standby
GigabitEthernet0/0.1 - Group 1
  State is Active
    6 state changes, last state change 01:03:31
    Virtual IP address is 192.192.192.1
    Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.635 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-1 (default)
GigabitEthernet0/0.2 - Group 2
  State is Active
    5 state changes, last state change 01:04:06
    Virtual IP address is 192.192.193.1
    Active virtual MAC address is 0000.0C07.AC02
    Local virtual MAC address is 0000.0C07.AC02 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.497 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-2 (default)
$S3-5-CONFIG_I: Configured from console by console

Router#show standby
GigabitEthernet0/0.1 - Group 1
  State is Active
    6 state changes, last state change 01:03:31
    Virtual IP address is 192.192.192.1
    Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.635 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-1 (default)
GigabitEthernet0/0.2 - Group 2
  State is Active
    5 state changes, last state change 01:04:06
    Virtual IP address is 192.192.193.1
    Active virtual MAC address is 0000.0C07.AC02
    Local virtual MAC address is 0000.0C07.AC02 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.497 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-2 (default)
GigabitEthernet0/0.3 - Group 3
  State is Active
    7 state changes, last state change 01:05:09
    Virtual IP address is 192.192.193.129
    Active virtual MAC address is 0000.0C07.AC03
    Local virtual MAC address is 0000.0C07.AC03 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 1.716 secs
    Preemption enabled
    Active router is local
    Standby router is unknown
    Priority 150 (configured 150)
    Group name is harp-Gig-3 (default)
GigabitEthernet0/0.4 - Group 4
  State is Active
    6 state changes, last state change 01:05:32
    Virtual IP address is 192.192.193.16
    Active virtual MAC address is 0000.0C07.AC04
    Local virtual MAC address is 0000.0C07.AC04 (vl default)
    Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.359 secs
    Preemption enabled
    Active router is local
$S3-5-CONFIG_I: Configured from console by console

```

Top

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
Router1# show ip route vrf VRF1
Active virtual MAC address is 0000.0C07.AC02
  Local virtual MAC address is 0000.0C07.AC02 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 0.847 secs
  Preemption disabled
  Active router is local
  Standby router is unknown
Priority 150 (configured 150)
Group name is harp-Gig-3 (default)
GigabitEthernet0/0.3 - Group 3
State is Active
  7 state changes, last state change 01:05:09
Virtual IP address is 192.192.193.128
Active virtual MAC address is 0000.0C07.AC03 (vl default)
  Local virtual MAC address is 0000.0C07.AC03 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 1.716 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
Priority 150 (configured 150)
Group name is harp-Gig-3 (default)
GigabitEthernet0/0.4 - Group 4
State is Active
  6 state changes, last state change 01:05:32
Virtual IP address is 192.192.193.161
Active virtual MAC address is 0000.0C07.AC04
  Local virtual MAC address is 0000.0C07.AC04 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 2.359 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
Priority 150 (configured 150)
Group name is harp-Gig-4 (default)
GigabitEthernet0/0.5 - Group 5
State is Active
  4 state changes, last state change 01:06:05
Virtual IP address is 192.192.193.174
Active virtual MAC address is 0000.0C07.AC05 (vl default)
  Local virtual MAC address is 0000.0C07.AC05 (vl default)
Hello time 3 sec, hold time 10 sec
  Next hello sent in 2.204 secs
  Preemption disabled
  Active router is local
  Standby router is unknown
Priority 150 (configured 150)
Group name is harp-Gig-5 (default)
Router#
Router#
Router#
Router#
Router#
```

Top

## Main Campus Network: DHCP Configuration for Automatic IP Assignment

**Router1**

```
Physical Config CLI Attributes
IOS Command Line Interface

[GigabitEthernet0/0.3 192.192.193.130 YES manual up
GigabitEthernet0/0.4 192.192.193.140 YES manual up
GigabitEthernet0/0.5 192.192.193.178 YES manual up
GigabitEthernet0/1 unassigned YES unmet administratively down down
Serial0/0/0 unassigned YES unmet administratively down down
Serial0/0/1 unassigned YES unmet administratively down down
Vlan1 unassigned YES unmet administratively down down
Router#write
Building configuration...
[OK]
Router2#
Router2#
Router2>conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp p
Router(config)#ip dhcp pool Colombo-Department
Router(dhcp-config)#net
Router(dhcp-config)#network 192.192.192.0 255.255.255.0
Router(dhcp-config)#ip default-router 192.192.192.1
Router(dhcp-config)#ip dhcp excluded-address 192.192.192.1
Router(config)#ip dhcp pool Colombo-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.192.2
Router(config)#ip dhcp pool Colombo-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.192.3
Router(config)#exit
Router2#
$SYS-5-CONFIG_I: Configured from console by console

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dhcp pool Business-Department
Router(dhcp-config)#net
Router(dhcp-config)#network 192.192.193.0 255.255.255.128
Router(dhcp-config)#ip default-router 192.192.193.1
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.1
Router(config)#ip dhcp pool Business-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.2
Router(dhcp-config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.224
Router(dhcp-config)#ip default-router 192.192.193.129
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.129
Router(config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.130
Router(config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.131
Router(config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip default-router 192.192.193.161 255.255.255.240
Router(config)#ip dhcp excluded-address 192.192.193.161
Router(dhcp-config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.162
Router(config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.163
Router(config)#ip dhcp pool Human-Resources
Router(dhcp-config)#ip default-router 192.192.193.176 255.255.255.240
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.176
Router(dhcp-config)#ip dhcp pool Human-Resources
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.177
Router(config)#ip dhcp pool Human-Resources
Router(dhcp-config)#ip dhcp pool Human-Resources
Router(config)#ip dhcp excluded-address 192.192.193.178
Router(config)#ip dhcp excluded-address 192.192.193.179
Router(config)#exit
Router2#
Router2#
Router2>show ip dhcp pool
Pool Colombo-Department :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 1 / 0
  Total addresses           : 154
  Leased addresses          : 2
  Excluded addresses        : 15
  Pending event              : none
  1 subnet is currently in the pool
  Current index      : 18 address range      : leased/Excluded/Total
$SYS-5-CONFIG_I: Configured from console by console
```

Top

**Router1**

```
Physical Config CLI Attributes
IOS Command Line Interface

Router(dhcp-config)#network 192.192.193.0 255.255.255.128
Router(dhcp-config)#ip default-router 192.192.193.1
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.1
Router(config)#ip dhcp pool Business-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.2
Router(dhcp-config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.224
Router(dhcp-config)#ip default-router 192.192.193.129
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.129
Router(config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.130
Router(config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.131
Router(config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip default-router 192.192.193.161 255.255.255.240
Router(config)#ip dhcp excluded-address 192.192.193.161
Router(dhcp-config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.162
Router(config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.163
Router(config)#ip dhcp pool Human-Resources
Router(dhcp-config)#ip network 192.192.193.176 255.255.255.240
Router(dhcp-config)#ip default-router 192.192.193.177
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.177
Router(config)#ip dhcp pool Human-Resources
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.178
Router(config)#ip dhcp excluded-address 192.192.193.179
Router(config)#exit
Router2#
Router2#
Router2>show ip dhcp pool
Pool Colombo-Department :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 1 / 0
  Total addresses           : 154
  Leased addresses          : 2
  Excluded addresses        : 15
  Pending event              : none
  1 subnet is currently in the pool
  Current index      : 18 address range      : leased/Excluded/Total
$SYS-5-CONFIG_I: Configured from console by console
```

Top

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
[Pool Colombo-Department :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 254  
  Leased addresses : 2  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.192.1 - 192.192.192.254 2 / 15 / 254  
  
Pool Business-Department :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 1 / 0 / 0  
  Total addresses : 126  
  Leased addresses : 1  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.1 - 192.192.193.126 1 / 15 / 126  
  
Pool Marketing-Department :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 30  
  Leased addresses : 1  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.129 - 192.192.193.158 1 / 15 / 30  
  
Pool Academic-Administration :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 14  
  Leased addresses : 1  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.161 - 192.192.193.174 1 / 15 / 14  
  
Pool Human-Resource :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 6  
  Leased addresses : 0  
  Excluded addresses : 15  
  Pending event : none
```

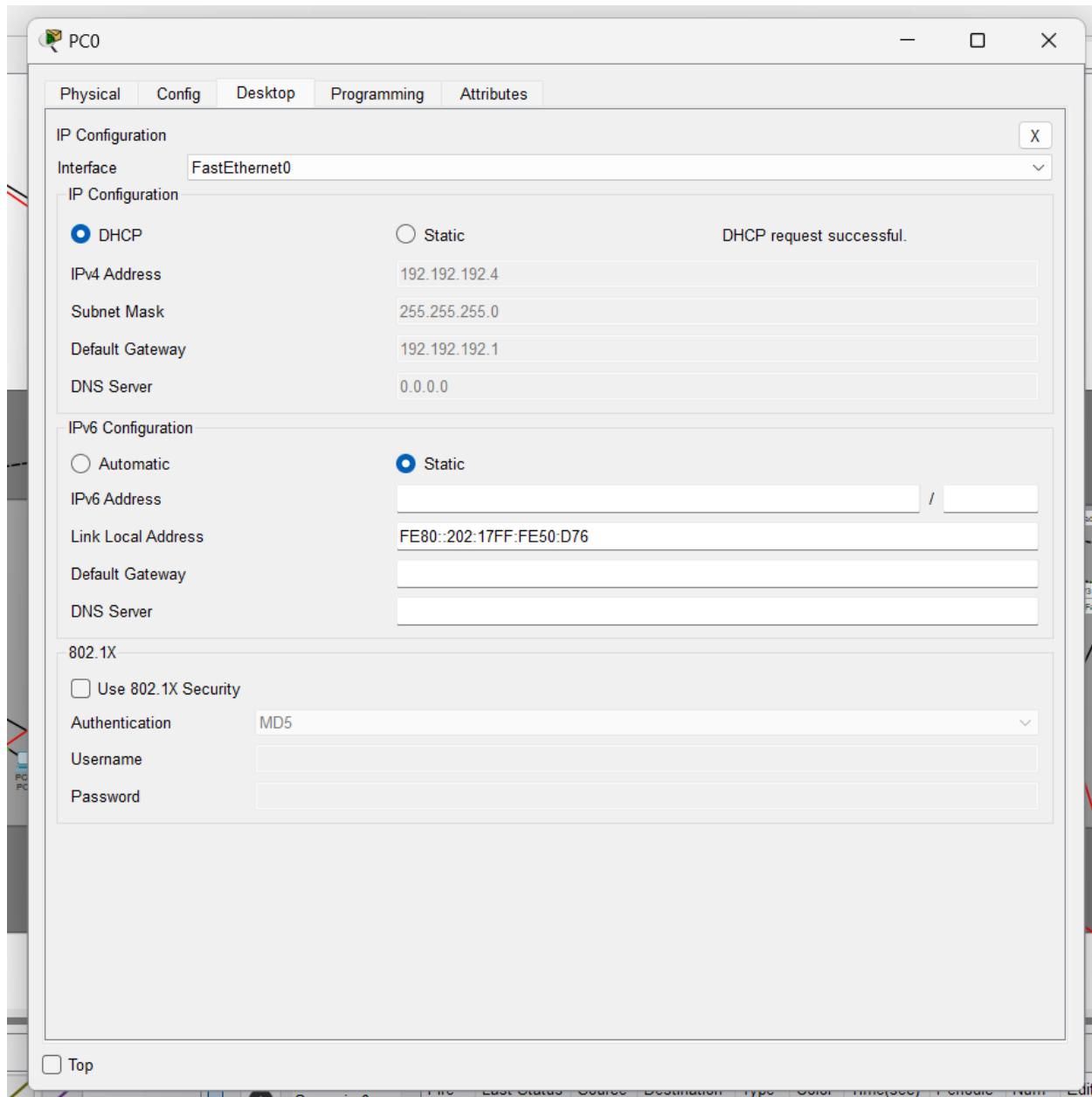
Router1

Physical Config CLI Attributes

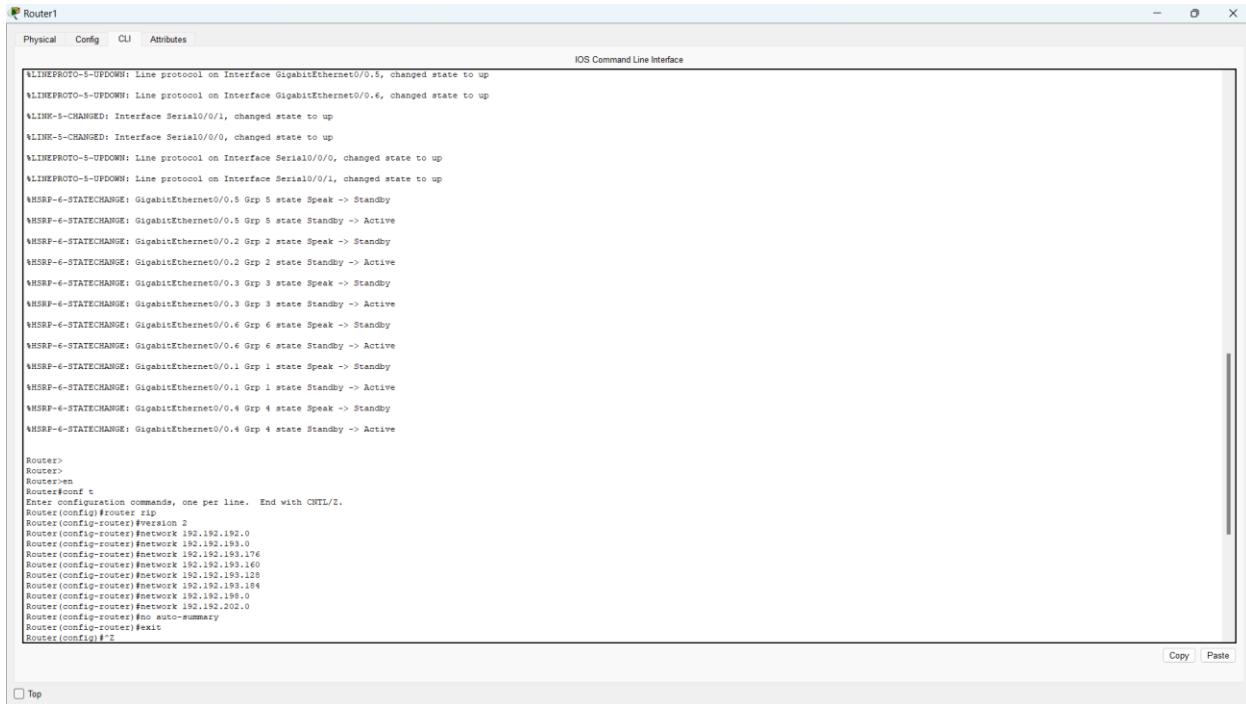
IOS Command Line Interface

```
Pool Business-Department :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 128  
  Leased addresses : 1  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.1 - 192.192.193.1 1 / 15 / 126  
  
Pool Marketing-Department :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 30  
  Leased addresses : 1  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.129 - 192.192.193.129 1 / 15 / 30  
  
Pool Administration :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 14  
  Leased addresses : 1  
  Excluded addresses : 13  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.161 - 192.192.193.161 1 / 15 / 14  
  
Pool Human-Resource :  
  Utilization mark (high/low) : 100 / 0  
  Subnet size (first/next) : 0 / 0  
  Total addresses : 6  
  Leased addresses : 0  
  Excluded addresses : 15  
  Pending event : none  
  
 1 subnet is currently in the pool  
  Current index IP address range Leased/Excluded/Total  
 192.192.193.177 - 192.192.193.177 0 / 15 / 6  
Router#  
Router#  
Router#  
Router#  
Router#  
Router#  
Router#
```

- DHCP Success: Automatic IP Assignment (Main Router)



## Main Router Configuration: RIP for Network Reachability



The screenshot shows a Cisco IOS Command Line Interface window titled "Router1". The window has tabs for "Physical", "Config" (which is selected), "CLI", and "Attributes". The main pane displays the following configuration commands:

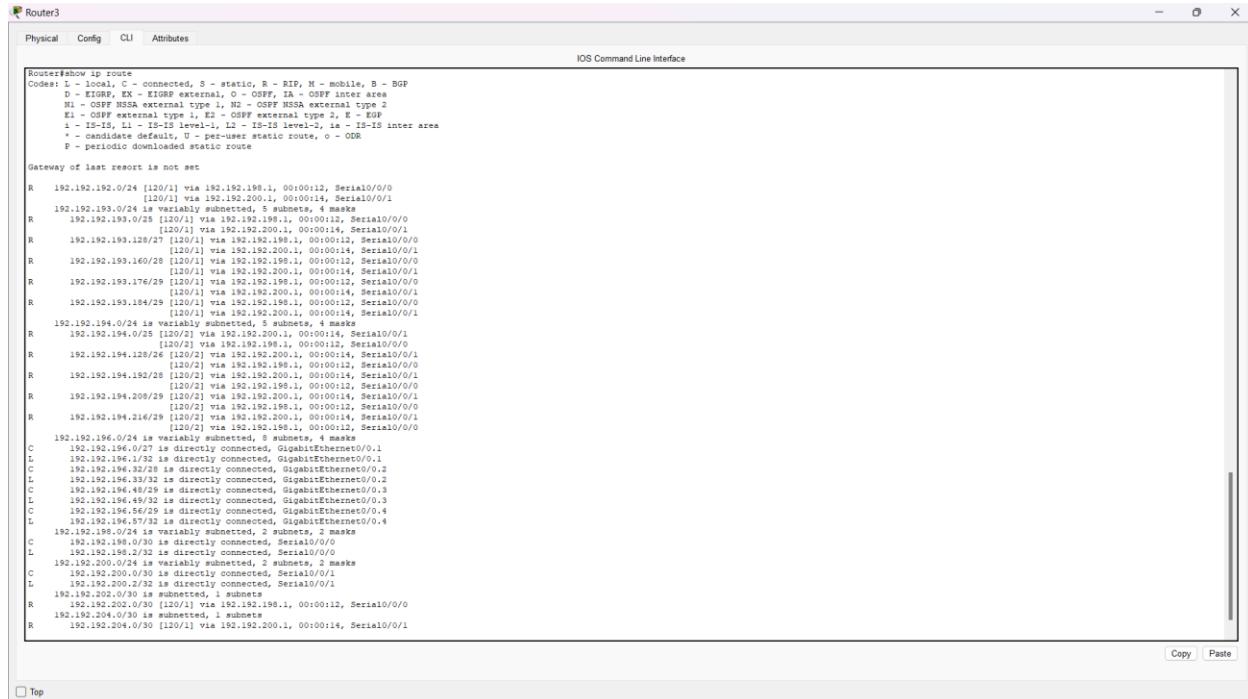
```
IOS Command Line Interface
Router1
Physical Config CLI Attributes
LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.5, changed state to up
LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.6, changed state to up
LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
WSMRP-6-STATECHANGE: GigabitEthernet0/0.5 Grp 5 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.5 Grp 5 state Standby -> Active
WSMRP-6-STATECHANGE: GigabitEthernet0/0.2 Grp 2 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.3 Grp 3 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.3 Grp 3 state Standby -> Active
WSMRP-6-STATECHANGE: GigabitEthernet0/0.4 Grp 4 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.6 Grp 6 state Standby -> Active
WSMRP-6-STATECHANGE: GigabitEthernet0/0.1 Grp 1 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.1 Grp 1 state Standby -> Active
WSMRP-6-STATECHANGE: GigabitEthernet0/0.4 Grp 4 state Speak -> Standby
WSMRP-6-STATECHANGE: GigabitEthernet0/0.4 Grp 4 state Standby -> Active

Router>
Router>en
Router>en 5
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.192.193.0
Router(config-router)#network 192.192.193.0
Router(config-router)#network 192.192.193.176
Router(config-router)#network 192.192.193.160
Router(config-router)#network 192.192.193.128
Router(config-router)#network 192.192.193.194
Router(config-router)#network 192.192.198.0
Router(config-router)#network 192.192.202.0
Router(config-router)#no auto-summary
Router(config-router)#exit
Router(config)#?
```

At the bottom left of the window, there is a "Top" button and at the bottom right, there are "Copy" and "Paste" buttons.

RIP routing on Main Router successfully advertised networks. Verified on Research & Development and Kandy Branch routers.

- In Research & Development Branch Router.



The screenshot shows the Router3 software interface with the 'CLI' tab selected. The window title is 'Router3' and the sub-tab is 'CLI'. The content area displays the output of the 'show ip route' command. The output lists various network routes with their metrics, interfaces, and subnet masks. It includes entries for directly connected interfaces like GigabitEthernet0/0 and GigabitEthernet0/1, as well as routes learned via RIP (R) and static routes (S). The interface also features 'Copy' and 'Paste' buttons at the bottom right.

```

Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E3 - OSPF external type 3
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      F - periodic downloaded static route

Gateway of last resort is not set

R 192.192.192.0/24 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.0/24 [120/1] via 192.192.200.1, 00:00:12, Serial0/0/1
192.192.193.0/23 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.128/27 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.128/28 [120/1] via 192.192.200.1, 00:00:12, Serial0/0/1
R 192.192.193.160/28 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/1
R 192.192.193.176/29 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.184/29 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.184/29 [120/1] via 192.192.200.1, 00:00:12, Serial0/0/1
192.192.194.0/24 is variably subnetted, 5 subnets, 4 masks
R 192.192.194.0/23 [120/2] via 192.192.200.1, 00:00:12, Serial0/0/1
[120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.194.128/26 [120/2] via 192.192.198.1, 00:00:12, Serial0/0/1
R 192.192.194.128/28 [120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.194.192/28 [120/2] via 192.192.198.1, 00:00:12, Serial0/0/1
R 192.192.194.208/28 [120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.194.216/29 [120/2] via 192.192.200.1, 00:00:14, Serial0/0/1
[120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
192.192.196.0/24 is variably subnetted, 8 subnets, 4 masks
C 192.192.196.0/27 is directly connected, GigabitEthernet0/0/1
L 192.192.196.1/32 is directly connected, GigabitEthernet0/0/0
C 192.192.196.2/32 is directly connected, GigabitEthernet0/0/2
L 192.192.196.33/32 is directly connected, GigabitEthernet0/0/3
C 192.192.196.49/32 is directly connected, GigabitEthernet0/0/3
L 192.192.196.49/32 is directly connected, GigabitEthernet0/0/4
C 192.192.196.57/32 is directly connected, GigabitEthernet0/0/4
U 192.192.196.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.192.196.0/30 is directly connected, Serial0/0/0
L 192.192.196.0/30 is directly connected, Serial0/0/0
192.192.200.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.192.200.0/30 is directly connected, Serial0/0/1
L 192.192.200.2/32 is directly connected, Serial0/0/1
C 192.192.202.0/30 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
192.192.204.0/30 [120/1] via 192.192.200.1, 00:00:14, Serial0/0/1

```

- In Kandy Branch Router

The screenshot shows the Cisco IOS CLI interface for Router4. The window title is "Router4" and the tab selected is "CLI". The command entered is "show ip route". The output displays the routing table with detailed information about each route, including the route type (R for RIP, E for EIGRP, C for static, L for local), subnet mask, and interface. The output is as follows:

```

Router4# show ip route
Codes: L - local, C - connected, S - static, R - RIP, E - EIGRP, B - BGP
       N1 - OSPF external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       1 - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter-area
* - candidate default, C - per-user static route, o - ODR
# - periodic downloaded static route

Gateway of last resort is not set

R  192.192.192.0/24 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:11, Serial0/0/1
R  192.192.193.0/24 is variably subnetted, 4 subnets, 3 masks
      [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
R  192.192.193.128/27 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
R  192.192.193.140/28 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
R  192.192.193.176/28 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
R  192.192.193.184/28 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
192.192.194.0/24 is variably subnetted, 10 subnets, 9 masks
C   192.192.194.1/32 is directly connected, GigabitEthernet0/0.1
L   192.192.194.1/32 is directly connected, GigabitEthernet0/0.2
C   192.192.194.128/26 is directly connected, GigabitEthernet0/0.2
L   192.192.194.128/26 is directly connected, GigabitEthernet0/0.3
C   192.192.194.192/26 is directly connected, GigabitEthernet0/0.3
L   192.192.194.192/26 is directly connected, GigabitEthernet0/0.4
C   192.192.194.208/29 is directly connected, GigabitEthernet0/0.5
L   192.192.194.208/29 is directly connected, GigabitEthernet0/0.5
C   192.192.194.209/29 is directly connected, GigabitEthernet0/0.5
L   192.192.194.209/29 is directly connected, GigabitEthernet0/0.6
C   192.192.194.217/27 is directly connected, GigabitEthernet0/0.4
L   192.192.194.217/27 is directly connected, GigabitEthernet0/0.4
192.192.196.0/24 is variably subnetted, 4 subnets, 3 masks
R  192.192.196.0/27 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
R  192.192.196.32/28 [120/1] via 192.192.202.1, 00:00:11, Serial10/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial10/0/1
R  192.192.196.48/29 [120/1] via 192.192.202.1, 00:00:11, Serial10/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial10/0/1
R  192.192.196.56/29 [120/1] via 192.192.202.1, 00:00:11, Serial10/0/0
      [120/1] via 192.192.204.1, 00:00:15, Serial10/0/1
192.192.198.0/30 is directly connected, 1 subnet, 1 mask
R  192.192.198.0/30 [120/1] via 192.192.202.1, 00:00:11, Serial0/0/0
192.192.200.0/30 is subnetted, 1 subnets
R  192.192.200.0/30 [120/1] via 192.192.204.1, 00:00:15, Serial0/0/1
192.192.202.0/30 is subnetted, 2 subnets, 2 masks
C   192.192.202.0/30 is directly connected, Serial0/0/0
L   192.192.202.0/30 is directly connected, Serial0/0/0
C   192.192.202.2/32 is directly connected, Serial0/0/0
L   192.192.202.2/32 is directly connected, Serial0/0/0
192.192.204.0/30 is variably subnetted, 2 subnets, 2 masks
C   192.192.204.0/30 is directly connected, Serial0/0/1
L   192.192.204.0/30 is directly connected, Serial0/0/1
C   192.192.204.2/32 is directly connected, Serial0/0/1
L   192.192.204.2/32 is directly connected, Serial0/0/1

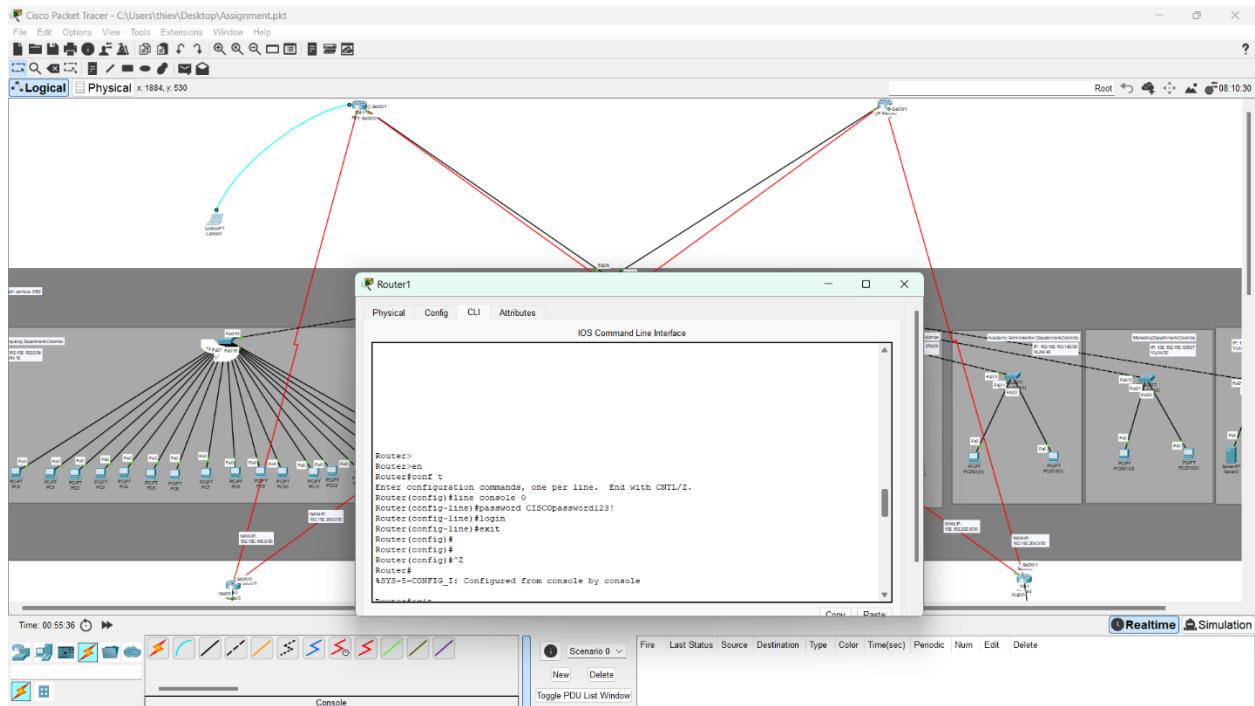
```

Copy Paste

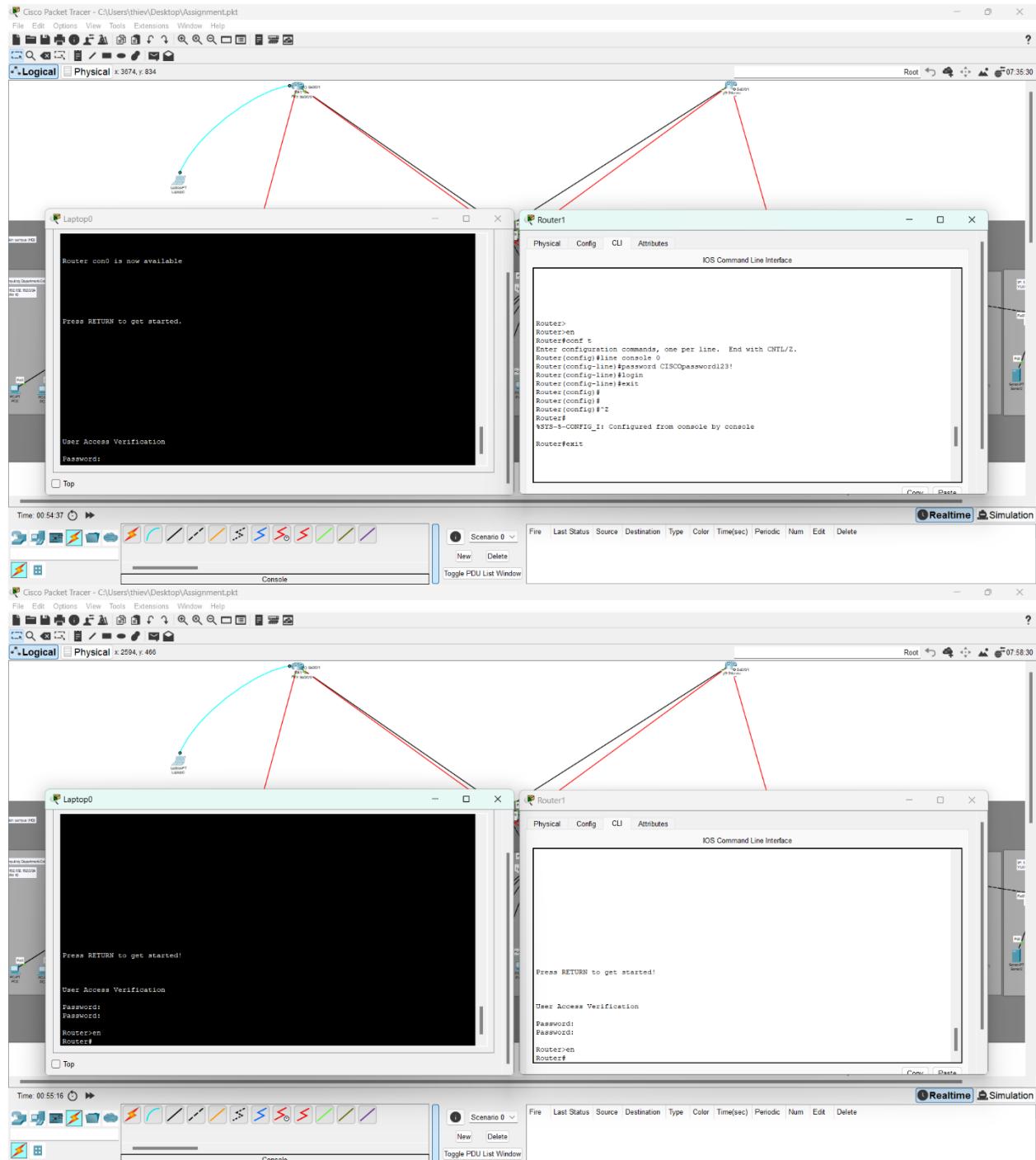
Top

## Main Router Console Line Security

- Password: CISCOpassword123!

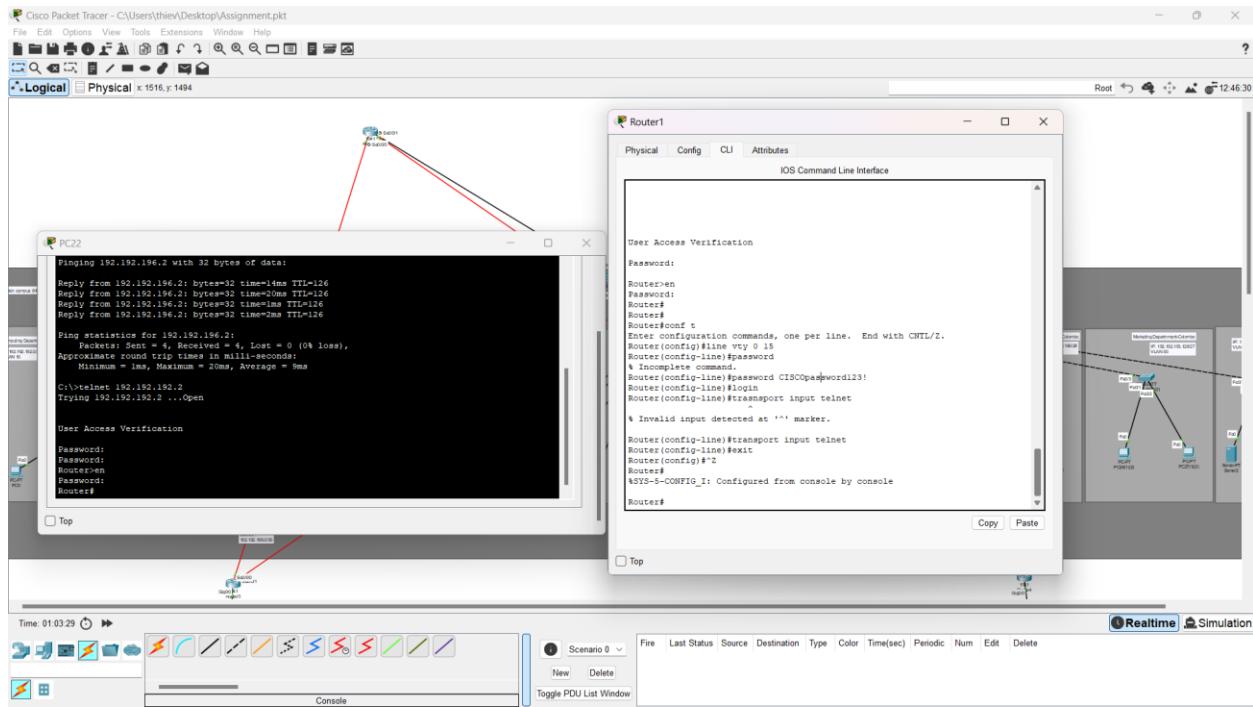


- Prompts User for Password to Access Console



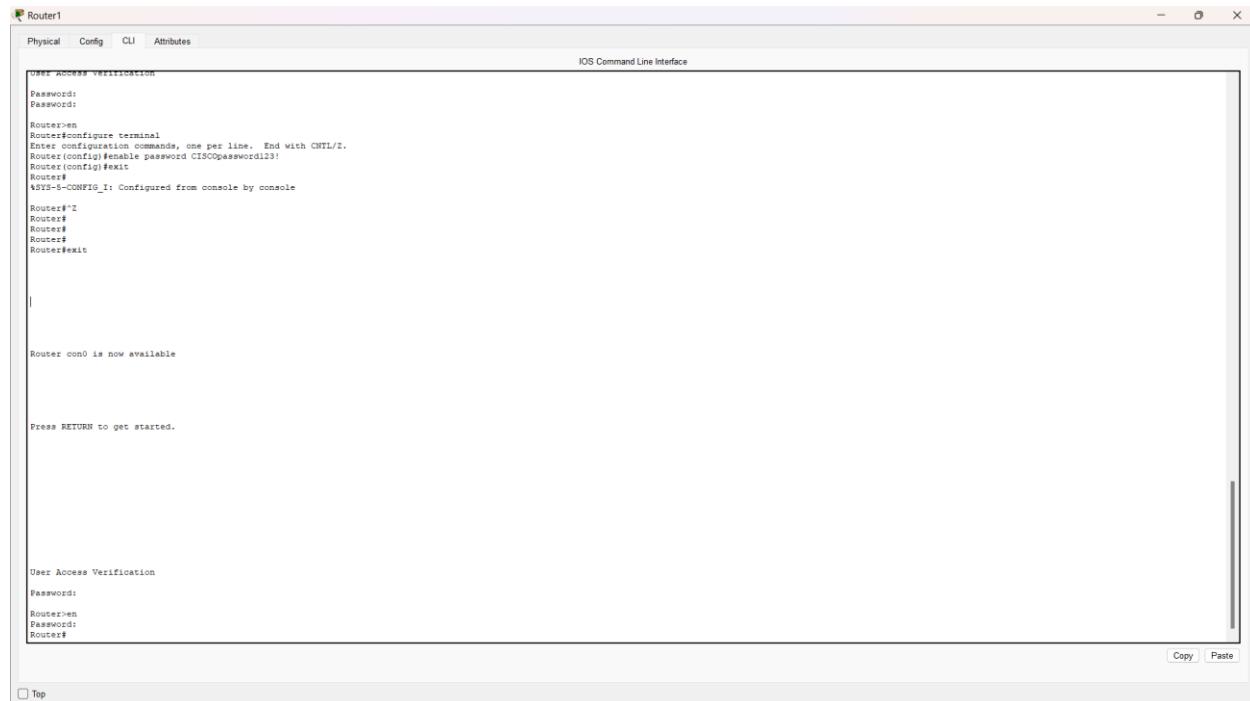
## Main Router Remote Connection Security

- Password: CISCOpassword123!



## **Main Router Privilege Mode Security**

- **Password: CISCOpassword123!**



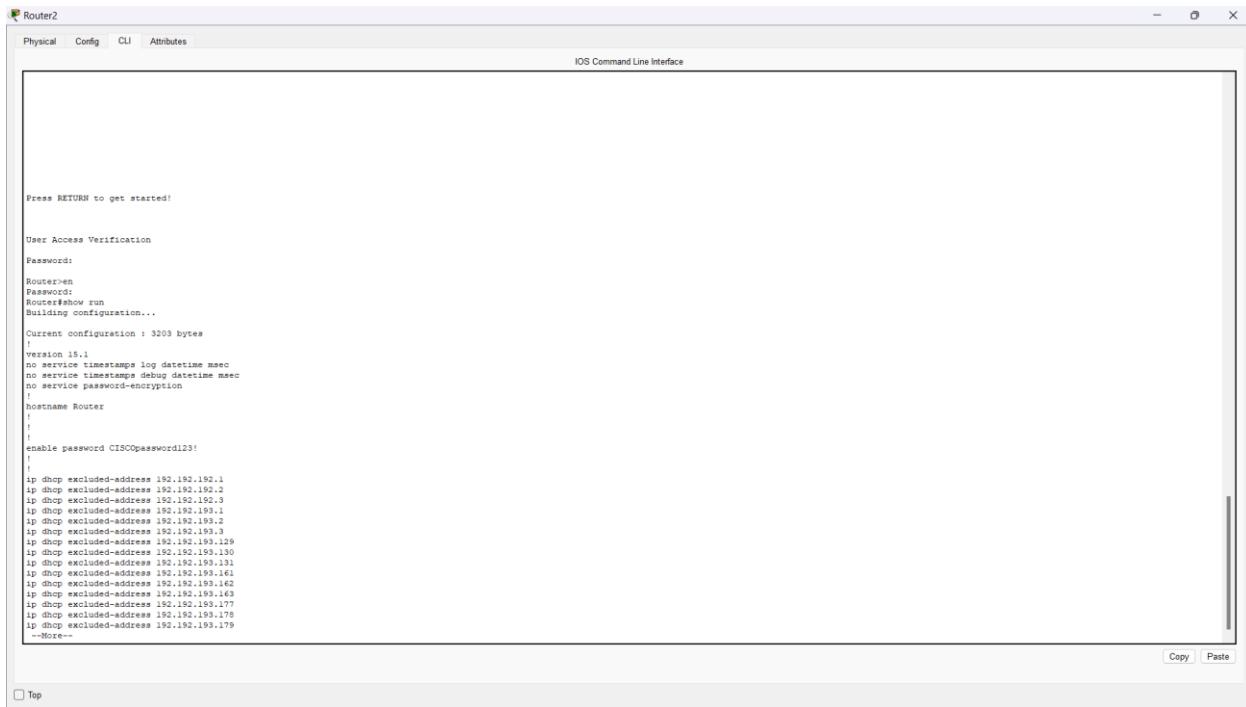
The screenshot shows a Windows-style application window titled "Router1". The menu bar includes "Physical", "Config", "CLI", and "Attributes". The main window is labeled "IOS Command Line Interface". The terminal session shows the following commands:

```
User Access Verification
Password:
Password:
Router>en
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password CISCOpassword123!
Router(config)#exit
Router#
*SVI-5-CONFIG_I: Configured from console by console
Router#Z
Router#
Router#
Router#exit
Router|
```

Below the terminal window, a message says "Router con0 is now available". It then prompts "Press RETURN to get started." At the bottom of the window, there is a "User Access Verification" section and a "Copy" button.

## Main Router Password Encryption

- While passwords are used to secure network connections, they are visible in plain text when using the "show run" command. To address this security concern, the "service password-encryption" command was implemented. This encrypts passwords, so only a scrambled value appears in the output of "show run," enhancing network security.



The screenshot shows a window titled "Router2" with the following content:

```
Press RETURN to get started!

User Access Verification
Password:
Router>en
Router#show run
Building configuration...
Current configuration : 3203 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
enable password CISCOpassword123!
!
ip dhcp excluded-address 192.162.192.1
ip dhcp excluded-address 192.162.192.2
ip dhcp excluded-address 192.162.192.3
ip dhcp excluded-address 192.162.193.1
ip dhcp excluded-address 192.162.193.2
ip dhcp excluded-address 192.162.193.3
ip dhcp excluded-address 192.162.193.129
ip dhcp excluded-address 192.162.193.130
ip dhcp excluded-address 192.162.193.131
ip dhcp excluded-address 192.162.193.161
ip dhcp excluded-address 192.162.193.162
ip dhcp excluded-address 192.162.193.163
ip dhcp excluded-address 192.162.193.177
ip dhcp excluded-address 192.162.193.178
ip dhcp excluded-address 192.162.193.179
--More--
```

At the bottom left is a "Top" button, and at the bottom right are "Copy" and "Paste" buttons.



Router#

Physical Config CLI Attributes

IOS Command Line Interface

```
;  
end  
  
Router#  
Router# configuration commands, one per line. End with CNTL/Z.  
Router(config)#service password-encryption  
Router(config)#exit  
Router#  
SYS-5-CONFIG_I: Configured from console by console  
  
Router#  
Router#show run  
Building configuration...  
  
Current configuration : 3284 bytes  
!  
version 15.1  
no service timestamps log datetime msec  
no service timestamps debug datetime msec  
service password-encryption  
  
hostname Router  
!  
  
enable password ? 0802657D2A36151601181B0B382F757a6074  
  
ip dhcp excluded-address 192.192.192.1  
ip dhcp excluded-address 192.192.192.2  
ip dhcp excluded-address 192.192.192.3  
ip dhcp excluded-address 192.192.193.1  
ip dhcp excluded-address 192.192.193.2  
ip dhcp excluded-address 192.192.193.3  
ip dhcp excluded-address 192.192.193.129  
ip dhcp excluded-address 192.192.193.130  
ip dhcp excluded-address 192.192.193.131  
ip dhcp excluded-address 192.192.193.161  
ip dhcp excluded-address 192.192.193.162  
ip dhcp excluded-address 192.192.193.163  
ip dhcp excluded-address 192.192.193.177  
--More-- |
```

Top

## **Backup Router of HQ Campus**

- Using DOT1Q Trunking Protocol for Managing VLANs and Segmenting Network Traffic on the Main Core Switch



## HSRP Priority Configuration: Backup Router with Lower Value

- To designate the main router as the primary and the backup router as the standby, the main router's HSRP priority was set to 150 (higher priority). The backup router remains at the default priority (100).

**Router2**

Physical Config CLI Attributes

IOS Command Line Interface

```

Router(config)#ip dhcp pool Business-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.3
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.129
Router(dhcp-config)#network 192.192.193.128 255.255.255.244
Router(dhcp-config)#default-router 192.192.193.129
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.129
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.130
Router(dhcp-config)#ip dhcp pool Marketing-Department
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.131
Router(dhcp-config)#ip pool Computing-Department
Router(dhcp-config)#network 192.192.193.160 255.255.255.240
Router(dhcp-config)#default-router 192.192.193.161
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.161
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.162
Router(dhcp-config)#ip dhcp pool Academic-Administration
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.163
Router(dhcp-config)#ip pool Human-Resources
Router(dhcp-config)#network 192.192.193.176 255.255.255.248
Router(dhcp-config)#default-router 192.192.193.177
Router(dhcp-config)#ip dhcp excluded-addresses 192.192.193.177
Router(dhcp-config)#ip pool Human-Resources
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.178
Router(dhcp-config)#ip dhcp excluded-address 192.192.193.179
Router(config)#exit
Router#show ip dhcp pool

Pool Computing-Department :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 15
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.192.1 192.192.192.1 - 192.192.192.254 0 / 15 / 254

Pool Business-Department :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 126
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.1 192.192.193.1 - 192.192.193.126 0 / 15 / 126

Pool Marketing-Department :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 30
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.129 192.192.193.129 - 192.192.193.158 0 / 15 / 30

Pool Academic-Administration :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 14
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.161 192.192.193.161 - 192.192.193.174 0 / 15 / 14

Pool Human-Resources :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 6
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.177 192.192.193.177 - 192.192.193.182 0 / 15 / 6
Router#
Router#
Router#
Router#
Router#write
Building configuration...

```

Top

**Router2**

Physical Config CLI Attributes

IOS Command Line Interface

```

Pool Business-Department :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 126
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.1 192.192.193.1 - 192.192.193.126 0 / 15 / 126

Pool Marketing-Department :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 30
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.129 192.192.193.129 - 192.192.193.158 0 / 15 / 30

Pool Academic-Administration :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 14
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.161 192.192.193.161 - 192.192.193.174 0 / 15 / 14

Pool Human-Resources :
Utilization mark (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 6
Leased addresses : 0
Excluded addresses : 15
Pending event : none

1 subnet is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.193.177 192.192.193.177 - 192.192.193.182 0 / 15 / 6
Router#
Router#
Router#
Router#
Router#write
Building configuration...

```

Top

## Backup Router Configuration: RIP for Network Reachability

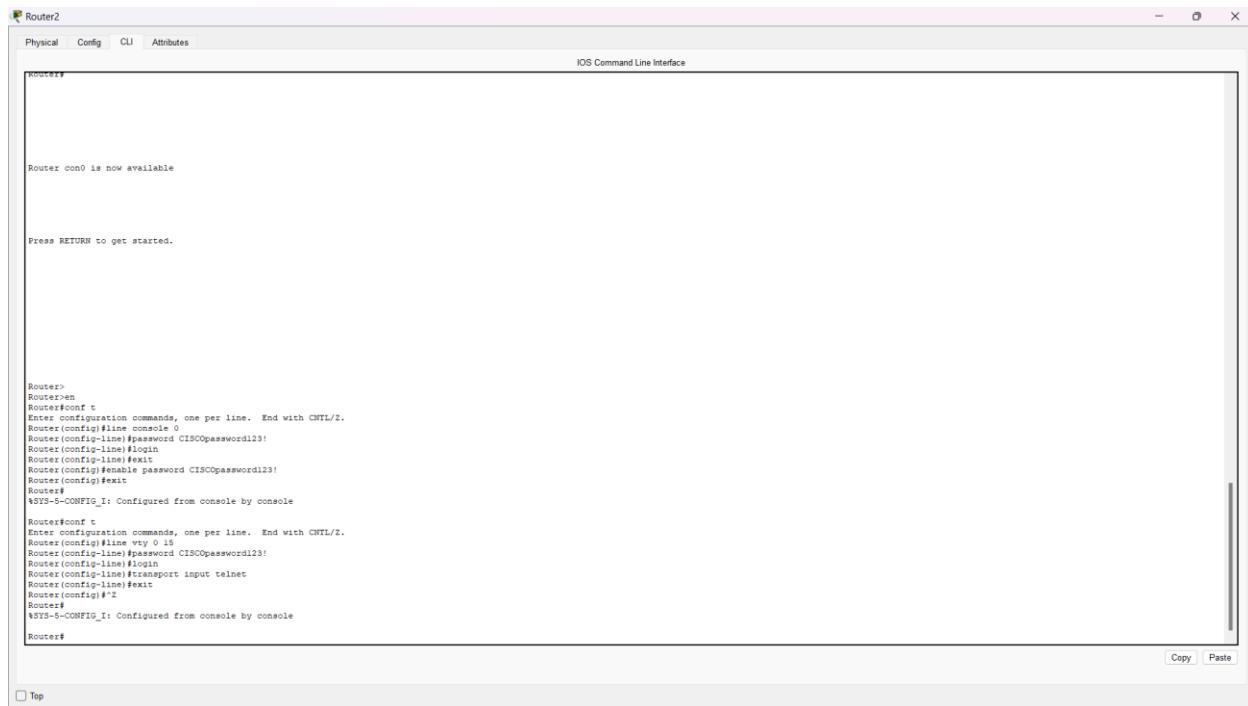
The screenshot shows a Cisco IOS CLI interface with the title bar "Router2". The menu bar includes "Physical", "Config", "CLI", and "Attributes". The main window displays the following configuration commands:

```
IOS Command Line Interface

Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.192.192.0
Router(config-router)#network 192.192.193.0
Router(config-router)#network 192.192.193.176
Router(config-router)#network 192.192.193.160
Router(config-router)#network 192.192.193.128
Router(config-router)#network 192.192.193.184
Router(config-router)#network 192.192.193.204.0
Router(config-router)#no auto-summary
Router(config-router)#exit
Router(config)#
Router#conf #2
Router#
$SYS-5-CONFIG_I: Configured from console by console|
Router#
Router#write
Building configuration...
[OK]
Router#
```

At the bottom right of the window, there are "Copy" and "Paste" buttons.

## Backup Router Access Control: Console Line, Remote Connection, and Privilege Mode Password Protection



The screenshot shows a Windows application window titled "Router2" with the tab "CLI" selected. The title bar includes "Physical", "Config", "CLI", and "Attributes". The main area is labeled "IOS Command Line Interface". The terminal window displays the following configuration commands:

```
Router>
Router>en
Router>conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#line console 0
Router(config-line)#password CISCOpASSWORD123!
Router(config-line)#login
Router(config-line)#exit
Router(config)#enable password CISCOpASSWORD123!
Router(config)#exit
Router#
$5T5-5-CONFIG_I: Configured from console by console
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#line vty 0 15
Router(config-line)#password CISCOpASSWORD123!
Router(config-line)#login
Router(config-line)#transport input telnet
Router(config-line)#exit
Router(config)#exit
Router#
$5T5-5-CONFIG_I: Configured from console by console
Router#
```

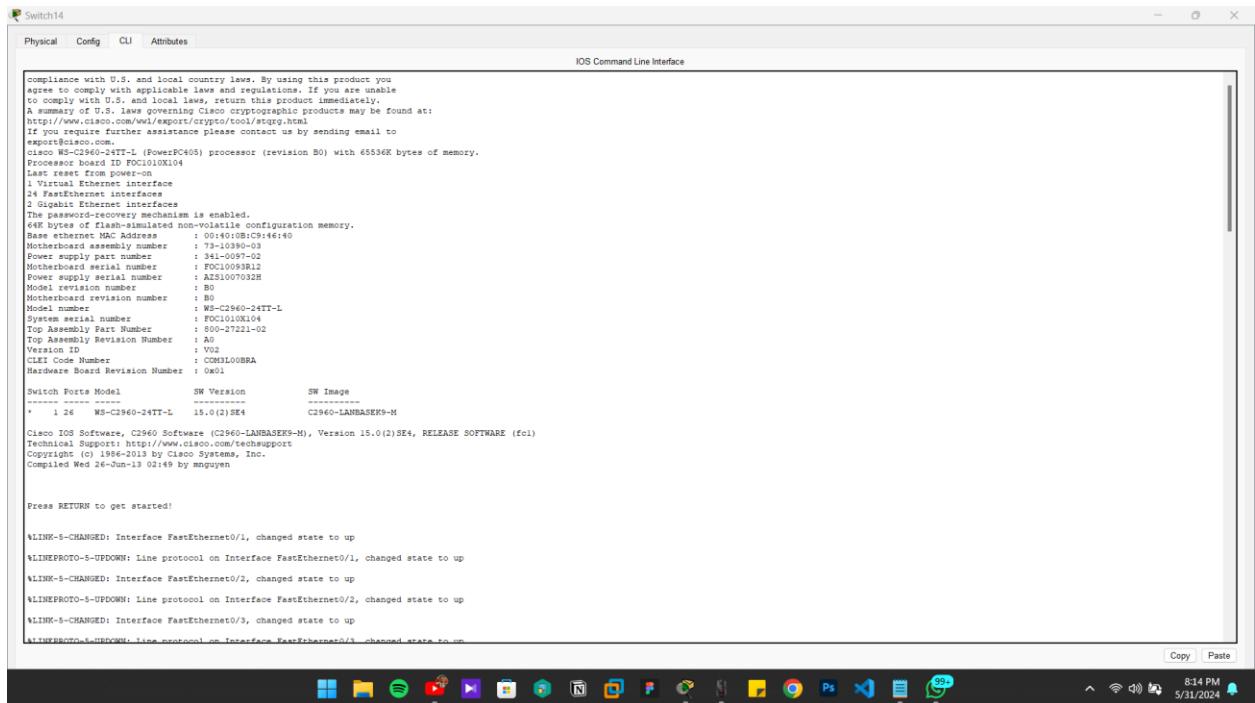
At the bottom right of the terminal window, there are "Copy" and "Paste" buttons. A "Top" checkbox is located at the bottom left.

**RESEARCH AND  
DEVELOPMENT PACKET  
TRACER  
CONFIGURATIONS**

# Research & Development Core Switch: VLAN Configuration and Access

## Switch Port Assignment

- Established VLANs on the Research & Development Branch core switch and assigned connected end devices to their corresponding VLANs for network segmentation.



```
Switch14
Physical Config CLI Attributes
IOS Command Line Interface

compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to do so, then do not use this product. Cisco has a legal obligation to
comply with these laws and regulations. A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/w处处/export/crypto/tool/stcrg.html
If you require further assistance please contact us by sending email to
support@cgw.cisco.com
cisco WS-C2960-24TT-L (PowerPC405) processor (revision B0) with 65536K bytes of memory.
Processor board ID FOC1010X104
Last reset from power-on
1 Virtual Ethernet interface
24 FastEthernet interfaces
2 Gigabit Ethernet interfaces
The password-protected management is enabled.
64K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address : 0014008C9C46:40
Motherboard assembly number : 73-10390-03
Power supply part number : 1A231007032H
Motherboard serial number : FOC109SR12
Power supply serial number : A231007032H
Model revision number : B0
Motherboard revision number : B0
Model number : WS-C2960-24TT-L
System serial number : FOC1010X104
Top Assembly Part Number : 800-27221-02
Top Assembly Revision Number : 1
Version ID : V02
CLEX Code Number : COM3L00BRA
Hardware Board Revision Number : 0x01

Switch Ports Model SW Version SW Image
----- -----
* 1 26 WS-C2960-24TT-L 15.0(2)SE4 C2960-LANBASEK9-M

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE4, RELEASE SOFTWARE (f01)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2013 by Cisco Systems, Inc.
Compiled Wed 26-Jun-13 02:49 by mnnguyen

Press RETURN to get started!

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
```

Switch14

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/6, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/6, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/7, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/7, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/8, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/8, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/9, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/9, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0/7, changed state to down
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/7, changed state to down
%LINK-5-CHANGED: Interface FastEthernet0/7, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/7, changed state to up

Switch>
Switch#
Switch#config
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name Rad
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name Sever-Room
Switch(config-vlan)#exit
Switch(config)#vlan 40
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#exit
Switch(config)#*
Switch#<CONFIG_I: Configured from console by console

Switch#
Switch#
Switch#
Switch#
```

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Switch14

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch#
Switch#
Switch#
Switch#
Switch#show vlan brief
-----  

VLAN Name          Status Ports
-----  

1    default        active  Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                Gig0/1, Gig0/2
10   RAD             active
20   Marketing       active
30   Sever-Room     active
40   Human-Resource active
1005  fddinet-default active
1004  fddinet-default active
1005  trust-default active
Switch#<CONFIG_I: Configured from console by console

Switch(config)#Fa0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 40
Switch(config-if)#exit
Switch(config-if)#Fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 40
Switch(config-if)#exit
Switch(config-if)#Fa0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config-if)#Fa0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
^
% Invalid input detected at '***' marker.

Switch(config-if)#exit
Switch(config-if)#Fa0/8
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config-if)#Fa0/9
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
```

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Switch14 Physical Config CLI Attributes

IOS Command Line Interface

```
Switch(config-if)#int fa0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
% Invalid input detected at `'' marker.

Switch(config-if)#exit
Switch(config-if)#
Switch(config-if)#!switchport mode access
Switch(config-if)#!switchport access vlan 10
Switch(config-if)#exit
Switch(config-if)#!switchport mode access
Switch(config-if)#!switchport access vlan 10
Switch(config-if)#exit
Switch(config-if)#!switchport mode access
Switch(config-if)#!switchport access vlan 10
Switch(config-if)#exit
Switch(config-if)#!switchport mode access
Switch(config-if)#!switchport access vlan 30
Switch(config-if)#!switchport mode access
Switch(config-if)#!switchport access vlan 30
Switch(config-if)#exit
Switch(config-if)#!2
Switch#
*SYS-S-CONFIG_I: Configured from console by console

Switch#
Switch#
Switch#show vian brief
VLAN Name          Status    Ports
---  -----
1   default         active    Fa0/7, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2
10  FaD             active    Fa0/8, Fa0/9
20  Marketing       active    Fa0/3, Fa0/4
30  Server-Room    active    Fa0/5, Fa0/6
40  Human-Resource active    Fa0/1, Fa0/2
1003 token-ring-default active
1008 fddnet-default active
1005 tirst-default  active
1008 tirst-default  active
Switch#exit
Translating "wizc"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address

Switch#wizc
Building configuration...
[OK]
Switch#
```

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# Using DOT1Q Trunking Protocol for Managing VLANs and Segmenting Network Traffic on the Main Core Switch

Router3

Physical Config CLI Attributes

IOS Command Line Interface

```

Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#int add
Router(config-subif)#ip address 192.192.196.1 255.255.255.224
Router(config-subif)#exit
Router(config)#int g0/0.2
Router(config-subif)
%LINK-5-CHANGED: Interface GigabitEthernet0/0.2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up

Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 192.192.196.33 255.255.255.240
Router(config-subif)#exit
Router(config)#int g0/0.3
Router(config-subif)
%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up

Router(config-subif)#encapsulation dot1Q 40
Router(config-subif)#ip address 192.192.196.57 255.255.255.248
Router(config-subif)#exit
Router(config)#Z
Router#
%SYS-3-CONFIG_I: Configured from console by console

Router#
Router#
Router#
Router#show ip int brief
Interface          IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  unassigned     YES manual up
GigabitEthernet0/0.1 192.192.196.1  YES manual up
GigabitEthernet0/0.2 192.192.196.33 YES manual up
GigabitEthernet0/0.3 192.192.196.49 YES manual up
GigabitEthernet0/0.4 192.192.196.57 YES manual up
GigabitEthernet0/1  unassigned     YES unmet administratively down down
Serial0/0/0         unassigned     YES unmet administratively down down
Serial0/0/1         unassigned     YES unmet administratively down down
Serial0/0/2         unassigned     YES unmet administratively down down
Vlan1              unassigned     YES unmet administratively down down
Router#
Router#
Router#
Router>conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dh

```

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Router3

Physical Config CLI Attributes

IOS Command Line Interface

```

Router>
Router>en
Router#Z
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int serial0/0/0
Router(config-if)#ip address 192.192.198.2 255.255.255.252
Router(config-if)#shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up

Router(config-if)#exit
Router(config)#int serial0
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

^
% Invalid input detected at `''' marker.

Router(config)#int serial0/0/1
Router(config-if)#ip address 192.192.200.2 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

Router(config-if)#exit
Router(config)#Z
Router#
%SYS-3-CONFIG_I: Configured from console by console

Router#show ip
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

^
% Invalid input detected at `''' marker.

Router#show ip int brief
Interface          IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  unassigned     YES unmet up
GigabitEthernet0/0.1 192.192.196.1  YES manual up
GigabitEthernet0/0.2 192.192.196.33 YES manual up
GigabitEthernet0/0.3 192.192.196.49 YES manual up
GigabitEthernet0/0.4 192.192.196.57 YES manual up
GigabitEthernet0/1  unassigned     YES unmet administratively down down
Serial0/0/0         192.192.198.2  YES manual up
Serial0/0/1         192.192.200.2  YES manual up
Vlan1              unassigned     YES unmet administratively down down
Router#write
Building configuration...
[OK]
Router#

```

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Router3

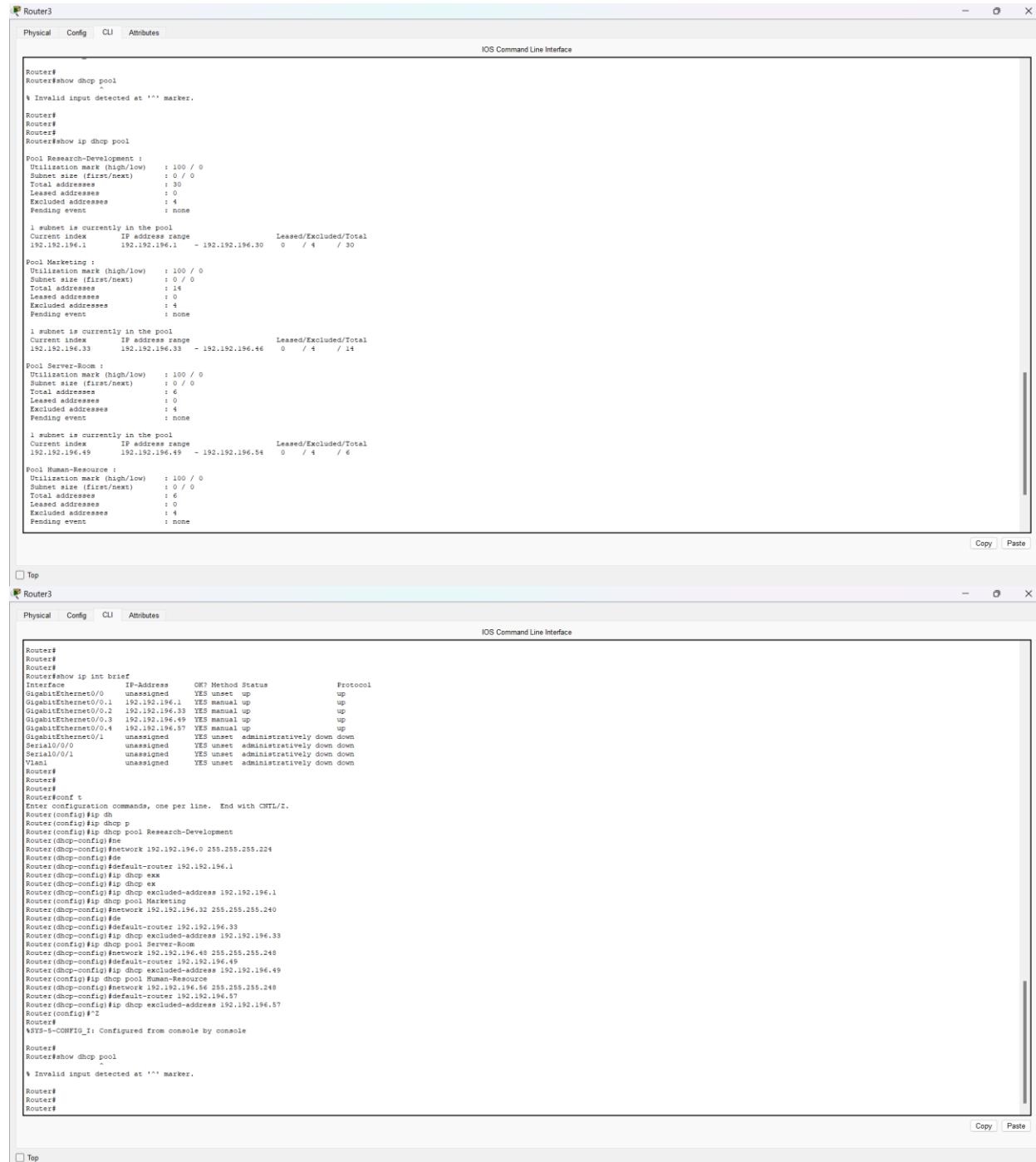
Physical Config CLI Attributes

Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#int g1o/0/0  
Router(config-if)#no shutdown  
Router(config-if)#  
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up  
Router(config-if)#  
Router(config-if)#exit  
Router(config)#int g1o/0/1  
Router(config-subif)  
%LINK-5-CHANGED: Interface GigabitEthernet0/0.1, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1, changed state to up  
Router(config-subif)#encapsulation d10  
Router(config-subif)#encapsulation dot1Q 10  
Router(config-subif)#encapsulation dot1Q 10  
Router(config-subif)#ip add  
Router(config-subif)#address 192.192.196.1 255.255.255.224  
Router(config-subif)#exit  
Router(config)#int g1o/0/2  
Router(config-subif)  
%LINK-5-CHANGED: Interface GigabitEthernet0/0.2, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2, changed state to up  
Router(config-subif)#encapsulation dot1Q 20  
Router(config-subif)#encapsulation dot1Q 20  
Router(config-subif)#address 192.192.196.33 255.255.255.240  
Router(config-subif)#exit  
Router(config)#int g1o/0/3  
Router(config-subif)  
%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up  
Router(config-subif)#encapsulation dot1Q 30  
Router(config-subif)#ip address 192.192.196.45 255.255.255.248  
Router(config-subif)#exit  
Router(config)#int g1o/0/4  
Router(config-subif)  
%LINK-5-CHANGED: Interface GigabitEthernet0/0.4, changed state to up  
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up  
Router(config-subif)#encapsulation dot1Q 40  
Router(config-subif)#ip address 192.192.196.57 255.255.255.248  
Router(config-subif)#exit  
Router(config)#  
Router#

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# Research & Development Network: DHCP Configuration for Automatic IP Assignment



The screenshot displays two windows from a Cisco IOS Command Line Interface (CLI) session on Router3. The top window shows the output of the command `Router#show ip dhcp pool`, detailing four DHCP pools: Research-Development, Marketing, Room, and Human-Resource. The bottom window shows the configuration of the Research-Development pool, including subnet ranges (192.192.196.0 to 192.192.196.30, 192.192.196.33 to 192.192.196.44, 192.192.196.49 to 192.192.196.54), excluded addresses (192.192.196.1, 192.192.196.33, 192.192.196.49, 192.192.196.55), and default routers (192.192.196.1).

```
Router#show ip dhcp pool
% Invalid input detected at '^' marker.

Router#
Router#
Router#
Router#show ip dhcp pool

Pool Research-Development :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 30
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range           Leased/Excluded/Total
  192.192.196.1       192.192.196.1 - 192.192.196.30      0 / 4 / 30

Pool Marketing :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 14
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range           Leased/Excluded/Total
  192.192.196.33      192.192.196.33 - 192.192.196.44      0 / 4 / 14

Pool Room :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 4
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range           Leased/Excluded/Total
  192.192.196.49       192.192.196.49 - 192.192.196.54      0 / 4 / 6

Pool Human-Resource :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 6 / 0
  Total addresses           : 6
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

Router#show ip int brief
Intf    IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0  unassigned      YES unset up
GigabitEthernet0/0.1 192.192.196.1  YES manual up
GigabitEthernet0/0.2  192.192.196.33  YES manual up
GigabitEthernet0/0.3  192.192.196.49  YES manual up
GigabitEthernet0/0.4  192.192.196.57  YES manual up
GigabitEthernet0/1  unassigned      YES unset administratively down down
Serial0/0/0          unassigned      YES unset down down
Serial0/0/1          unassigned      YES unset administratively down down
Vlan1               unassigned      YES unset administratively down down
Router#
Router#
Router#
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip dh
Router(config)#ip dhcp p
Router(config)#ip dhcp pool Research-Development
Router(dhcp-config)#n
Router(dhcp-config)#network 192.192.196.0 255.255.255.224
Router(dhcp-config)#de
Router(dhcp-config)#default-router 192.192.196.1
Router(dhcp-config)#ip dhcp ex
Router(dhcp-config)#ip d
Router(dhcp-config)#ip dhcp excluded-address 192.192.196.1
Router(config)#ip dhcp pool Marketing
Router(config)#network 192.192.196.32 255.255.255.240
Router(config)#ip d
Router(dhcp-config)#default-router 192.192.196.33
Router(dhcp-config)#ip dhcp excluded-address 192.192.196.33
Router(config)#ip d
Router(dhcp-config)#network 192.192.196.48 255.255.255.248
Router(dhcp-config)#defa
Router(dhcp-config)#ip dhcp excluded-address 192.192.196.49
Router(config)#ip d
Router(dhcp-config)#ip dhcp excluded-address 192.192.196.49
Router(config)#ip d
Router(dhcp-config)#network 192.192.196.56 255.255.255.248
Router(dhcp-config)#defa
Router(dhcp-config)#ip dhcp excluded-address 192.192.196.57
Router(dhcp-config)#ip d
Router(config)#^Z
Router#
Router#show ip dhcp pool
-
% Invalid input detected at '^' marker.

Router#
Router#
```

Router3

Physical Config CLI Attributes

IOS Command Line Interface

```
Pool Research-Development :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 30
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range          Leased/Excluded/Total
  192.192.196.1       192.192.196.1 - 192.192.196.30    0 / 4 / 30

Pool Marketing :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 14
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range          Leased/Excluded/Total
  192.192.196.33      192.192.196.33 - 192.192.196.46    0 / 4 / 14

Pool Server-Room :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 6
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range          Leased/Excluded/Total
  192.192.196.49      192.192.196.49 - 192.192.196.54    0 / 4 / 6

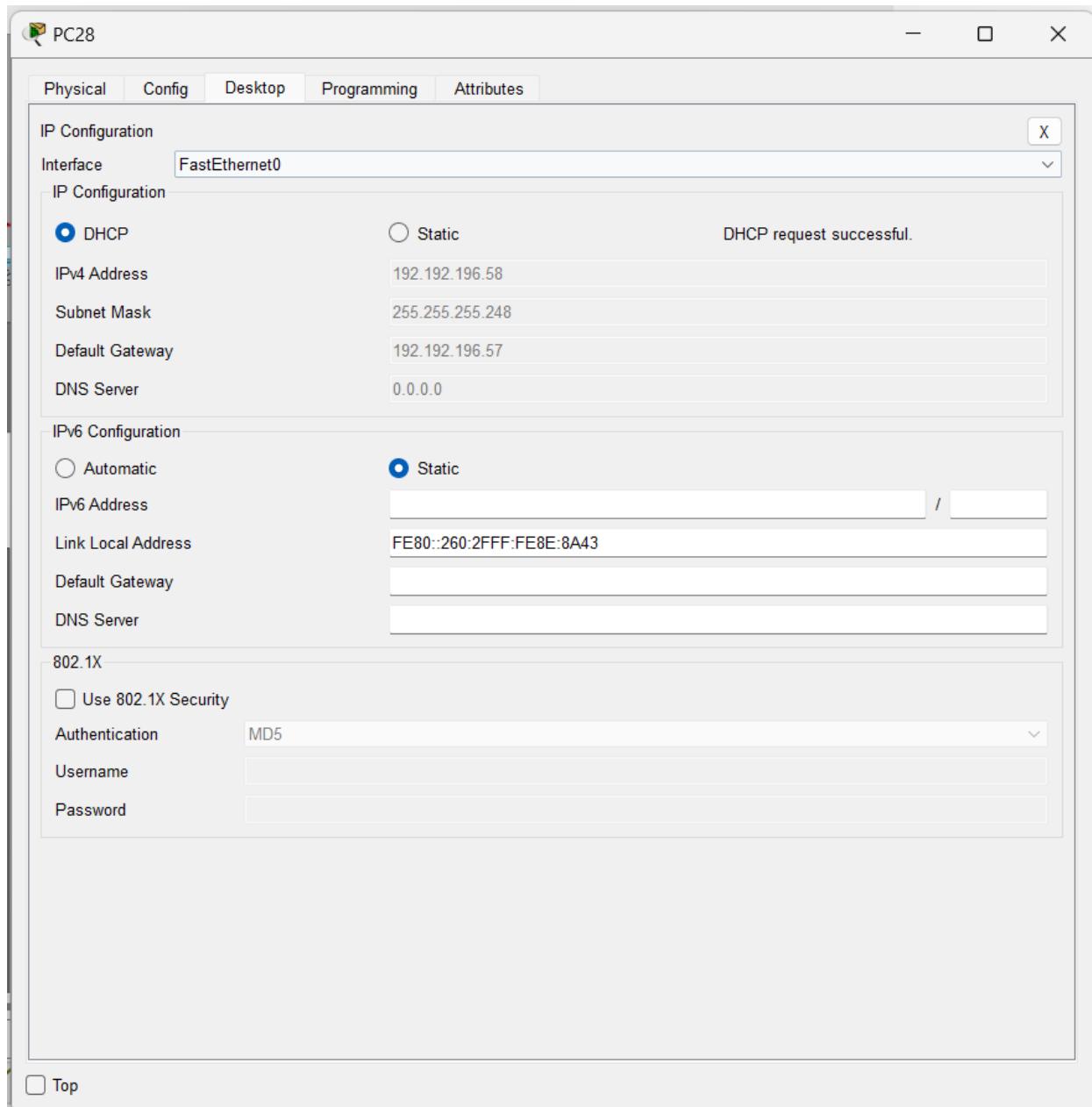
Pool Human-Resource :
  Utilization mark (high/low) : 100 / 0
  Subnet size (first/next)   : 0 / 0
  Total addresses           : 6
  Leased addresses          : 0
  Excluded addresses        : 4
  Pending event             : none

  1 subnet is currently in the pool
  Current index      IP address range          Leased/Excluded/Total
  192.192.196.57      192.192.196.57 - 192.192.196.62    0 / 4 / 6

Router# Router#
Router# Router#
Router# Router#
Router# Router#
Router# Router#
Router# Router#
```

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- DHCP Success: Automatic IP Assignment



# Research & Development Router Configuration: RIP for Network Reachability

Router3

Physical Config CLI Attributes

IOS Command Line Interface

```
Router con0 is now available

Press RETURN to get started.

Router>
Router#en
Router#
Router#
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.192.196.56
Router(config-router)#network 192.192.196.32
Router(config-router)#network 192.192.196.40
Router(config-router)#network 192.192.196.48
Router(config-router)#network 192.192.198.0
Router(config-router)#network 192.192.200.0
Router(config-router)#no auto-summary
Router(config-router)#exit
Router(config)#^Z
Router#
[Router]#Config I: Configured from console by console

Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
```

RIP routing on Router successfully advertised networks. Verified on HQ Campus and Kandy Branch routers.

- In HQ Branch Router.

```

Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       E1 - Ethernet, X - Ficon external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, ND - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

192.192.192.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.192.192.0/24 is directly connected, GigabitEthernet0/0.1
L 192.192.192.0/24 is directly connected, Serial10/0/1
192.192.193.0/24 is variably subnetted, 4 subnets, 5 masks
C 192.192.193.0/25 is directly connected, GigabitEthernet0/0.2
L 192.192.193.2/32 is directly connected, GigabitEthernet0/0.2.5
C 192.192.193.128/32 is directly connected, GigabitEthernet0/0.3
L 192.192.193.130/32 is directly connected, GigabitEthernet0/0.3
C 192.192.193.160/28 is directly connected, GigabitEthernet0/0.4
L 192.192.193.162/32 is directly connected, GigabitEthernet0/0.4.5
C 192.192.193.164/32 is directly connected, GigabitEthernet0/0.5
L 192.192.193.178/32 is directly connected, GigabitEthernet0/0.5
C 192.192.193.180/32 is directly connected, GigabitEthernet0/0.6
L 192.192.193.182/32 is directly connected, GigabitEthernet0/0.6.5
C 192.192.193.184/29 is directly connected, GigabitEthernet0/0.7
L 192.192.193.186/29 is directly connected, GigabitEthernet0/0.7.5
C 192.192.193.188/32 is directly connected, GigabitEthernet0/0.8
R 192.192.194.0/25 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.128/26 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.192/27 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.255/28 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.216/29 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
192.192.196.0/24 is variably subnetted, 4 subnets, 3 masks
R 192.192.196.0/24 [120/1] via 192.192.196.2, 00:00:13, Serial10/0/0
R 192.192.196.128/32 [120/1] via 192.192.196.2, 00:00:13, Serial10/0/0
R 192.192.196.49/29 [120/1] via 192.192.196.2, 00:00:12, Serial10/0/0
R 192.192.196.56/29 [120/1] via 192.192.196.2, 00:00:12, Serial10/0/0
C 192.192.196.64/32 is variably subnetted, 2 subnets, 2 masks
L 192.192.196.64/32 is directly connected, Serial10/0/0
C 192.192.196.1/32 is directly connected, Serial10/0/0
L 192.192.200.0/30 is subnetted, 1 subnets
R 192.192.200.0/30 [120/1] via 192.192.196.9, 00:00:14, GigabitEthernet0/0.1
[120/1] via 192.192.193.12, 00:00:14, GigabitEthernet0/0.2
[120/1] via 192.192.193.13, 00:00:14, GigabitEthernet0/0.3
192.192.202.0/24 is variably subnetted, 4 subnets, 4 masks
C 192.192.202.0/24 is directly connected, Serial10/0/1
L 192.192.202.1/32 is directly connected, Serial10/0/1
C 192.192.202.128/32 is directly connected, Serial10/0/1
R 192.192.202.0/30 [120/1] via 192.192.196.9, 00:00:14, GigabitEthernet0/0.1
[120/1] via 192.192.193.12, 00:00:14, GigabitEthernet0/0.2
[120/1] via 192.192.193.13, 00:00:14, GigabitEthernet0/0.3
[120/1] via 192.192.193.14, 00:00:14, GigabitEthernet0/0.4
Router#

```

- In Kandy Branch Router.

```

Router#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       E1 - Ethernet, X - Ficon external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, ND - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R 192.192.192.0/24 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
[120/1] via 192.192.204.1, 00:00:00, Serial10/0/1
192.192.193.0/23 is variably subnetted, 5 subnets, 4 masks
R 192.192.193.0/24 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
[120/1] via 192.192.204.1, 00:00:00, Serial10/0/1
R 192.192.193.128/27 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.193.160/28 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.193.176/29 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.193.184/30 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.193.192/31 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
192.192.194.0/24 is variably subnetted, 10 subnets, 5 masks
C 192.192.194.0/24 is directly connected, GigabitEthernet0/0.1
L 192.192.194.1/32 is directly connected, GigabitEthernet0/0.1
C 192.192.194.128/32 is directly connected, GigabitEthernet0/0.2
L 192.192.194.129/32 is directly connected, GigabitEthernet0/0.2.5
C 192.192.194.130/32 is directly connected, GigabitEthernet0/0.3
L 192.192.194.131/32 is directly connected, GigabitEthernet0/0.3.5
C 192.192.194.208/29 is directly connected, GigabitEthernet0/0.5
C 192.192.194.209/32 is directly connected, GigabitEthernet0/0.5.5
L 192.192.194.210/32 is directly connected, GigabitEthernet0/0.6
L 192.192.194.217/32 is directly connected, GigabitEthernet0/0.4
192.192.196.0/24 is variably subnetted, 4 subnets, 3 masks
R 192.192.196.0/27 [120/2] via 192.192.202.1, 00:00:05, Serial10/0/0
[120/2] via 192.192.204.1, 00:00:00, Serial10/0/1
R 192.192.196.32/32 [120/2] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.196.49/29 [120/2] via 192.192.202.1, 00:00:05, Serial10/0/0
R 192.192.196.56/29 [120/2] via 192.192.202.1, 00:00:05, Serial10/0/0
192.192.198.0/24 is variably subnetted, 1 subnet, 1 mask
R 192.192.198.0/24 [120/1] via 192.192.202.1, 00:00:05, Serial10/0/0
192.192.200.0/30 is subnetted, 1 subnets
R 192.192.200.0/30 [120/1] via 192.192.204.1, 00:00:00, Serial10/0/1
C 192.192.201.0/30 is directly connected, Serial10/0/0
L 192.192.202.2/32 is directly connected, Serial10/0/0
C 192.192.204.0/24 is variably subnetted, 2 subnets, 2 masks
L 192.192.204.0/30 is directly connected, Serial10/0/1
L 192.192.204.2/32 is directly connected, Serial10/0/1
Router#

```

**KANDY BRANCH PACKET  
TRACER  
CONFIGURATIONS**

# Kandy Branch Core Switch: VLAN Configuration and Access Switch Port Assignment

- Created VLANs in Core Switch of Kandy Branch and assigned all the switchports connected to the access Switch to the correct VLAN

```
Multilayer Switch10
Physical Config CLI Attributes
IOS Command Line Interface

Base ethernet MAC Address : 0003.E404.2EEB
Motherboard assembly number : 73-5673-09
Power supply part number : 341-0029-05
Motherboard serial number : CAT103758V1
Power supply serial number : DTH1034CT0B
Model revision number : F0
Motherboard revision number : A0
Motherboard serial number : MS-C3560-24PS-E
System serial number : CAT1037RJF7
Top Assembly Part Number : 800-26380-04
Top Assembly Revision Number : B0
Version : V06
CLII Code Number : COM110GARC
Hardware Board Revision Number : 0x01

Switch Ports Model SW Version SW Image
----- -----
* 1 26 WS-C3560-24PS 12.2(37)SEI C3560-ADVISERSERVICESK9
Cisco IOS Software, C3560 Software (C3560-ADVISERSERVICESK9-M), Version 12.2(37)SEI, RELEASE SOFTWARE (fc1)
Copyright (c) 1996-2007 by Cisco Systems, Inc.
Compiled Thu 05-Jul-07 22:22 by pt_team

Press RETURN to get started!

%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/2, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-3-UPDOWN: Interface FastEthernet0/3, changed state to down
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to down
%LINK-5-CHANGED: Interface FastEthernet0/3, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state to up
Press RETURN to get started!

Copy | Paste
```

```
Top
Multilayer Switch10
Physical Config CLI Attributes
IOS Command Line Interface

%LINKPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Switch>
Switch#en
Switch#conf t<
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#Name Computing-School
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#Name Business-School
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#Name Academic-Administration
Switch(config-vlan)#exit
Switch(config-vlan)#vlan 40
Switch(config-vlan)#Name Human-Resource
Switch(config-vlan)#exit
Switch(config-vlan)#vlan 50
Switch(config-vlan)#Name Marketing
Switch(config-vlan)#exit
Switch(config)#r2
Switch#
*SV3-5-CONFIG_I: Configured from console by console

Switch#show vlan brief

VLAN Name Status Ports
----- -----
1 default active Fa0/1, Fa0/2, Fa0/3, Fa0/4
Fa0/5, Fa0/6, Fa0/7, Fa0/8
Fa0/9, Fa0/10, Fa0/11, Fa0/12
Fa0/13, Fa0/14, Fa0/15, Fa0/16
Fa0/17, Fa0/18, Fa0/19, Fa0/20
Fa0/21, Fa0/22, Fa0/23, Fa0/24
Gig0/1, Gig0/2

10 Computing-School active
20 Business-School active
30 Academic-Administration active
40 Human-Resource active
50 Marketing active
1002 fddi-default active
1003 token-ring-default active
1004 fddiinet-default active
1005 trnet-default active
Switch#conf t<
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int fa0/1<
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config-if)#int fa0/2<

Copy | Paste
```

Multilayer Switch10

Physical Config CLI Attributes

IOS Command Line Interface

```
%LINK-5-CHANGED: Interface FastEthernet0/4, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/4, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/8, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/8, changed state to up
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINKPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up

Switch>
Switch>confi ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name Computing-School
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name Business-School
Switch(config-vlan)#exit
Switch(config)#vlan 30
Switch(config-vlan)#name Academic-Administration
Switch(config-vlan)#exit
Switch(config)#vlan 40
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#exit
Switch(config)#vlan 50
Switch(config-vlan)#name Marketing
Switch(config-vlan)#exit
Switch(config)#exit
Switch#^ZT3-3-CONFIG_1: Configured from console by console

Switch#show vlan brief
VLAN Name          Status     Ports
----+-----+-----+
1   default         active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2

10  Computing-School      active
20  Business-School      active
30  Academic-Administration      active
40  Human-Resource      active
50  Marketing            active
1002 fddi-default       active
1003 isab-default        active

```

Top

Multilayer Switch10

Physical Config CLI Attributes

IOS Command Line Interface

```
1005 ttnet-default           active
Switch#confi ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int fa0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#int fa0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#int fa0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 30
Switch(config-if)#exit
Switch(config)#int fa0/4
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 40
Switch(config-if)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#exit
Switch#^ZT3-3-CONFIG_1: Configured from console by console

Switch#show vlan brief
VLAN Name          Status     Ports
----+-----+-----+
1   default         active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                           Fa0/13, Fa0/14, Fa0/15, Fa0/16
                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                           Gig0/1, Gig0/2

10  Computing-School      active    Fa0/1
```

Top

Multilayer Switch10

Physical Config CLI Attributes

IOS Command Line Interface

```

Switch#config#int fa0/4
Switch(config)#switchport mode access
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (30), with Switch FastEthernet0/3 (1).

Switch(config-if)#switchport access vlan 30
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (20), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/1 (10), with Switch FastEthernet0/3 (1).

Switch(config-if)#switchport access vlan 40
Switch(config)#exit
Switch(config)#int fa0/5
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 50
Switch(config-if)#exit
Switch(config)#2
Switch#
$SIS-5-CONFIG_I: Configured from console by console

Switch#show vlan brief

VLAN Name          Status     Ports
----+-----+-----+
1   default        active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                Gig0/2

10  Computing-School  active    Fa0/1
20  Business-School  active    Fa0/2
30  Academic-Administration  active    Fa0/3
40  Human-Resource   active    Fa0/4
50  Marketing        active    Fa0/5
1002 fddi-default   active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default   active
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (30), with Switch FastEthernet0/3 (1).

Building configuration...
[OK]
Switch#
Switch#write
Building configuration...
[OK]
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (20), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/1 (10), with Switch FastEthernet0/3 (1).

```

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Multilayer Switch10

Physical Config CLI Attributes

IOS Command Line Interface

```

VLAN NAME          STATUS     PORTS
----+-----+-----+
1   default        active    Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                Fa0/14, Fa0/15, Fa0/16, Fa0/17
                                Fa0/18, Fa0/19, Fa0/20, Fa0/21
                                Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                Gig0/2

10  Computing-School  active    Fa0/1
20  Business-School  active    Fa0/2
30  Academic-Administration  active    Fa0/3
40  Human-Resource   active    Fa0/4
50  Marketing        active    Fa0/5
1002 fddi-default   active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default   active
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (30), with Switch FastEthernet0/3 (1).

Building configuration...
[OK]
Switch#
Switch#write
Building configuration...
[OK]
Switch#
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (20), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/1 (10), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (40), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (50), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (30), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/2 (20), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/1 (10), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/4 (40), with Switch FastEthernet0/3 (1).

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/5 (50), with Switch FastEthernet0/3 (1).

```

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**Access Switch VLAN Configuration – Computing School (Kandy Branch)**

- Created Sub-VLANs in access Switch of Kandy Branch in Computing School and assigned all the switchports connected to the device to the correct VLAN

Switch18

Physical Config CLI Attributes

IOS Command Line Interface

```
Switch>
Switch>en
Switch#conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#Name Com
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).

Switch(config-vlan)#
Switch(config-if-range)#switchport mode access
% Invalid input detected at '^' marker.
Switch(config)#int fa0/1-9
Switch(config)#int fa0/1-9
% Invalid input detected at '^' marker.

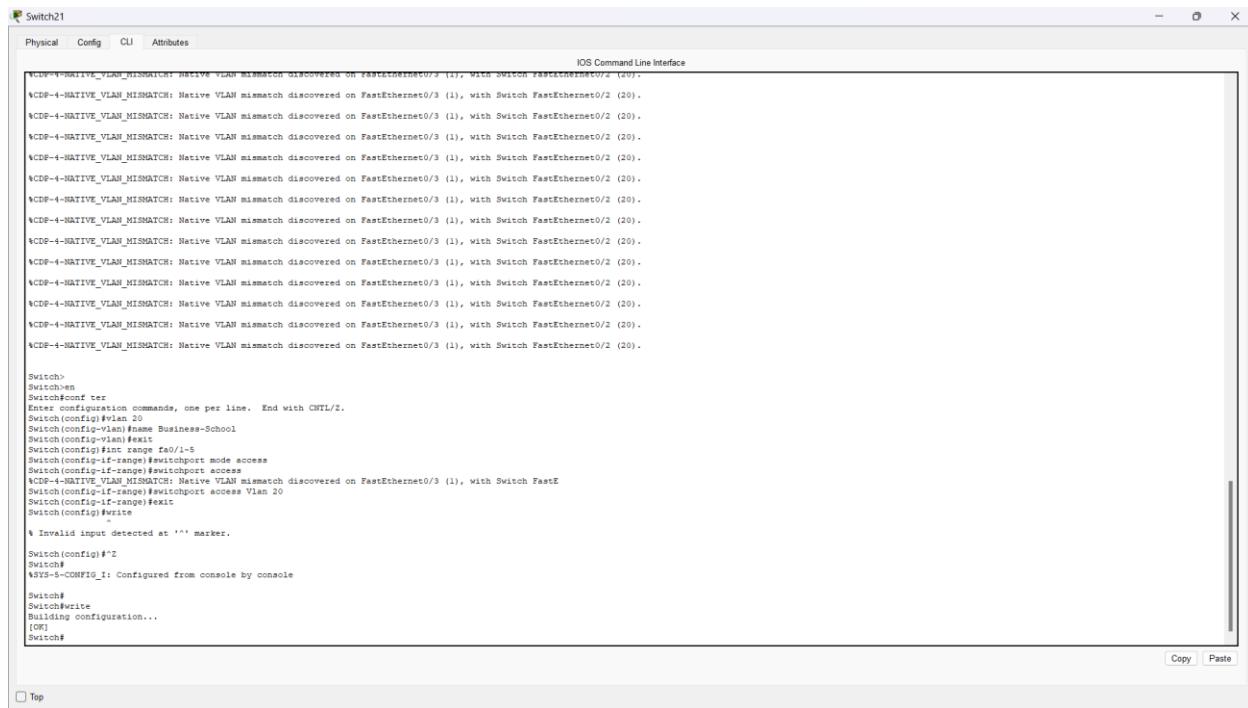
Switch(config)#int range fa0/1-5
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/1 (10).

Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access Vlan 10
Switch(config-if-range)#exit
Switch(config)#
Switch(config)#
Switch#
%TS-3-CONFIG_ID_I: Configured from console by console
Switch#
Switch#write
Building configuration...
[OK]
Switch#
```

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## Access Switch VLAN Configuration – Business School (Kandy Branch)

- Created Sub-VLANs in access Switch of Kandy Branch in Business School and assigned all the switchports connected to the device to the correct VLAN



```
Switch21
Physical Config CLI Attributes
IOS Command Line Interface

%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20).

Switch>
Switch>sh ver
Switch>conf ter
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name Business-School
Switch(config-vlan)#exit
Switch(config)#int range fa0/1-5
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/2 (20)
Switch(config-if-range)#exit
Switch(config)#write
Switch(config)#exit
Switch(config)#write

% Invalid input detected at `'' marker.

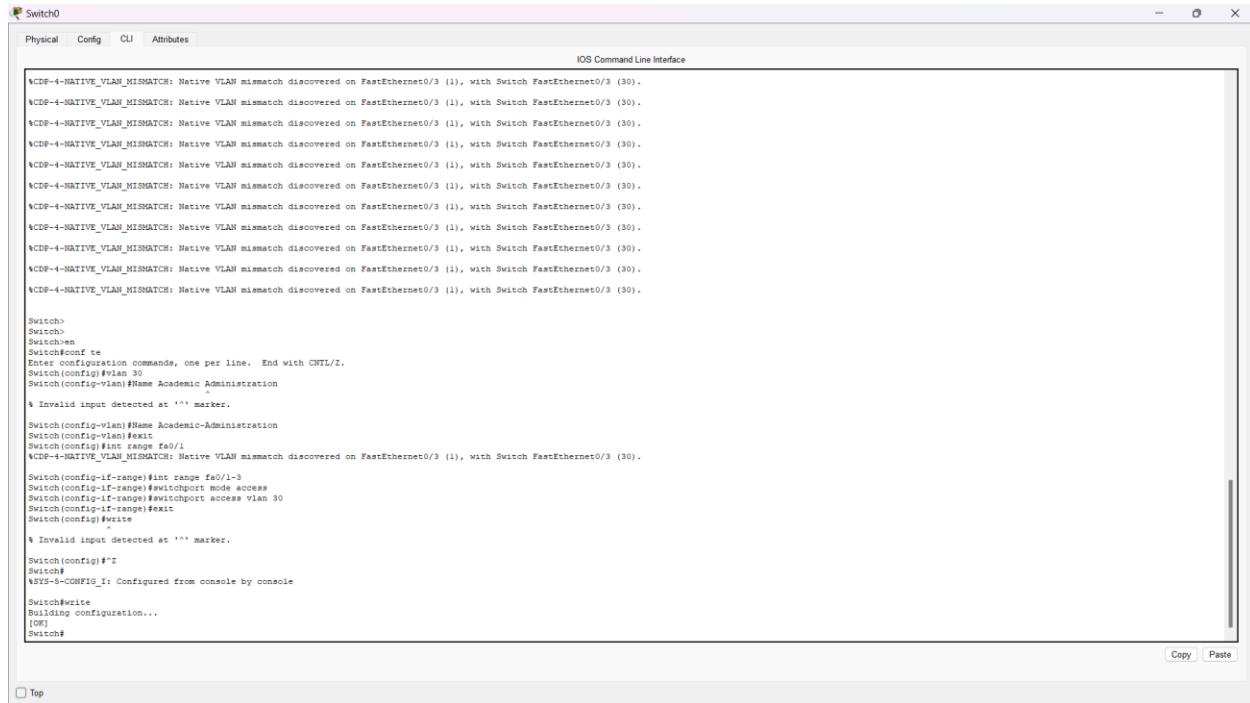
Switch(config)#^Z
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#
Switch#write
Building configuration...
[OK]
Switch#
```

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## Access Switch VLAN Configuration –Academic Administration (Kandy Branch)

- Created Sub-VLANs in access Switch of Kandy Branch in Academic Administration and assigned all the switchports connected to the device to the correct VLAN



The screenshot shows a Cisco IOS Command Line Interface (CLI) window titled "Switch0". The window has tabs for "Physical", "Config", "CLI", and "Attributes". The "Config" tab is selected. The command-line session shows the configuration of VLAN 30 in the "Academic Administration" interface. It includes creating the VLAN, assigning it to the interface, and configuring port access. There are several error messages related to native VLAN mismatch on FastEthernet0/3 ports.

```
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).

Switch>
Switch>
Switch>en
Switch#conf te
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 30
Switch(config-vlan)#Name Academic Administration
Switch(config-vlan)#Name Academic-Administration
^
% Invalid input detected at `'' marker.

Switch(config-vlan)#Name Academic-Administration
Switch(config-vlan)#exit
Switch(config)#int range fa0/0/
%CDE-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/3 (30).

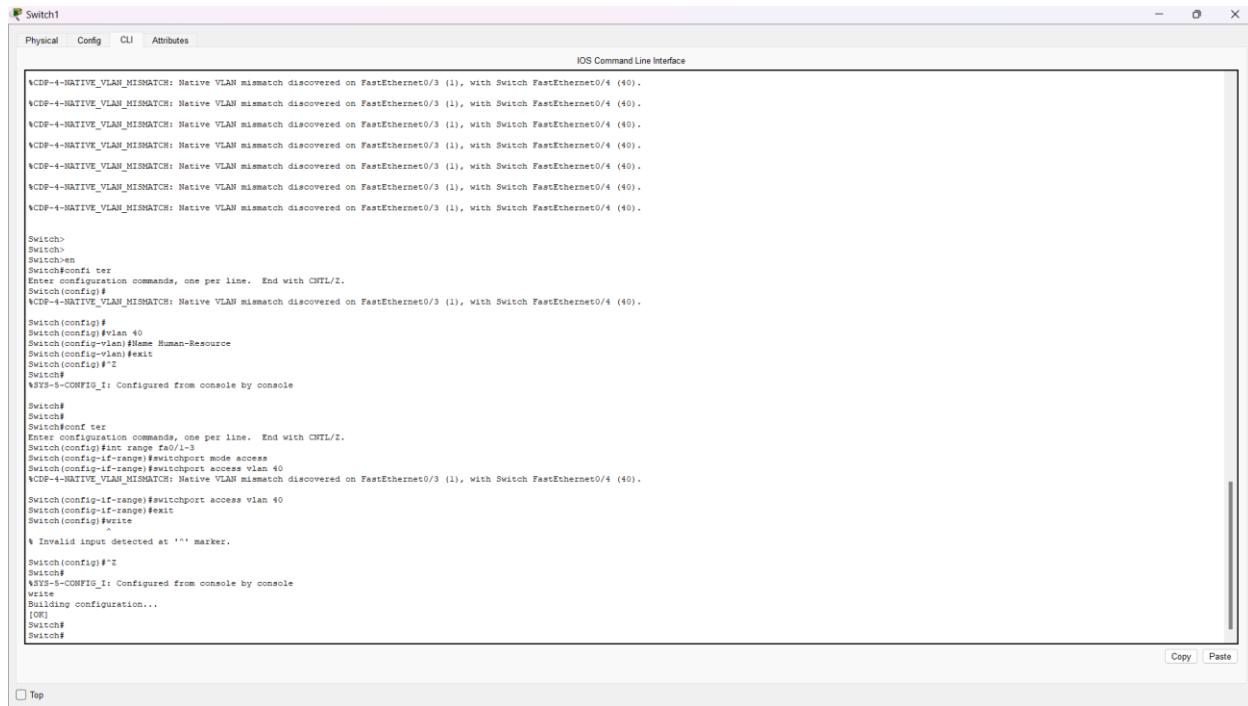
Switch(config-if-range)#int range fa0/1-3
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#exit
Switch(config)#write
Switch# 

% Invalid input detected at `'' marker.

Switch(config)#?Z
Switch#?
#S12-5-CONFIG_I: Configured from console by console
Switch#write
Building configuration...
[OK]
Switch#
```

## Access Switch VLAN Configuration –Human Resource (Kandy Branch)

- Created Sub-VLANs in access Switch of Kandy Branch in Human Resource and assigned all the switchports connected to the device to the correct VLAN



```
Switch# 
Switch# conf t
Switch(config)# int range fa0/1-3
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 40
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/4 (40).

Switch(config)# 
Switch(config)#vlan 40
Switch(config-vlan)#name Human-Resource
Switch(config-vlan)#exit
Switch(config)#?
Switch#
WS3-5-CONFIG_I: Configured from console by console

Switch#
Switch# conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# int range fa0/1-3
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 40
%CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/4 (40).

Switch(config-if-range)# switchport access vlan 40
Switch(config-if-range)#exit
Switch(config)#?
Switch#
% Invalid input detected at `'' marker.

Switch(config)#?
Switch#
WS3-5-CONFIG_I: Configured from console by console
write
Building configuration...
[OK]
Switch#
Switch#
```

## Access Switch VLAN Configuration –Marketing Department (Kandy Branch)

- Created Sub-VLANs in access Switch of Kandy Branch in Marketing Department and assigned all the switchports connected to the device to the correct VLAN

```
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).

Switch#en
Switch#co t
% Ambiguous command: "co t"
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 50
Switch(config-vlan)#Name Marketing
Switch(config-vlan)#exit
Switch(config)#int fa
% CDP-4-NATIVE_VLAN_MISMATCH: Native VLAN mismatch discovered on FastEthernet0/3 (1), with Switch FastEthernet0/5 (50).

% Incomplete command.
Switch(config)#int fa0/1-3
Switch(config)#int fa0/1-3
% Invalid input detected at '' marker.

Switch(config)#int range fa0/1-3
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 50
Switch(config-if-range)#exit
Switch(config)##2
Switch#
#WS3-5-CONFIG_I: Configured from console by console
Switch#write
Building configuration...
[OK]
Switch#
```

## Kandy Branch Network: DHCP Configuration for Automatic IP Assignment

Router#show ip dhcp pool

```
Pool Computing :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 126  
Leased addresses : 0  
Excluded addresses : 0  
Pending event : none  
1 subnet is currently in the pool  
Current index IP address range Leased/Excluded/Total  
192.192.194.1 192.192.194.1 - 192.192.194.126 0 / 5 / 126  
Pool Business :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 62  
Leased addresses : 0  
Excluded addresses : 0  
Pending event : none  
1 subnet is currently in the pool  
Current index IP address range Leased/Excluded/Total  
192.192.194.129 192.192.194.129 - 192.192.194.190 0 / 5 / 62  
Pool Academic-Administration :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 14  
Leased addresses : 0  
Excluded addresses : 5  
Pending event : none  
1 subnet is currently in the pool  
Current index IP address range Leased/Excluded/Total  
192.192.194.193 192.192.194.193 - 192.192.194.206 0 / 5 / 14  
Pool Marketing :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 6  
Leased addresses : 0  
Excluded addresses : 5  
Pending event : none  
1 subnet is currently in the pool  
Current index IP address range Leased/Excluded/Total  
192.192.194.209 192.192.194.209 - 192.192.194.214 0 / 5 / 6  
Pool Human-Resource :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 6  
Leased addresses : 0
```

KALAICELVAN THIEVESHKAR (cb013248@students.apit.lk) is signed in.

Router#

```
Router# Router# Router# Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#ip dh  
Router(config)#ip dhcp p  
Router(config)#ip dhcp pool Computing  
Router(dhcp-config)#network 192.192.194.0 255.255.255.128  
Router(dhcp-config)#de  
Router(dhcp-config)#default-router 192.192.194.1  
Router(config)#ip dhcp excluded-address 192.192.194.1  
Router(config)#ip dhcp pool Business  
Router(dhcp-config)#network 192.192.194.128 255.255.255.192  
Router(config)#ip dhcp excluded-address 192.192.194.129  
Router(dhcp-config)#ip dhcp pool Academic-Administration  
Router(config)#network 192.192.194.193 255.255.255.240  
Router(config)#ip dhcp excluded-address 192.192.194.193  
Router(dhcp-config)#ip dhcp excluded-address 192.192.194.193  
Router(config)#ip dhcp pool Marketing  
Router(config)#network 192.192.194.208 255.255.255.248  
Router(config)#ip dhcp excluded-address 192.192.194.209  
Router(dhcp-config)#ip dhcp pool Academic-Administration  
Router(config)#network 192.192.194.192 255.255.255.240  
Router(config)#ip dhcp excluded-address 192.192.194.193  
Router(dhcp-config)#ip dhcp excluded-address 192.192.194.193  
Router(config)#ip dhcp pool Human-Resource  
Router(config)#network 192.192.194.216 255.255.255.248  
Router(config)#ip dhcp excluded-address 192.192.194.217  
Router(dhcp-config)#ip dhcp excluded-address 192.192.194.217  
Router(config)#  
Router#  
Router#CONFIG_I: Configured from console by console  
Router#show ip dhcp pool
```

Pool Computing :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 126  
Leased addresses : 0  
Excluded addresses : 5  
Pending event : none  
1 subnet is currently in the pool  
Current index IP address range Leased/Excluded/Total  
192.192.194.1 192.192.194.1 - 192.192.194.126 0 / 5 / 126  
Pool Business :  
Utilization mark (high/low) : 100 / 0  
Subnet size (first/next) : 0 / 0  
Total addresses : 62  
Leased addresses : 0  
Excluded addresses : 0

KALAICELVAN THIEVESHKAR (cb013248@students.apit.lk) is signed in.

Router#

Router#

Physical Config CLI Attributes

IOS Command Line Interface

```
[root@Router]#
Utilization mask (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 62
Leased addresses : 0
Excluded addresses : 5
Pending event : none

1 subset is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.194.129 192.192.194.129 - 192.192.194.190 0 / 5 / 62

Pool Academic-Administration :
Utilization mask (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 14
Leased addresses : 0
Excluded addresses : 5
Pending event : none

1 subset is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.194.193 192.192.194.193 - 192.192.194.206 0 / 5 / 14

Pool Marketing :
Utilization mask (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 6
Leased addresses : 0
Excluded addresses : 5
Pending event : none

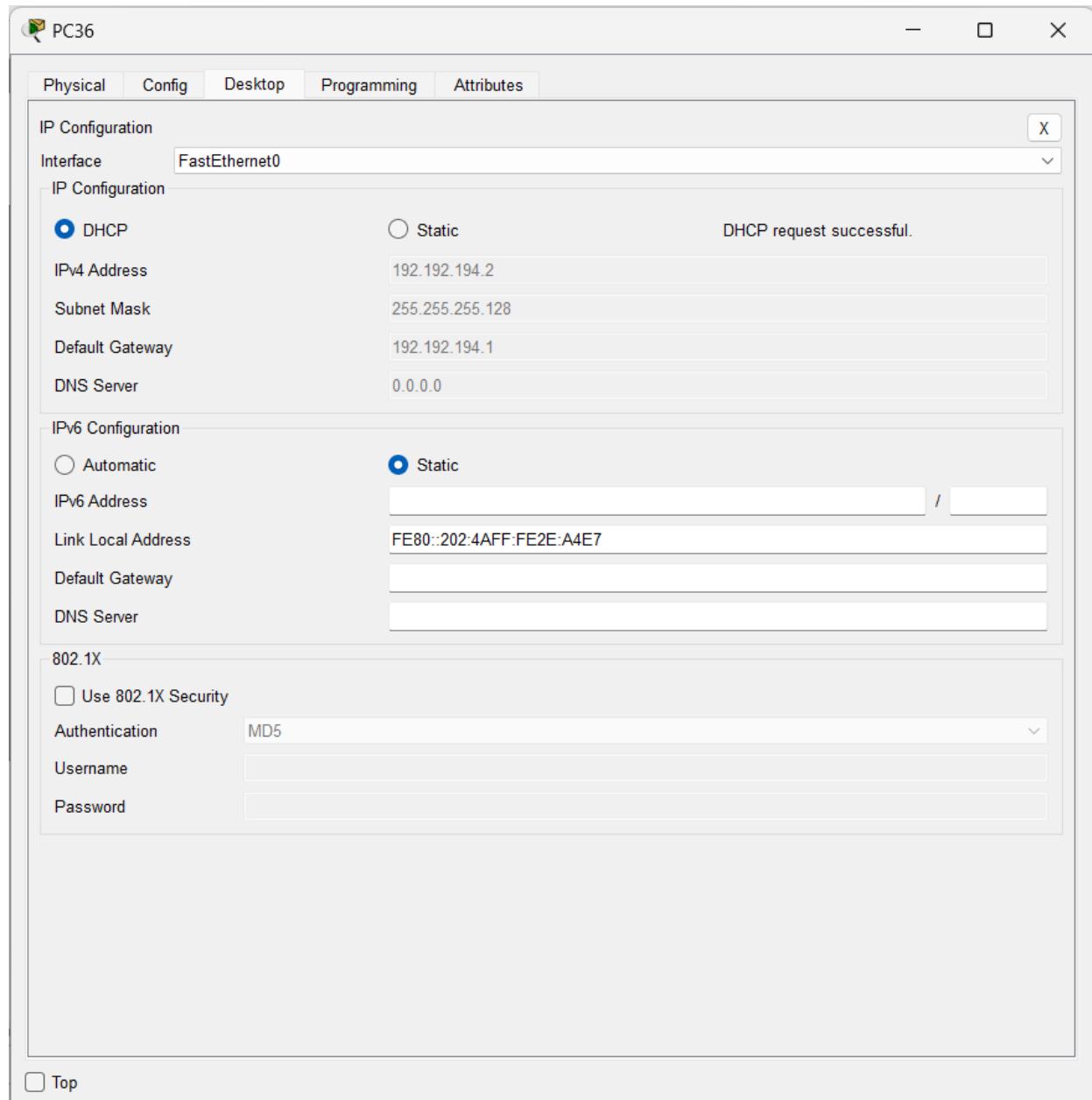
1 subset is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.194.209 192.192.194.209 - 192.192.194.214 0 / 5 / 6

Pool Human-Resource :
Utilization mask (high/low) : 100 / 0
Subnet size (first/next) : 0 / 0
Total addresses : 5
Leased addresses : 0
Excluded addresses : 5
Pending event : none

1 subset is currently in the pool
Current index IP address range Leased/Excluded/Total
192.192.194.217 192.192.194.217 - 192.192.194.222 0 / 5 / 6

Router#
Router#
Router#
Router#
Router#write
Building configuration...
[OK]
Router#
```

- DHCP Success: Automatic IP Assignment



## Kandy Branch Router Configuration: RIP for Network Reachability

The screenshot shows a Windows-style application window titled "Router". The window has tabs at the top: "Physical", "Config", "CLI", and "Attributes". The "Config" tab is selected. The main area is labeled "IOS Command Line Interface". The terminal window displays the following configuration session:

```
Router#show version
Cisco CISCO1941/K9 (revision 1.0) with 4915200/32768 bytes of memory.
Processor board ID FTX152400KS
2 Gigabit Ethernet interfaces
1 Low-speed serial (async) network interface(s)
DRAM configuration is 4M bits wide with parity disabled.
256K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

Press RETURN to get started!

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.5, changed state to up
%LINK-5-CHANGED: Interface Serial0/0/0, changed state to up
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Router>
Router>en
Router>conf t
Router#Conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.192.194.0
Router(config-router)#network 192.192.194.192
Router(config-router)#network 192.192.194.194
Router(config-router)#network 192.192.194.128
Router(config-router)#network 192.192.194.208
Router(config-router)#network 192.192.204.0
Router(config-router)#network 192.192.204.0
Router(config-router)no auto-summary
Router(config-router)#exit
Router(config)#Z
Router#
$T3-5-CONFIG_I: Configured from console by console
Router#
Router#
```

At the bottom right of the terminal window, there are "Copy" and "Paste" buttons. At the bottom left, there is a "Top" link.

RIP routing on Router successfully advertised networks. Verified on HQ Campus and Research & Development routers.

- In HQ Branch Router.

```

Router#show ip route
Codes: L - Local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       E1 - Ethernet, X - PPPoE external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       1 - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
Gateway of last resort is not set

192.192.192.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.192.192.0/24 is directly connected, GigabitEthernet0/0.1
L 192.192.192.0/24 is variably subnetted, 20 subnets, 5 masks
C 192.192.193.0/25 is directly connected, GigabitEthernet0/0.2
C 192.192.193.2/32 is directly connected, GigabitEthernet0/0.3
C 192.192.193.130/32 is directly connected, GigabitEthernet0/0.3
C 192.192.193.160/28 is directly connected, GigabitEthernet0/0.4
C 192.192.193.162/29 is directly connected, GigabitEthernet0/0.4
C 192.192.193.164/29 is directly connected, GigabitEthernet0/0.4
C 192.192.193.178/32 is directly connected, GigabitEthernet0/0.5
C 192.192.193.184/29 is directly connected, GigabitEthernet0/0.6
L 192.192.193.186/29 is directly connected, GigabitEthernet0/0.6
192.192.194.0/24 is variably subnetted, 4 subnets, 3 masks
R 192.192.194.0/25 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.128/26 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.192/27 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
R 192.192.194.216/29 [120/1] via 192.192.202.2, 00:00:13, Serial10/0/1
192.192.196.0/24 is variably subnetted, 4 subnets, 3 masks
R 192.192.196.0/25 [120/1] via 192.192.198.2, 00:00:13, Serial10/0/0
R 192.192.196.128/26 [120/1] via 192.192.198.2, 00:00:13, Serial10/0/0
R 192.192.196.49/29 [120/1] via 192.192.198.2, 00:00:12, Serial10/0/0
R 192.192.196.56/29 [120/1] via 192.192.198.2, 00:00:12, Serial10/0/0
R 192.192.196.129/30 [120/1] via 192.192.198.2, 00:00:12, Serial10/0/0
192.192.196.1/32 is directly connected, Serial10/0/0
192.192.196.1/32 is directly connected, Serial10/0/0
192.192.200.0/30 is subnetted, 1 subnets
R 192.192.200.0/30 [120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.1
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.2
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.3
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.4
192.192.202.0/24 is variably subnetted, 4 subnets, 3 masks
C 192.192.202.0/25 [120/1] via 192.192.198.1, 00:00:14, Serial10/0/1
L 192.192.202.1/32 is directly connected, Serial10/0/1
192.192.204.0/30 is subnetted, 1 subnets
R 192.192.204.0/30 [120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.1
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.2
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.3
[120/1] via 192.192.198.3, 00:00:14, GigabitEthernet0/0.4
Router#

```

- In Research & Development Router.

Router#show ip route

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

Gateway of last resort is not set

```

R 192.192.192.0/24 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
R 192.192.193.0/24 is variably subnetted, 5 subnets, 4 masks
R   192.192.193.0/25 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
     [120/1] via 192.192.198.1, 00:00:14, Serial0/0/1
R   192.192.193.128/27 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
     [120/1] via 192.192.200.1, 00:00:14, Serial0/0/1
R   192.192.193.160/28 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
     [120/1] via 192.192.200.1, 00:00:14, Serial0/0/1
R   192.192.193.176/29 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
     [120/1] via 192.192.200.1, 00:00:14, Serial0/0/1
R   192.192.193.184/29 [120/1] via 192.192.198.1, 00:00:12, Serial0/0/0
     [120/1] via 192.192.200.1, 00:00:14, Serial0/0/1
R 192.192.194.0/24 is variably subnetted, 5 subnets, 4 masks
R   192.192.194.0/25 [120/2] via 192.192.200.1, 00:00:14, Serial0/0/1
     [120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
R   192.192.194.128/27 [120/2] via 192.192.200.1, 00:00:14, Serial0/0/1
     [120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
R   192.192.194.192/28 [120/2] via 192.192.198.1, 00:00:14, Serial0/0/1
     [120/2] via 192.192.200.1, 00:00:12, Serial0/0/0
R   192.192.194.208/29 [120/2] via 192.192.198.1, 00:00:14, Serial0/0/1
     [120/2] via 192.192.200.1, 00:00:12, Serial0/0/0
R   192.192.194.216/29 [120/2] via 192.192.200.1, 00:00:14, Serial0/0/1
     [120/2] via 192.192.198.1, 00:00:12, Serial0/0/0
C 192.192.196.0/24 is directly connected, GigabitEthernet0/0.1
L 192.192.196.1/32 is directly connected, GigabitEthernet0/0.1
C 192.192.196.32/28 is directly connected, GigabitEthernet0/0.2
L 192.192.196.40/29 is directly connected, GigabitEthernet0/0.2
C 192.192.196.48/29 is directly connected, GigabitEthernet0/0.3
L 192.192.196.49/31 is directly connected, GigabitEthernet0/0.3
C 192.192.196.56/23 is directly connected, GigabitEthernet0/0.4
L 192.192.196.57/31 is directly connected, GigabitEthernet0/0.4
192.192.199.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.192.199.0/30 is directly connected, Serial0/0/0
L 192.192.199.2/32 is directly connected, Serial0/0/0
192.192.199.3/32 is directly connected, Serial0/0/0
C 192.192.200.0/30 is directly connected, Serial0/0/1
L 192.192.200.2/32 is directly connected, Serial0/0/1
192.192.199.0/30 is subnetted, 1 subnets
  192.192.199.1, 00:00:12, Serial0/0/0
192.192.204.0/30 is subnetted, 1 subnets
  192.192.204.1 via 192.192.200.1, 00:00:14, Serial0/0/1

```

Copy | Paste

Top

# **Packet Tracer: Verifying Inter-Branch Connectivity and Routing**

- Connectivity Confirmed: Main Branch (HQ) Pings Research & Development Branch

The screenshot shows a window titled "PC0" with tabs for Physical, Config, Desktop, Programming, and Attributes. The Programming tab is selected, displaying a command prompt window. The command entered is "ping 192.192.196.58". The output shows two sets of ping results. The first set shows a request timed out and two replies from the target IP address with TTL=126. The second set shows four successful replies from the target IP address with TTL=126. Both sets include ping statistics: minimum = 1ms, maximum = 2ms, and average = 1ms.

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.192.196.58

Pinging 192.192.196.58 with 32 bytes of data:

Request timed out.
Reply from 192.192.196.58: bytes=32 time=1ms TTL=126
Request timed out.
Reply from 192.192.196.58: bytes=32 time=2ms TTL=126

Ping statistics for 192.192.196.58:
    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>ping 192.192.196.58

Pinging 192.192.196.58 with 32 bytes of data:

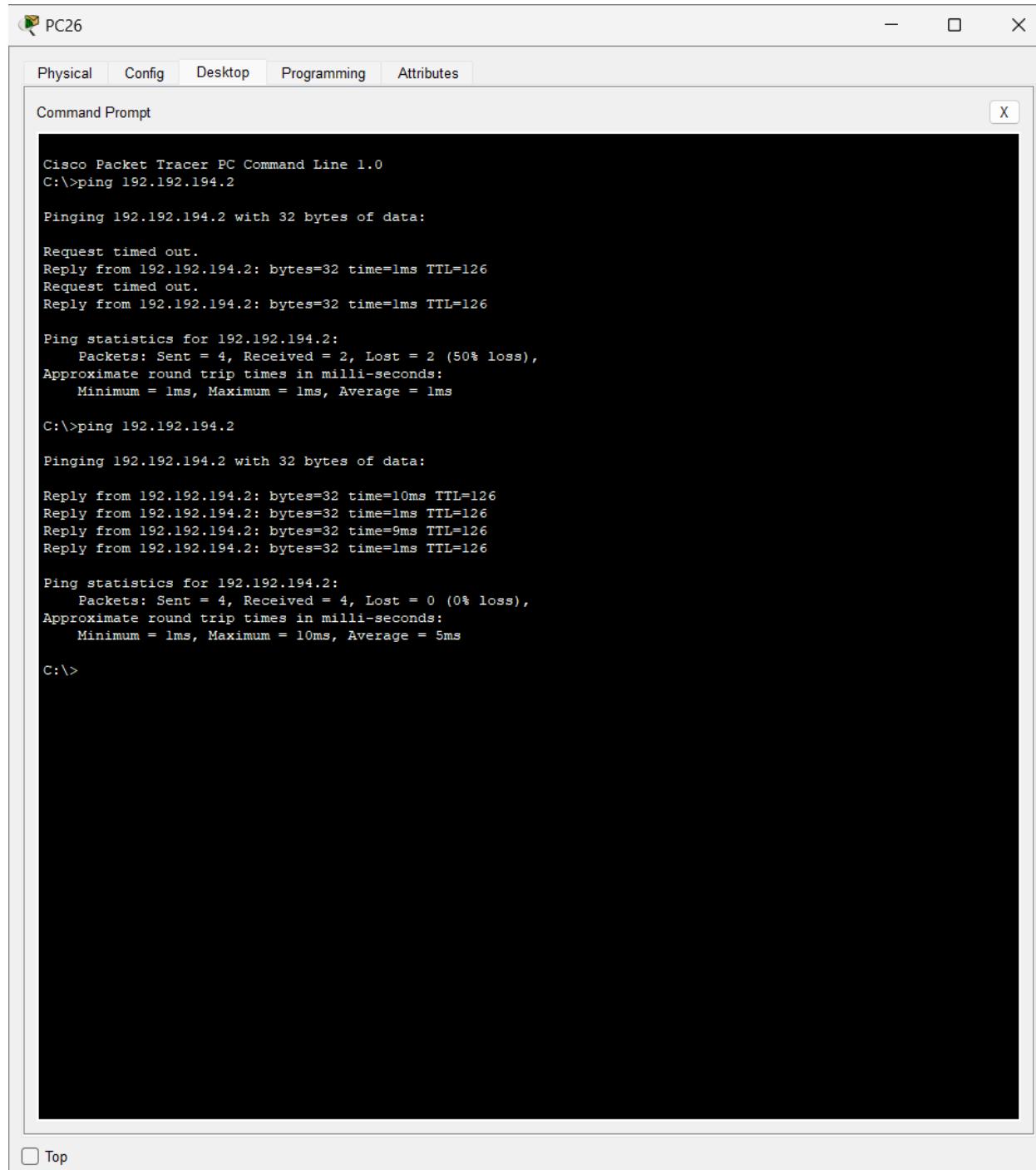
Reply from 192.192.196.58: bytes=32 time=1ms TTL=126

Ping statistics for 192.192.196.58:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>
```

Top

- Connectivity Confirmed: Main Branch (HQ) Pings Kandy Branch



The screenshot shows a window titled "PC26" containing a command prompt interface. The title bar includes standard window controls (minimize, maximize, close) and tabs for "Physical", "Config", "Desktop", "Programming", and "Attributes". The main area is labeled "Command Prompt" and contains the following text output from the Cisco Packet Tracer PC Command Line 1.0:

```
Cisco Packet Tracer PC Command Line 1.0
C:>ping 192.192.194.2

Pinging 192.192.194.2 with 32 bytes of data:

Request timed out.
Reply from 192.192.194.2: bytes=32 time=1ms TTL=126
Request timed out.
Reply from 192.192.194.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.192.194.2:
    Packets: Sent = 4, Received = 2, Lost = 2 (50% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:>ping 192.192.194.2

Pinging 192.192.194.2 with 32 bytes of data:

Reply from 192.192.194.2: bytes=32 time=10ms TTL=126
Reply from 192.192.194.2: bytes=32 time=1ms TTL=126
Reply from 192.192.194.2: bytes=32 time=9ms TTL=126
Reply from 192.192.194.2: bytes=32 time=1ms TTL=126

Ping statistics for 192.192.194.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 5ms

C:>
```

At the bottom left of the window, there is a small checkbox labeled "Top".

- Connectivity Confirmed: Research & Development Pings Kandy Branch

The screenshot shows a window titled "PC28" with a tab bar at the top containing "Physical", "Config", "Desktop", "Programming", and "Attributes". The main area is labeled "Command Prompt" and contains the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.192.194.2

Pinging 192.192.194.2 with 32 bytes of data:

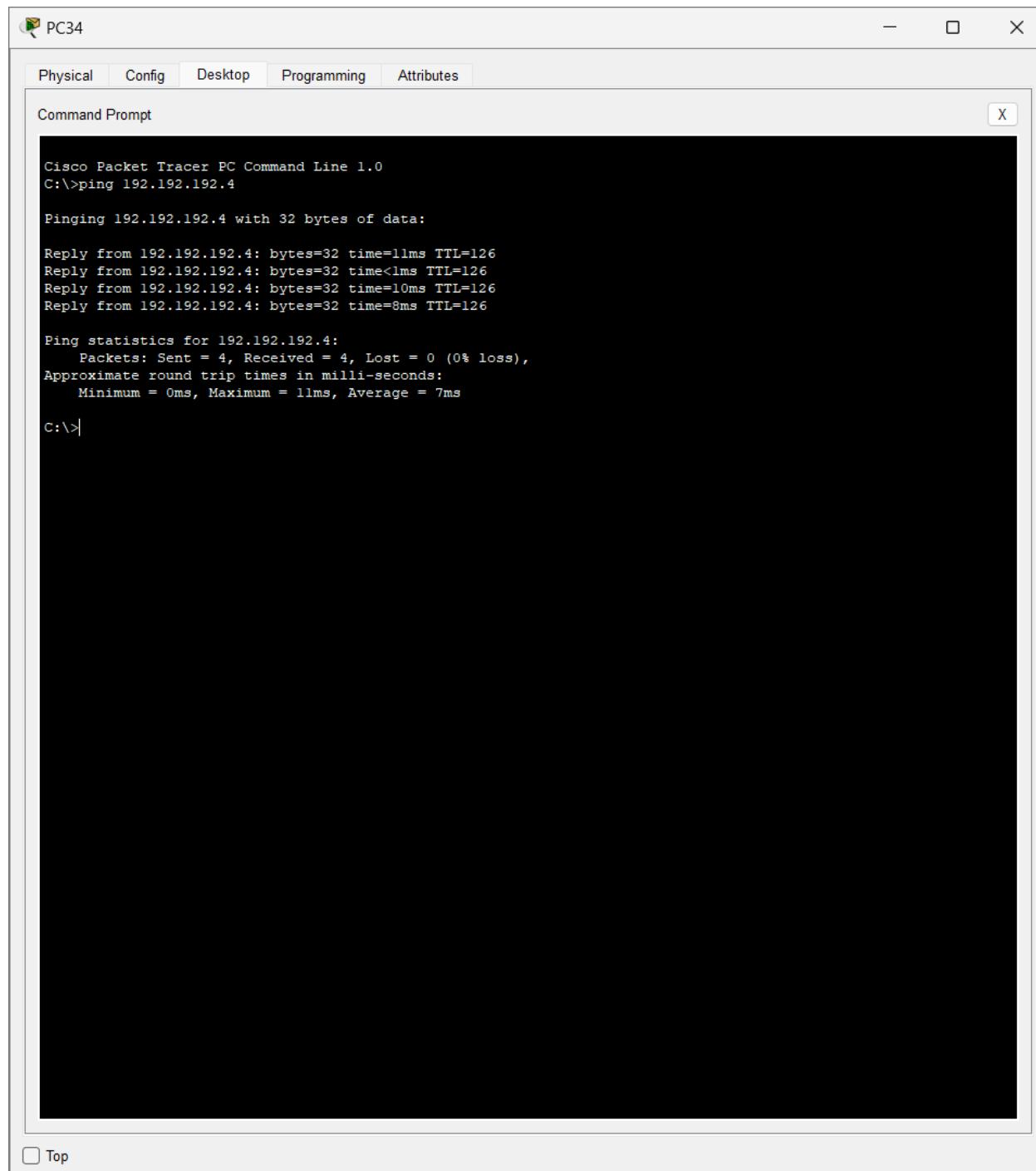
Reply from 192.192.194.2: bytes=32 time=40ms TTL=125
Reply from 192.192.194.2: bytes=32 time=3ms TTL=125
Reply from 192.192.194.2: bytes=32 time=16ms TTL=125
Reply from 192.192.194.2: bytes=32 time=4ms TTL=125

Ping statistics for 192.192.194.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 3ms, Maximum = 40ms, Average = 15ms

C:\>
```

At the bottom left of the window, there is a "Top" button.

- Connectivity Confirmed: Research & Development Pings Main Branch (HQ)



The screenshot shows a window titled "PC34" containing a "Command Prompt". The window has tabs at the top: Physical, Config, Desktop, Programming, and Attributes. The Command Prompt tab is active, displaying the following text:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.192.192.4

Pinging 192.192.192.4 with 32 bytes of data:

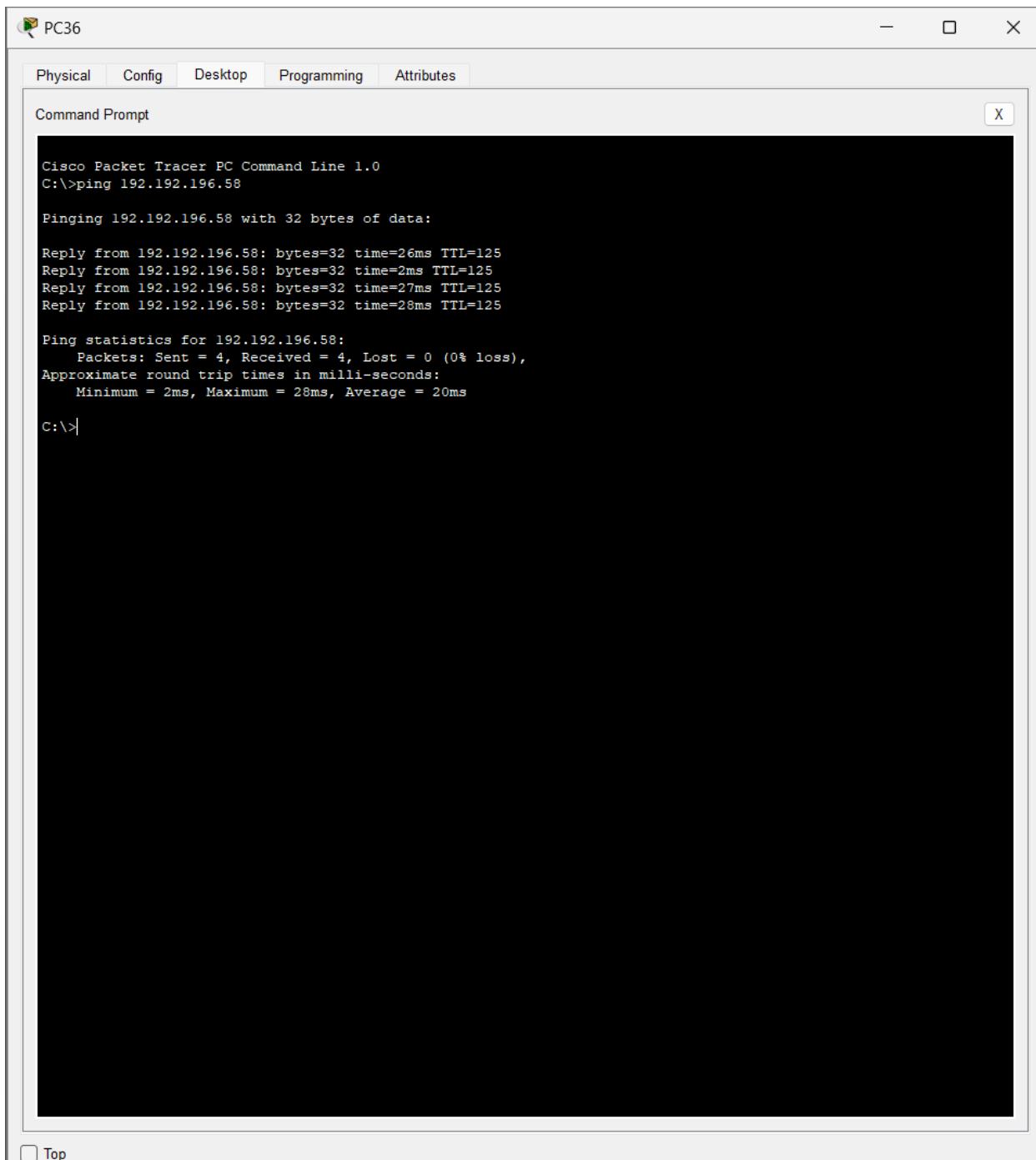
Reply from 192.192.192.4: bytes=32 time=11ms TTL=126
Reply from 192.192.192.4: bytes=32 time<1ms TTL=126
Reply from 192.192.192.4: bytes=32 time=10ms TTL=126
Reply from 192.192.192.4: bytes=32 time=8ms TTL=126

Ping statistics for 192.192.192.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 11ms, Average = 7ms

C:\>|
```

Top

- Connectivity Confirmed: Kandy Branch Pings Research & Development Branch



The screenshot shows a window titled "PC36" containing a "Command Prompt". The window has tabs at the top: Physical, Config, Desktop, Programming, and Attributes. The Command Prompt tab is active. The text in the window is as follows:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.192.196.58

Pinging 192.192.196.58 with 32 bytes of data:

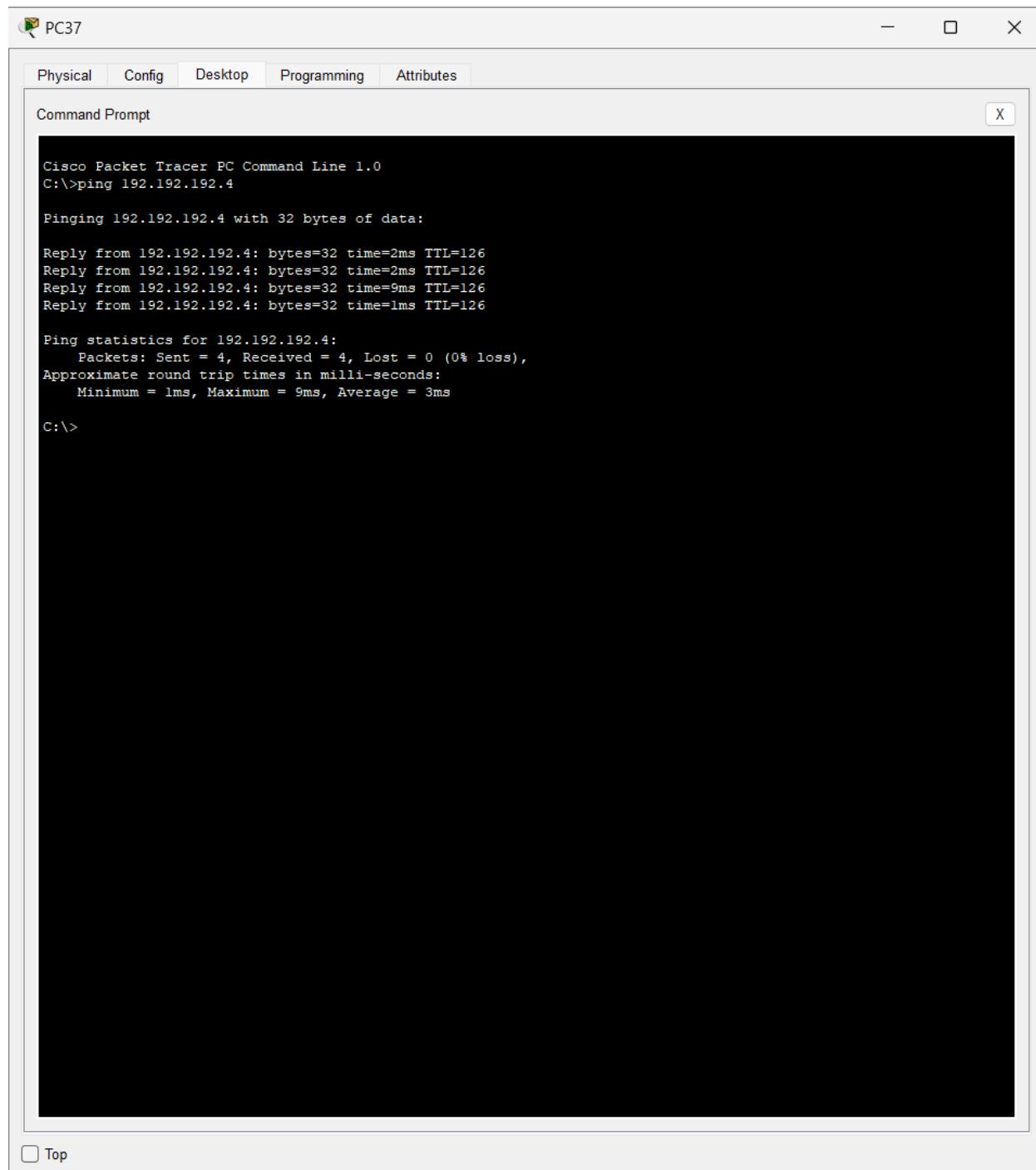
Reply from 192.192.196.58: bytes=32 time=26ms TTL=125
Reply from 192.192.196.58: bytes=32 time=2ms TTL=125
Reply from 192.192.196.58: bytes=32 time=27ms TTL=125
Reply from 192.192.196.58: bytes=32 time=28ms TTL=125

Ping statistics for 192.192.196.58:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 28ms, Average = 20ms

C:\>|
```

Top

- Connectivity Confirmed: Kandy Branch Pings Main Branch (HQ)



The screenshot shows a window titled "PC37" containing a Cisco Packet Tracer Command Prompt interface. The window has tabs for Physical, Config, Desktop, Programming, and Attributes, with "Physical" selected. The main area is a terminal window titled "Command Prompt" with an "X" button in the top right corner. The terminal displays the following output:

```
Cisco Packet Tracer PC Command Line 1.0
C:>ping 192.192.192.4

Pinging 192.192.192.4 with 32 bytes of data:

Reply from 192.192.192.4: bytes=32 time=2ms TTL=126
Reply from 192.192.192.4: bytes=32 time=2ms TTL=126
Reply from 192.192.192.4: bytes=32 time=9ms TTL=126
Reply from 192.192.192.4: bytes=32 time=1ms TTL=126

Ping statistics for 192.192.192.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 9ms, Average = 3ms

C:>
```

At the bottom left of the terminal window, there is a "Top" button.