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University of
Staffordshire

ASSIGNMENT

COMP40002 : Networking Concepts and Cyber Security - 1

Group Assignment - 1

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GROUP MEMBERS :

CB016370 Thunkorala Adipathige Sudheera Sandanuwan Perera (Group Leader)

CB016123 Gangatharan Pillai Kanish Ashwinth

CB016187 Lelwala Guruge Savinu Bimansith Guruge

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Introduction

The report takes focus on the following situation : The organization of APIIT Sri Lanka is expanding its services and needs to setup a new network over three new locations : the Main Campus , Research and Development Center and the Kandy Branch. Each area has its own specific needs , some prioritizing speed while others prioritize security . The ideas and solutions presented were developed with the following in mind : Security , Cost-Effective and efficient for all branches.

At the Main Campus, the internal network relies on a core switch as its backbone for communication across different departments. Each department has access switches assigned to manage traffic for end users, all structured in a Star Topology. This setup enables network engineers to quickly isolate and troubleshoot any network issues that may arise. Furthermore, the Main Campus is equipped with an extra router for redundancy, ensuring that this central hub of our network maintains its critical connectivity.

Although the R&D Center and Kandy Campus networks are structurally identical to the Main Campus, their basic infrastructure is powered by less expensive switches. The sophisticated setups and expensive equipment needed to manage larger networks are not necessary for these smaller networks. This method makes network troubleshooting easier and more effective while lowering operating costs.

Layer 2 technology

To ensure the effective management and organization of network traffic of APIIT Sri Lanka , **Virtual Local Area Network (VLANs)** are implemented across all locations to divide departments and improve overall management. **Inter-Vlan Routing** : Since different departments need to interact , **Inter VLAN routing** is configured through the router at the Main Campus however it is possible to use the Core Switch also. Thus, VLANs increase network performance by shrinking the broadcast domains and in other ways that improve security. R&D data and normal user traffic are kept separate. In conclusion, VLANs facilitate more efficient and secure network organization.

Port security is one of the most critical components of network security. It helps to block unauthorized devices from accessing the network through the use of switch ports. It limits the number of **MAC addresses** that can be identified on a given port. The port can be configured to either shut down or limit access to the device upon the connection of an unauthorized device. This ensures that unauthorized or untrusted devices cannot attach and share information within the network. In addition to this, port security provides a means for a network manager in dealing with a rogue device that may introduce threats. Through port security, organizations will be able to secure their networks and maintain safety in communication environments.

Because it regulates the process of frame forwarding within the devices on a local network-such as switches-**Spanning Tree Protocol** works at the Data Link Layer, just like Switches do: **Layer 2**. Its main goal is to avoid network loops, which can lead to severe problems, such as congestion or broadcast storms. By creating a **loop-free topological** structure for a network, the **STP** very effectively determines the most efficient path that data frames must travel between switches. It utilizes the physical connections of the switches and MAC addresses, which are unique hardware identifiers of devices. This protocol, in order to keep the network stable in case of any link failure, rapidly recalculates the paths and makes sure that only one path is ever active.

Layer 3 technology

RIP stands for **routing information protocol**, which is a protocol that shares the routing information between routers dynamically in a network to find the best path for data transmission. The routers regularly exchange routing information with each other; this usually happens every 30 seconds to keep their routing tables updated. This regular sharing makes RIP simple to use but delays the

adjustment in case of changes within the network. RIP used to stop loops in routing. It has the potential of causing problems in circuits and rounds that might keep data moving round in circles around the network.

Network Address Translation enables several devices in the same private network to use one single public IP address. This economizes in using the available limited IP addresses. This kind of technique ensures that there are sufficient IP addresses while enabling appropriate devices to gain access and use the internet effectively. NAT helps in managing the scarcity of IPv4 addresses by translating multiple private IP addresses to one public IP. This approach saves not just the IP addresses but makes network management a lot easier; hence, it is a practical solution for organizations like APIIT.

IP Subnetting is the method of splitting a larger network into smaller , more manageable subnets. This helps make the network more organized , secure , and efficient by reducing the size of broadcast domains and using IP addresses more efficiently. Subnetting is used in both IPv4 and IPv6 networks to help manage and organize the network better.

Selected Hardware for Proposed Network

Router

Cisco 1841 ISR

This model is designed to offer various services for small to medium-sized business networks. Although it is an older model, it remains popular in settings where budget-conscious organizations require dependable routing, security, and network services.

Switch

2960 Access switch

Cisco's entry-level enterprise switches, designed primarily for small to medium-sized businesses or branch office network.

Hardware Comparison

This Cisco Catalyst 9000 Series will support an enterprise that needs high performance and growth. SD-Access and automation, besides possessing excellent security with all its capabilities, will make it suitable for a high-demand area-for example, the Main Campus. Note that it is overpriced and may not be justifiable for the rest, say R&D Center or Kandy Branch. It is also more configuration and administrative challenging, which may be overkill for those networks that do not require such advanced features.

Cisco Catalyst 2960 Series switches are designed for basic Layer 2 switching. It is generally utilized in small-sized networks or as an access switch for bigger networks. It provides an economic solution with **(Power Over Ethernet) POE**, which is ideal for devices like IP phones and access points. It is designed to be easy to manage, providing reliable performance for smaller networks that do not require complex configurations or high-end features. Thus, it is the perfect solution for settings where simplicity and cost are actually major concerns.

Cisco ISR 4000 Series routers would therefore be great for branch offices, putting all routing, switching, and security into one box, making management easier. It is the ultimate all-in-one solution for any business in need of high performance and value-added services like **SD-WAN, VPN**, and voice applications. It ensures smooth, resilient operations from very edge to edge, thus being a perfect fit for growing businesses. However, while it's a mighty tool, the **Cisco ISR 4000 Series** is more expensive than smaller routers, and for very small offices that do not require such broad capabilities, it would be overkill. In its place, medium to large businesses have a versatile, high-performance solution that meets multiple needs in one box.

The **Cisco Catalyst 2960-X Series** provides a cost-effective solution and also highly reliable for a medium-sized network. It would serve companies well, in need of this level of performance without having to pay full-scale enterprise prices. The model provides PoE for powering other devices such as IP phones and cameras that best fit the office setting.

The Cisco 200 Series: Budget-friendly, Easy to Use for Small Offices.

It provides basic features such as basic VLAN support and security, which, in essence, are quite reliable for networks that do not need anything too complex. Designed to be energy-efficient, it's built to last and would serve well in most small-scale operations where simplicity is key. However, it

doesn't offer advanced features like Layer 3 routing, making it probably not the best fit for larger or evolving networks. This will also mean that it is not very scalable and might not grow well with your future needs.

WAN Technology

Lease lines offer a dedicated, high-speed communications way and an assured, uninterrupted connection. Bandwidth transaction is entirely reserved for the organization; hence, it can offer low latency between sites. They are an expensive option for WAN Connectivity but enjoy quite a low amount of downtime, meaning uninterrupted access to all critical services within an organization.

Multiple protocol label switching, or MPLS, allows packets to be transmitted via "labels" as an alternative to conventional IP-based routing. Each packet is given a label by MPLS, which speeds up transmission over a variety of networks. It is situated between technologies at Layers 2 and 3. The R&D center and the main campus make use of this connectivity.

The one such modern WAN technology is **Software Defined WAN**, which provides flexibility and performance enhancement through software management and cloud technology. The traffic can be dynamically routed over multiple different connections such as MPLS, Broadband, etc. scaled up according to the requirements and real-time conditions. This greatly simplifies the WAN management and is more economical than other management techniques such as VPN solutions like IP-Sec.

Fiber optical WAN provides extremely high-speed transport services with low latency. This makes it an ideal technology to back the high demand of the Main Campus and the R&D Center. The technology employs reliable, fast connectivity which can handle huge data volumes, thus providing smooth performance for mission-critical applications. However, the installation and maintenance of fiber optics are exorbitantly expensive and one of the most costly options compared to other WAN technologies.

Virtual Private Network over the Internet provides secure and encrypted messaging to protect against sensitive data when using public internet links. Low-cost solution: uses existing Internet infrastructure.

Therefore, it is most suitable for small or remote branches looking to cut down costs. Its performance, though, might vary since the type of and stability in a connection differs from one place to another. There might be delays or degraded performance at the peak hours of the internet. That surely would affect user quality.

Security Considerations

Potential Threats and Solutions

1. APIIT's network design provides the highest level of protection over DHCP servers to preserve network integrity and guarantee that devices on the end can get an IP address. A frequent security risk known as "**DHCP starvation**" occurs when a hacker overwhelms a DHCP server with phony DHCP Discovery requests, using all of the available IP addresses. There are numerous security measures that can be used to reduce this danger.

Port Security: Through port security on network switches, the remaining access to the port is limited to a desired number of devices. This way, it will restrict unauthorized devices, preventing them from establishing DHCP connections while allowing only members of an authorized network to request IP addresses from the DHCP server.

DHCP Snooping: When DHCP Snooping is enabled on all users of the network devices, it prevents DHCP Starvation only because trusted network devices, such as true DHCP servers, would have the power to give DHCP addresses and unauthorized DHCP servers could not issue inaccurate IP address servers, hence making certain things regarding safe IP address distribution.

2. Communication security between the Main Campus, Kandy Branch, and R&D Center must be guaranteed as APIIT Sri Lanka grows. Every time data is transmitted over the unprotected public internet, there is a risk of attacks like **man-in-the-middle** or **illegal data interception** if sufficient security measures are not taken.

Dynamic ARP Inspection (DAI) verifies the legitimacy of **Address Resolution Protocol (ARP)** in order to stop "**Man-in-the-middle**" attacks. By recording unsuccessful entry and keeping an eye on continuing attacks, the logging DAI feature complements port security and facilitates network administration's ability to get up-to-date information about network access attempts.

3. Intrusion prevention systems and firewalls are used to defend against denial of service attacks. By creating distinct security zones for each network sub-net assigned to a specific branch, network

engineers can implement traffic management in a **zone-based firewall**. Configuring **ZBF** on edge routers or with a dedicated firewall server is simple. **Zone-based policies** can be used to limit access to the business and computer departments, preventing them from accessing the sensitive administrative departments, such as marketing, academics, and human resources. Additional regulations could be implemented to allow the administrative departments to have more access to other departments and provide secure inter-WAN communications for improved branch management.

Redundancy

Redundancy is essential to guaranteeing the network's availability, dependability, and resilience in the given network architecture . Redundancy is essential in this system for the following reasons:

1. Reduces Downtime in the Network

Redundancy makes guarantee that network disruptions don't result from the failure of a single link, device, or path.

In this configuration:

Each segment has several links and switches to guarantee that the network will continue to function via a backup route in the event of a link or switch failure.

To keep connectivity, for instance, traffic might be rerouted by the several routers and switches.

2. Guarantees Availability

Networks that support vital functions (such offices, corporations, or educational institutions) need to be extremely accessible.

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APPENDIX A : IP ADDRESSING TABLE

Main Branch (HQ)

Subnet (Department)	Number of Host s	Neede d Size	Allocate d Size	Subnetwork Address	Actual Mask	Subnet	First Usable IP Address	Last Usable IP Address	Broadcast Address	No. Of Unused IP Address es
Computing	100	105	128	192.135.0.0	255.255.255.128	192.135.0.1	192.135.0.126	192.135.0.127	23	
Business	100	105	128	192.135.0.128	255.255.255.128	192.135.0.129	192.135.0.254	192.135.0.255	23	
Marketing	20	25	32	192.135.1.0	255.255.255.224	192.135.1.1	192.135.1.30	192.135.1.31	7	
Human resource	20	25	32	192.135.1.32	255.255.255.224	192.135.1.33	192.135.1.62	192.135.1.63	7	
Academic administr ation	8	13	16	192.135.1.64	255.255.255.240	192.135.1.65	192.135.1.78	192.135.1.79	3	

R&D Center

Subnet (Department)	Number of Hosts	Needed Size	Allocated Size	Subnetwork Address	Actual Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address	No. Of Unused IP Addresses
Research and Development	20	23	32	192.135.64.0	255.255.255.224	192.135.64.1	192.135.64.30	192.135.64.31	9
Human Resource	4	7	8	192.135.64.32	255.255.255.248	192.135.64.33	192.135.64.38	192.135.64.37	1
Marketing	4	7	8	192.135.64.40	255.255.255.248	192.135.64.41	192.135.64.46	192.135.64.45	1
Server Room	4	7	8	192.135.64.48	255.255.255.248	192.135.64.49	192.135.64.54	192.135.64.53	1

Kandy Branch

Subnet (Department)	Nu mb er of Ho sts	Neede d Size	Allo cated Size	Subnetwork Address	Actual Subnet Mask	First Usable IP Address	Last Usable IP Address	Broadcast Address	No. Of Unused IP Addre sses
Computing	80	85	128	192.135.128.0	255.255.255.128	192.135.1228.1	192.135.128.126	192.135.128.127	43
Business	40	45	64	192.135.128.128	255.255.255.192	192.135.0.129	192.135.128.190	192.135.128.191	19
Academic administrat ion	6	11	16	192.135.128.224	255.255.255.248	192.135.128.225	192.135.128.230	192.135.128.231	5
Human resource	6	11	16	192.135.128.208	255.255.255.240	192.135.1.209	192.135.128.222	192.135.128.223	5
Marketing	4	9	16	192.135.128.192	255.255.255.240	192.135.128.193	192.135.128.206	192.135.128.207	7

APPENDIX B : PACKET TRACER CONFIGURATIONS

VLAN Configuration

Main branch

Computing

```
Switch#confi terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#host name
name(config)#host
name(config)#hostname COM
COM(config)#vlan 10
COM(config-vlan)#swi
COM(config-vlan)#swi
COM(config-vlan)#name COM
COM(config-vlan)#ex
COM(config)#int
COM(config)#interface fa
COM(config)#interface range fastEthernet 0/1-21
COM(config-if-range)#swi
COM(config-if-range)#switchport mo
COM(config-if-range)#switchport mode acc
COM(config-if-range)#switchport mode access
COM(config-if-range)#swi
COM(config-if-range)#switchport acc
COM(config-if-range)#switchport access vlan 10
COM(config-if-range)#ex
COM(config)#^z
COM#
%SYS-5-CONFIG_I: Configured from console by console

COM#show vlan bri
COM#show vlan brief

VLAN Name          Status      Ports
----- -----
1    default        active     Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                Gig0/2
10   COM            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

1002 fddi-default  active
1003 token-ring-default  active
1004 fddinet-default  active
1005 trnet-default   active
COM#
```

Business

```
Switch>enable
Switch#cof
Switch#cofi
Switch#confi
Switch#configure t
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 11
Switch(config-vlan)#name BUS
Switch(config-vlan)#exit
Switch(config)#host
Switch(config)#hostname BUS
BUS(config)#int
BUS(config)#interface ran
BUS(config)#interface range fa
BUS(config)#interface range fastEthernet 0/1-21
BUS(config-if-range)#swi
BUS(config-if-range)#switchport mode acc
BUS(config-if-range)#switchport mode access
BUS(config-if-range)#swit
BUS(config-if-range)#switchport acc
BUS(config-if-range)#switchport access vlan 11
BUS(config-if-range)#ex
BUS(config-if-range)#exit
BUS(config)#^z
BUS#
%SYS-5-CONFIG_I: Configured from console by console

BUS#show vlan brief

VLAN Name          Status      Ports
----- -----
1    default        active     Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                Gig0/2
11   BUS            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

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

Marketing

```
Switch>enable
Switch#conf
Switch#configure t
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 12
Switch(config-vlan)#name MR
Switch(config-vlan)#ex
Switch(config-vlan)#exit
Switch(config)#host
Switch(config)#hostname MR
MR(config)#int
MR(config)#interface ra
MR(config)#interface range fa
MR(config)#interface range fastEthernet 0/1-21
MR(config-if-range)#swi
MR(config-if-range)#switchport mode acc
MR(config-if-range)#switchport mode access
MR(config-if-range)#switchport mode access
MR(config-if-range)#swit
MR(config-if-range)#switchport acc
MR(config-if-range)#switchport access vlan 12
MR(config-if-range)#ex
MR(config-if-range)#exit
```

Human resource

```
Switch#configure t
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 13
^
% Invalid input detected at '^' marker.

Switch(config)#vIan 13
Switch(config-vlan)#name HU
Switch(config-vlan)#ex
Switch(config-vlan)#exit
Switch(config)#int
Switch(config)#int
Switch(config)#interface ra
Switch(config)#interface range fa
Switch(config)#interface range fastEthernet 0/1-21
Switch(config-if-range)#swi
Switch(config-if-range)#switchport mode acc
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#swi
Switch(config-if-range)#switchport acc
Switch(config-if-range)#switchport access vlan 13
Switch(config-if-range)#+Z
Switch#
%SYS-5-CONFIG_I: Configured from console by console
show vlan br
Switch#show vlan brief

VLAN Name          Status    Ports
---- ----
1    default        active    Fa0/22, Fa0/23, Fa0/24, Gig0/1
                                Gig0/2
13   HU             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
1002 fddi-default  active
1003 token-ring-default active
1004 fddinet-default  active
1005 trnet-default   active
Switch#
```

Academic Administration

```
switch#configure t
switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 14
Switch(config-vlan)#name AC
Switch(config-vlan)#ex
Switch(config-vlan)#exit
Switch(config)#int
switch(config)#interface ra
Switch(config)#interface range fa
switch(config)#interface range fastEthernet 0/1-9
switch(config-if-range)#swit
switch(config-if-range)#switchport mo
switch(config-if-range)#switchport mode acc
switch(config-if-range)#switchport mode access
switch(config-if-range)#swit
switch(config-if-range)#switchport acc
switch(config-if-range)#switchport access vlan 14
switch(config-if-range)#{^Z
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#show vlan bri
Switch#show vlan brief

VLAN Name          Status      Ports
---  -----
1    default        active     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
14   AC            active     Fa0/1,  Fa0/2,  Fa0/3,  Fa0/4
                           Fa0/5,  Fa0/6,  Fa0/7,  Fa0/8
                           Fa0/9
1002 fddi-default  active
1003 token-ring-default active
1004 fdnet-default   active
1005 trnet-default   active
Switch#
```

Main switch

version 15.0

no service timestamps log datetime msec

no service timestamps debug datetime msec

no service password-encryption

!

hostname Switch

!

!

!

!

!

spanning-tree mode pvst

spanning-tree extend system-id

!

interface FastEthernet0/1

```
switchport access vlan 10
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/2
```

```
switchport access vlan 10
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/3
```

```
switchport access vlan 10
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/4
```

```
switchport access vlan 10
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/5
```

```
switchport access vlan 10
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/6
```

```
switchport access vlan 11
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/7
```

```
switchport access vlan 11
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/8
```

```
switchport access vlan 11
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/9
```

```
switchport access vlan 11
```

```
switchport mode access
```

```
!  
interface FastEthernet0/10  
switchport access vlan 11  
switchport mode access  
!  
interface FastEthernet0/11  
switchport access vlan 12  
switchport mode access  
!  
interface FastEthernet0/12  
switchport access vlan 13  
switchport mode access  
!  
interface FastEthernet0/13  
switchport access vlan 14  
switchport mode access  
!  
interface FastEthernet0/14  
switchport access vlan 14  
switchport mode access  
!  
interface FastEthernet0/15  
switchport access vlan 14  
switchport mode access  
!  
interface FastEthernet0/16  
switchport access vlan 14  
switchport mode access  
!  
interface FastEthernet0/17  
switchport access vlan 14  
switchport mode access  
!  
interface FastEthernet0/18
```

```
switchport access vlan 14
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/19
```

```
switchport access vlan 14
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/20
```

```
switchport access vlan 14
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/21
```

```
switchport mode trunk
```

```
!
```

```
interface FastEthernet0/22
```

```
switchport mode trunk
```

```
Switch>enable
Switch#show vlan b
Switch#show vlan brief

VLAN Name Status Ports
---- -----
1 default active Fa0/23, Fa0/24, Gig0/1, Gig0/2
10 com active Fa0/1, Fa0/2, Fa0/3, Fa0/4
           Fa0/5
11 bus active Fa0/6, Fa0/7, Fa0/8, Fa0/9
           Fa0/10
12 mr active Fa0/11
13 hu active Fa0/12
14 a active Fa0/13, Fa0/14, Fa0/15, Fa0/16
           Fa0/17, Fa0/18, Fa0/19, Fa0/20
1002 fddi-default active
1003 token-ring-default active
1004 fddinet-default active
1005 trnet-default active
Switch#
```

```

Switch>enable
Switch#show int t
Switch#show int trunk
Port      Mode       Encapsulation  Status      Native vlan
Fa0/21    on        802.1q         trunking   1
Fa0/22    on        802.1q         trunking   1

Port      Vlans allowed on trunk
Fa0/21   1-1005
Fa0/22   1-1005

Port      Vlans allowed and active in management domain
Fa0/21   1,10,11,12,13,14
Fa0/22   1,10,11,12,13,14

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/21   1,10,11,12,13,14
Fa0/22   1,10,11,12,13,14

Switch#

```

Main router :

```

ip dhcp excluded-address 192.135.0.1
ip dhcp excluded-address 192.135.0.2
ip dhcp excluded-address 192.135.0.3
ip dhcp excluded-address 192.135.0.129
ip dhcp excluded-address 192.135.0.130
ip dhcp excluded-address 192.135.0.131
ip dhcp excluded-address 192.135.1.1
ip dhcp excluded-address 192.135.1.2
ip dhcp excluded-address 192.135.1.3
ip dhcp excluded-address 192.135.1.33
ip dhcp excluded-address 192.135.1.34
ip dhcp excluded-address 192.135.1.35
ip dhcp excluded-address 192.135.1.65
ip dhcp excluded-address 192.135.1.66
ip dhcp excluded-address 192.135.1.67
!
```

```
ip dhcp pool main-com
network 192.135.0.0 255.255.255.128
default-router 192.135.0.3

ip dhcp pool main-bus
network 192.135.0.128 255.255.255.128
default-router 192.135.0.131

ip dhcp pool main-mr
network 192.135.1.0 255.255.255.224
default-router 192.135.1.3

ip dhcp pool main-hu
network 192.135.1.32 255.255.255.224
default-router 192.135.1.35

ip dhcp pool main-a
network 192.135.1.64 255.255.255.240
default-router 192.135.1.67

!
interface FastEthernet0/0.1
encapsulation dot1Q 10
ip address 192.135.0.2 255.255.255.128
ip nat inside
standby 10 ip 192.135.0.3
standby preempt

!
interface FastEthernet0/0.2
encapsulation dot1Q 11
ip address 192.135.0.130 255.255.255.128
ip nat inside
standby 11 ip 192.135.0.131
standby priority 200
```

```
standby preempt
!
interface FastEthernet0/0.3
encapsulation dot1Q 12
ip address 192.135.1.2 255.255.255.224
ip nat inside
standby 12 ip 192.135.1.3
standby priority 200
standby preempt
!
interface FastEthernet0/0.4
encapsulation dot1Q 13
ip address 192.135.1.34 255.255.255.224
ip nat inside
standby 13 ip 192.135.1.35
standby priority 200
standby preempt
!
interface FastEthernet0/0.5
encapsulation dot1Q 14
ip address 192.135.1.66 255.255.255.240
ip nat inside
standby 14 ip 192.135.1.67
standby priority 200
standby preempt
interface Serial0/1/0
ip address 218.210.0.9 255.255.255.248
ip nat outside
!
```

```

ip nat inside source list 1 interface Serial0/1/0 overload
ip nat inside source list 2 interface Serial0/1/0 overload
ip nat inside source list 3 interface Serial0/1/0 overload
ip nat inside source list 4 interface Serial0/1/0 overload
ip nat inside source list 5 interface Serial0/1/0 overload
ip classless
!
ip flow-export version 9
!
!
```

```

access-list 1 permit 192.135.0.0 0.0.0.127
access-list 2 permit 192.135.0.128 0.0.0.127
access-list 3 permit 192.135.1.0 0.0.0.31
access-list 4 permit 192.135.1.32 0.0.0.31
access-list 5 permit 192.135.1.64 0.0.0.15
!
```

```

Router>enable
Router#show ip int b
Interface          IP-Address      OK? Method Status      Protocol
FastEthernet0/0    unassigned     YES unset  up           up
FastEthernet0/0.1   192.135.0.2   YES manual up          up
FastEthernet0/0.2   192.135.0.130 YES manual up          up
FastEthernet0/0.3   192.135.1.2   YES manual up          up
FastEthernet0/0.4   192.135.1.34 YES manual up          up
FastEthernet0/0.5   192.135.1.66 YES manual up          up
FastEthernet0/1     unassigned     YES unset administratively down down
Serial0/1/0         218.210.0.9  YES manual up           up
Serial0/1/1         unassigned     YES unset administratively down down
Vlan1              unassigned     YES unset administratively down down
Router#

```

```

Router#show ip dhcp b
IP address      Client-ID/          Lease expiration      Type
                  Hardware address
192.135.0.4     00D0.580A.0613    --                Automatic
192.135.0.132   0001.64B9.602B    --                Automatic
192.135.1.4     0001.4295.1756   --                Automatic
192.135.1.36   0005.5EC2.6812    --                Automatic
192.135.1.68   00E0.A3DB.40C5    --                Automatic
Router#

```

```

Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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
      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

      192.135.0.0/25 is subnetted, 2 subnets
C        192.135.0.0 is directly connected, FastEthernet0/0.1
C        192.135.0.128 is directly connected, FastEthernet0/0.2
      192.135.1.0/24 is variably subnetted, 3 subnets, 2 masks
C          192.135.1.0/27 is directly connected, FastEthernet0/0.3
C          192.135.1.32/27 is directly connected, FastEthernet0/0.4
C          192.135.1.64/28 is directly connected, FastEthernet0/0.5
      192.135.64.0/24 is variably subnetted, 4 subnets, 2 masks
R          192.135.64.0/27 [120/2] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.64.32/29 [120/2] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.64.40/29 [120/2] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.64.48/29 [120/2] via 218.210.0.10, 00:00:03, Serial0/1/0
--More-- |

```

```

      192.135.128.0/24 is variably subnetted, 5 subnets, 4 masks
R          192.135.128.0/25 [120/5] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.128.128/26 [120/5] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.128.192/28 [120/5] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.128.208/28 [120/5] via 218.210.0.10, 00:00:03, Serial0/1/0
R          192.135.128.224/29 [120/5] via 218.210.0.10, 00:00:03, Serial0/1/0
      218.210.0.0/29 is subnetted, 7 subnets
R          218.210.0.0 [120/1] via 218.210.0.10, 00:00:03, Serial0/1/0
                  [120/1] via 192.135.0.1, 00:00:03, FastEthernet0/0.1
                  [120/1] via 192.135.0.129, 00:00:03, FastEthernet0/0.2
                  [120/1] via 192.135.1.1, 00:00:03, FastEthernet0/0.3
C          218.210.0.8 is directly connected, Serial0/1/0
R          218.210.0.16 [120/1] via 218.210.0.10, 00:00:03, Serial0/1/0
R          218.210.0.24 [120/1] via 218.210.0.10, 00:00:03, Serial0/1/0
R          218.210.0.32 [120/2] via 218.210.0.10, 00:00:03, Serial0/1/0
R          218.210.0.40 [120/3] via 218.210.0.10, 00:00:03, Serial0/1/0
R          218.210.0.48 [120/4] via 218.210.0.10, 00:00:03, Serial0/1/0

```

Secondary router

ip dhcp excluded-address 192.135.0.1
 ip dhcp excluded-address 192.135.0.2
 ip dhcp excluded-address 192.135.0.3
 ip dhcp excluded-address 192.135.0.129
 ip dhcp excluded-address 192.135.0.130
 ip dhcp excluded-address 192.135.0.131
 ip dhcp excluded-address 192.135.1.1

```
ip dhcp excluded-address 192.135.1.2
ip dhcp excluded-address 192.135.1.3
ip dhcp excluded-address 192.135.1.33
ip dhcp excluded-address 192.135.1.34
ip dhcp excluded-address 192.135.1.35
ip dhcp excluded-address 192.135.1.65
ip dhcp excluded-address 192.135.1.66
ip dhcp excluded-address 192.135.1.67
ip dhcp pool main-com
network 192.135.0.0 255.255.255.128
default-router 192.135.0.3
ip dhcp pool main-bus
network 192.135.0.128 255.255.255.128
default-router 192.135.0.131
ip dhcp pool main-mr
network 192.135.1.0 255.255.255.224
default-router 192.135.1.3
ip dhcp pool main-hu
network 192.135.1.32 255.255.255.224
default-router 192.135.1.35
ip dhcp pool main-a
network 192.135.1.64 255.255.255.240
default-router 192.135.1.67
spanning-tree mode pvst
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
```

```
interface FastEthernet0/0.1
encapsulation dot1Q 10
ip address 192.135.0.1 255.255.255.128
ip nat inside
standby 10 ip 192.135.0.3
standby priority 100
standby preempt
!

interface FastEthernet0/0.2
encapsulation dot1Q 11
ip address 192.135.0.129 255.255.255.128
ip nat inside
standby 11 ip 192.135.0.131
standby priority 100
standby preempt
!

interface FastEthernet0/0.3
encapsulation dot1Q 12
ip address 192.135.1.1 255.255.255.224
ip nat inside
standby 12 ip 192.135.1.3
standby priority 100
standby preempt
!

interface FastEthernet0/0.4
encapsulation dot1Q 13
ip address 192.135.1.33 255.255.255.224
ip nat inside
standby 13 ip 192.135.1.35
```

```
standby priority 100
standby preempt
!
interface FastEthernet0/0.5
encapsulation dot1Q 14
ip address 192.135.1.65 255.255.255.240
ip nat inside
standby 14 ip 192.135.1.67
standby priority 100
standby preempt
!
interface Serial0/1/0
ip address 218.210.0.1 255.255.255.248
ip nat outside
clock rate 2000000
router rip
version 2
network 192.135.0.0
network 192.135.1.0
network 218.210.0.0
no auto-summary
!
ip nat inside source list 1 interface Serial0/1/0 overload
ip nat inside source list 2 interface Serial0/1/0 overload
ip nat inside source list 3 interface Serial0/1/0 overload
ip nat inside source list 4 interface Serial0/1/0 overload
ip nat inside source list 5 interface Serial0/1/0 overload
ip classless
access-list 1 permit 192.135.0.0 0.0.0.127
```

```

access-list 2 permit 192.135.0.128 0.0.0.127
access-list 4 permit 192.135.1.32 0.0.0.31
access-list 5 permit 192.135.1.64 0.0.0.15
access-list 3 permit 192.135.1.0 0.0.0.31

```

```

Router>
Router>enable
Router#show ip int b
Router#show ip int brief
Interface          IP-Address      OK? Method Status      Protocol
FastEthernet0/0    unassigned      YES unset  up           up
FastEthernet0/0.1   192.135.0.1    YES manual up          up
FastEthernet0/0.2   192.135.0.129  YES manual up          up
FastEthernet0/0.3   192.135.1.1    YES manual up          up
FastEthernet0/0.4   192.135.1.33   YES manual up          up
FastEthernet0/0.5   192.135.1.65   YES manual up          up
FastEthernet0/1     unassigned      YES unset administratively down down
Serial0/1/0         218.210.0.1   YES manual up           up
Serial0/1/1         unassigned      YES unset administratively down down
Vlan1              unassigned      YES unset administratively down down
Router#

```

Research and department:

Research and department

interface FastEthernet0/1

switchport access vlan 30

switchport mode access

switchport port-security

switchport port-security mac-address 00D0.971A.7391

!

interface FastEthernet0/2

switchport access vlan 30

switchport mode access

!

interface FastEthernet0/3

switchport access vlan 30

```
switchport mode access
!
interface FastEthernet0/4
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/5
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/6
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/8
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/9
switchport access vlan 30
switchport mode access
!
interface FastEthernet0/10
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/11
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/12
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/13
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/14
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/15
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/16
switchport access vlan 30
switchport mode access
```

!

```
interface FastEthernet0/17
switchport access vlan 30
switchport mode access
```

```
interface FastEthernet0/18
switchport access vlan 30
switchport mode access
```

```
!
```

```
interface FastEthernet0/19
switchport access vlan 30
switchport mode access
```

```
!
```

```
interface FastEthernet0/20
switchport access vlan 30
switchport mode access
```

```
!
```

```
interface FastEthernet0/21
switchport access vlan 30
switchport mode access
```

VLAN	Name	Status	Ports
1	default	active	Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
30	rd	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
1002	fdci-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

central switch

```
interface FastEthernet0/1
switchport access vlan 30
switchport mode access
```

```
!
```

```
interface FastEthernet0/2
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/3
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/4
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/5
switchport access vlan 31
switchport mode access
!
interface FastEthernet0/6
switchport access vlan 32
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 32
switchport mode access
!
interface FastEthernet0/8
switchport access vlan 32
switchport mode access
!
interface FastEthernet0/9
```

```
switchport access vlan 32
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/10
```

```
switchport access vlan 33
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/11
```

```
switchport access vlan 33
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/12
```

```
switchport access vlan 33
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/13
```

```
switchport access vlan 33
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/14
```

```
switchport mode trunk
```

```
!
```

VLAN	Name	Status	Ports
1	default	active	Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
30	rd	active	Fa0/1
31	hr	active	Fa0/2, Fa0/3, Fa0/4, Fa0/5
32	mr	active	Fa0/6, Fa0/7, Fa0/8, Fa0/9
33	se	active	Fa0/10, Fa0/11, Fa0/12, Fa0/13
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

```

Port          Mode        Encapsulation  Status        Native vlan
Fa0/14       on          802.1q         trunking     1

Port          Vlans allowed on trunk
Fa0/14       1-1005

Port          Vlans allowed and active in management domain
Fa0/14       1,30,31,32,33

Port          Vlans in spanning tree forwarding state and not pruned
Fa0/14       1,30,31,32,33

Switch#

```

Main router

```

ip dhcp excluded-address 192.135.64.1
ip dhcp excluded-address 192.135.64.33
ip dhcp excluded-address 192.135.64.41
ip dhcp excluded-address 192.135.64.49
!
ip dhcp pool rd-rd
network 192.135.64.0 255.255.255.224
default-router 192.135.64.1
ip dhcp pool rd-hr
network 192.135.64.32 255.255.255.248
default-router 192.135.64.33
ip dhcp pool rd-mr
network 192.135.64.40 255.255.255.248
default-router 192.135.64.41
ip dhcp pool rd-se
network 192.135.64.48 255.255.255.248
default-router 192.135.64.49
!
interface FastEthernet0/0.1

```

```
encapsulation dot1Q 30
ip address 192.135.64.1 255.255.255.224
ip nat inside
!
interface FastEthernet0/0.2
encapsulation dot1Q 31
ip address 192.135.64.33 255.255.255.248
ip nat inside
!
interface FastEthernet0/0.3
encapsulation dot1Q 32
ip address 192.135.64.41 255.255.255.248
ip nat inside
!
interface FastEthernet0/0.4
encapsulation dot1Q 33
ip address 192.135.64.49 255.255.255.248
ip nat inside
!
interface FastEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface Serial0/1/0
ip address 218.210.0.17 255.255.255.248
ip nat outside
!
```

```

router rip
version 2
network 192.135.64.0
network 218.210.0.0
no auto-summary
!
ip nat inside source list 1 interface Serial0/1/0 overload
ip nat inside source list 2 interface Serial0/1/0 overload
ip nat inside source list 3 interface Serial0/1/0 overload
ip nat inside source list 4 interface Serial0/1/0 overload
ip classless
!
ip flow-export version 9
!
!
```

```

access-list 1 permit 192.135.64.0 0.0.0.31
access-list 2 permit 192.135.64.32 0.0.0.7
access-list 3 permit 192.135.64.40 0.0.0.7
access-list 4 permit 192.135.64.48 0.0.0.7
!
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	unassigned	YES	unset	up	up
FastEthernet0/0.1	192.135.64.1	YES	manual	up	up
FastEthernet0/0.2	192.135.64.33	YES	manual	up	up
FastEthernet0/0.3	192.135.64.41	YES	manual	up	up
FastEthernet0/0.4	192.135.64.49	YES	manual	up	up
FastEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/1/0	218.210.0.17	YES	manual	up	up
Serial0/1/1	unassigned	YES	unset	administratively down	down
Vlan1	unassigned	YES	unset	administratively down	down

IP address	Client-ID/ Hardware address	Lease expiration	Type
192.135.64.34	00D0.58BD.6E64	--	Automatic
192.135.64.42	0001.433E.3B4A	--	Automatic
192.135.64.50	0003.E4C4.196A	--	Automatic

```

Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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
      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

  192.135.0.0/25 is subnetted, 2 subnets
R    192.135.0.0 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.0.128 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
  192.135.1.0/24 is variably subnetted, 3 subnets, 2 masks
R    192.135.1.0/27 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.1.32/27 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.1.64/28 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
  192.135.64.0/24 is variably subnetted, 4 subnets, 2 masks
C    192.135.64.0/27 is directly connected, FastEthernet0/0.1
C    192.135.64.32/29 is directly connected, FastEthernet0/0.2
C    192.135.64.40/29 is directly connected, FastEthernet0/0.3
C    192.135.64.48/29 is directly connected, FastEthernet0/0.4
  192.135.128.0/24 is variably subnetted, 5 subnets, 4 masks
R    192.135.128.0/25 [120/5] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.128.128/26 [120/5] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.128.192/28 [120/5] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.128.208/28 [120/5] via 218.210.0.18, 00:00:16, Serial0/1/0
R    192.135.128.224/29 [120/5] via 218.210.0.18, 00:00:16, Serial0/1/0
  218.210.0.0/29 is subnetted, 7 subnets
R    218.210.0.0 [120/1] via 218.210.0.18, 00:00:16, Serial0/1/0
R    218.210.0.8 [120/1] via 218.210.0.18, 00:00:16, Serial0/1/0
C    218.210.0.16 is directly connected, Serial0/1/0
R    218.210.0.24 [120/1] via 218.210.0.18, 00:00:16, Serial0/1/0
R    218.210.0.32 [120/2] via 218.210.0.18, 00:00:16, Serial0/1/0
R    218.210.0.40 [120/3] via 218.210.0.18, 00:00:16, Serial0/1/0
R    218.210.0.48 [120/4] via 218.210.0.18, 00:00:16, Serial0/1/0

```

Kandy Branch:

Business:

```
interface FastEthernet0/1
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/2
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/3
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/4
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/5
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/6
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/7
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/8
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/9
```

```
switchport access vlan 21
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/10
```

```
switchport access vlan 21
```

```
switchport mode access
!
interface FastEthernet0/11
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/12
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/13
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/14
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/15
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/16
switchport access vlan 21
switchport mode access
!
interface FastEthernet0/17
switchport access vlan 21
switchport mode access
```

!

```
interface FastEthernet0/18
switchport access vlan 21
switchport mode access
```

!

```
interface FastEthernet0/19
switchport access vlan 21
switchport mode access
```

!

```
interface FastEthernet0/20
switchport access vlan 21
switchport mode access
```

!

```
interface FastEthernet0/21
switchport access vlan 21
switchport mode access
```

!

VLAN	Name	Status	Ports
1	default	active	Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
21	bus	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
1002	fdci-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Switch#

Computer

```
interface FastEthernet0/1
switchport access vlan 20
switchport mode access
```

!

```
interface FastEthernet0/2
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/3
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/4
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/5
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/6
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/7
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/8
switchport access vlan 20
switchport mode access
!
interface FastEthernet0/9
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/10
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/11
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/12
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/13
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/14
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/15
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/16
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/17
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/18
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/19
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/20
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
interface FastEthernet0/21
```

```
switchport access vlan 20
```

```
switchport mode access
```

```
!
```

```
Switch#show vlan brief
```

VLAN	Name	Status	Ports
1	default	active	Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
20	com	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
1002	fdi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Central switch :

interface FastEthernet0/1

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/2

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/3

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/4

switchport access vlan 20

switchport mode access

!

interface FastEthernet0/5

switchport access vlan 21

switchport mode access

!

interface FastEthernet0/6

switchport access vlan 21

switchport mode access

!

interface FastEthernet0/7

switchport access vlan 22

switchport mode access

!

```
interface FastEthernet0/8
switchport access vlan 22
switchport mode access
!
interface FastEthernet0/9
switchport access vlan 22
switchport mode access
!
interface FastEthernet0/10
switchport access vlan 22
switchport mode access
!
interface FastEthernet0/11
switchport access vlan 22
switchport mode access
!
interface FastEthernet0/12
switchport access vlan 22
switchport mode access
!
interface FastEthernet0/13
switchport access vlan 23
switchport mode access
!
interface FastEthernet0/14
switchport access vlan 23
switchport mode access
!
interface FastEthernet0/15
```

switchport access vlan 23

switchport mode access

!

interface FastEthernet0/16

switchport access vlan 23

switchport mode access

!

interface FastEthernet0/17

switchport access vlan 23

switchport mode access

!

interface FastEthernet0/18

switchport access vlan 23

switchport mode access

!

interface FastEthernet0/19

switchport access vlan 24

switchport mode access

!

interface FastEthernet0/20

switchport access vlan 24

switchport mode access

!

interface FastEthernet0/21

switchport access vlan 24

switchport mode access

!

interface FastEthernet0/22

switchport access vlan 24

switchport mode access

!

interface FastEthernet0/23

switchport mode access

!

interface FastEthernet0/24

switchport mode trunk

VLAN	Name	Status	Ports
1	default	active	Fa0/23, Gig0/1, Gig0/2
20	com	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4
21	bus	active	Fa0/5, Fa0/6
22	ac	active	Fa0/7, Fa0/8, Fa0/9, Fa0/10 Fa0/11, Fa0/12
23	hr	active	Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18
24	mr	active	Fa0/19, Fa0/20, Fa0/21, Fa0/22
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	
Switch#			
Port	Mode	Encapsulation	Status
Fa0/24	on	802.1q	trunking
Port	Vlans allowed on trunk		
Fa0/24	1-1005		
Port	Vlans allowed and active in management domain		
Fa0/24	1,20,21,22,23,24		
Port	Vlans in spanning tree forwarding state and not pruned		
Fa0/24	1,20,21,22,23,24		
Switch#			

Main router

ip dhcp excluded-address 192.135.128.1

ip dhcp excluded-address 192.135.128.129

ip dhcp excluded-address 192.135.128.193

ip dhcp excluded-address 192.135.128.209

ip dhcp excluded-address 192.135.128.225

!

ip dhcp pool kandy-com

```
network 192.135.128.0 255.255.255.128
default-router 192.135.128.1
ip dhcp pool kandy-bus
network 192.135.128.128 255.255.255.192
default-router 192.135.128.129
ip dhcp pool kandy-ac
network 192.135.128.192 255.255.255.240
default-router 192.135.128.193
ip dhcp pool kandy-hr
network 192.135.128.208 255.255.255.240
default-router 192.135.128.209
ip dhcp pool kandy-mr
network 192.135.128.224 255.255.255.248
default-router 192.135.128.225
```

```
interface FastEthernet0/0
no ip address
duplex auto
speed auto
!
interface FastEthernet0/0.1
encapsulation dot1Q 20
ip address 192.135.128.1 255.255.255.128
ip nat inside
!
interface FastEthernet0/0.2
encapsulation dot1Q 21
ip address 192.135.128.129 255.255.255.192
ip nat inside
```

```
!
interface FastEthernet0/0.3
encapsulation dot1Q 22
ip address 192.135.128.193 255.255.255.240
ip nat inside
!
interface FastEthernet0/0.4
encapsulation dot1Q 23
ip address 192.135.128.209 255.255.255.240
ip nat inside
!
interface FastEthernet0/0.5
encapsulation dot1Q 24
ip address 192.135.128.225 255.255.255.248
ip nat inside
!
interface Serial0/1/0
ip address 218.210.0.49 255.255.255.248
ip nat outside
router rip
version 2
network 192.135.128.0
network 218.210.0.0
no auto-summary
!
ip nat inside source list 10 interface Serial0/1/0 overload
ip nat inside source list 6 interface Serial0/1/0 overload
ip nat inside source list 7 interface Serial0/1/0 overload
ip nat inside source list 8 interface Serial0/1/0 overload
```

ip nat inside source list 9 interface Serial0/1/0 overload

```
access-list 6 permit 192.135.128.0 0.0.0.127
access-list 8 permit 192.135.128.192 0.0.0.15
access-list 7 permit 192.135.128.128 0.0.0.63
access-list 9 permit 192.135.128.208 0.0.0.33
access-list 10 permit 192.135.128.224 0.0.0.7
```

Interface	IP-Address	OK?	Method	Status	Protocol
FastEthernet0/0	unassigned	YES	unset	up	up
FastEthernet0/0.1	192.135.128.1	YES	manual	up	up
FastEthernet0/0.2	192.135.128.129	YES	manual	up	up
FastEthernet0/0.3	192.135.128.193	YES	manual	up	up
FastEthernet0/0.4	192.135.128.209	YES	manual	up	up
FastEthernet0/0.5	192.135.128.225	YES	manual	up	up
FastEthernet0/1	unassigned	YES	unset	administratively down	down
Serial0/1/0	218.210.0.49	YES	manual	up	up
Serial0/1/1	unassigned	YES	unset	administratively down	down
Vlan1	unassigned	YES	unset	administratively down	down

```
Router#show ip anc p
IP address      Client-ID/
                  Hardware address
192.135.128.2  000D.BD58.4CCA
192.135.128.130 0009.7C09.BEBD
192.135.128.194 0060.3E66.D2EE
192.135.128.210 000C.8523.AB4B
192.135.128.226 000C.8506.8DCD
Router#ip ip t
```

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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
      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

  192.135.0.0/25 is subnetted, 2 subnets
R    192.135.0.0 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.0.128 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
  192.135.1.0/24 is variably subnetted, 3 subnets, 2 masks
R    192.135.1.0/27 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.1.32/27 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.1.64/28 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
  192.135.64.0/24 is variably subnetted, 4 subnets, 2 masks
R    192.135.64.0/27 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.64.32/29 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.64.40/29 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
R    192.135.64.48/29 [120/5] via 218.210.0.50, 00:00:18, Serial0/1/0
  192.135.128.0/24 is variably subnetted, 5 subnets, 4 masks
C    192.135.128.0/25 is directly connected, FastEthernet0/0.1
C    192.135.128.128/26 is directly connected, FastEthernet0/0.2
C    192.135.128.192/28 is directly connected, FastEthernet0/0.3
C    192.135.128.208/28 is directly connected, FastEthernet0/0.4
C    192.135.128.224/29 is directly connected, FastEthernet0/0.5
  218.210.0.0/29 is subnetted, 7 subnets
R    218.210.0.0 [120/4] via 218.210.0.50, 00:00:18, Serial0/1/0
R    218.210.0.8 [120/4] via 218.210.0.50, 00:00:18, Serial0/1/0
R    218.210.0.16 [120/4] via 218.210.0.50, 00:00:18, Serial0/1/0
R    218.210.0.24 [120/3] via 218.210.0.50, 00:00:18, Serial0/1/0
R    218.210.0.32 [120/2] via 218.210.0.50, 00:00:18, Serial0/1/0
R    218.210.0.40 [120/1] via 218.210.0.50, 00:00:18, Serial0/1/0
C    218.210.0.48 is directly connected, Serial0/1/0
```

NAT

Configuration

```
main(config-if)#ip address 218.210.0.1 255.255.255.248
main(config-if)#ex
main(config-if)#exit
main(config)#rou
main(config)#router rip
main(config-router)#net
main(config-router)network 218.210.0.0
main(config-router)#ex
main(config-router)#exit
main(config)#int
main(config)#interface fa
main(config)#interfaceser
main(config)#int
main(config)#interface ser
main(config)#interface serial 0/1/0
main(config-if)#ip na ou
main(config-if)#ip na outside
main(config-if)#ex
main(config)#exit
main(config)#ip nat insi
main(config)#ip nat inside so
main(config)#ip nat inside source list 1 int
main(config)#ip nat inside source list 1 interface ser
main(config)#ip nat inside source list 1 interface serial 0/1/0 ov
main(config)#ip nat inside source list 1 interface serial 0/1/0 overload
main(config)#ip nat inside source list 2 interface serial 0/1/0 overload
main(config)#ip nat inside source list 3 interface serial 0/1/0 overload
main(config)#ip nat inside source list 4 interface serial 0/1/0 overload
main(config)#ip nat inside source list 5 interface serial 0/1/0 overload
main(config)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
main(config)#+Z
main#
%SYS-5-CONFIG_I: Configured from console by console
main#show ip nat
% Incomplete command.
main#show ip nat t
main#show ip nat translations
Pro Inside global      Inside local        Outside local        Outside global
icmp 218.210.0.1:5    192.135.1.5:5    218.210.0.2:5    218.210.0.2:5
icmp 218.210.0.1:6    192.135.1.5:6    218.210.0.2:6    218.210.0.2:6
icmp 218.210.0.1:7    192.135.1.5:7    218.210.0.2:7    218.210.0.2:7
icmp 218.210.0.1:8    192.135.1.5:8    218.210.0.2:8    218.210.0.2:8
```

IOS Corr

```
main(config-router)#net
main(config-router)network 218.210.0.0
main(config-router)#ex
main(config-router)#exit
main(config)#int
main(config)#interface fa
main(config)#interfaceser
main(config)#int
main(config)#interface ser
main(config)#interface serial 0/1/0
main(config-if)#ip na ou
main(config-if)#ip na outside
main(config-if)#ex
main(config-if)#exit
main(config)#ip nat insi
main(config)#ip nat inside so
main(config)#ip nat inside source list 1 int
main(config)#ip nat inside source list 1 interface ser
main(config)#ip nat inside source list 1 interface serial 0/1/0 ov
main(config)#ip nat inside source list 1 interface serial 0/1/0 overload
main(config)#ip nat inside source list 2 interface serial 0/1/0 overload
main(config)#ip nat inside source list 3 interface serial 0/1/0 overload
main(config)#ip nat inside source list 4 interface serial 0/1/0 overload
main(config)#ip nat inside source list 5 interface serial 0/1/0 overload
main(config)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
main(config)#+Z
main#
%SYS-5-CONFIG_I: Configured from console by console
main#show ip nat
% Incomplete command.
main#show ip nat t
main#show ip nat translations
Pro Inside global      Inside local        Outside local        Outside global
icmp 218.210.0.1:5    192.135.1.5:5    218.210.0.2:5    218.210.0.2:5
icmp 218.210.0.1:6    192.135.1.5:6    218.210.0.2:6    218.210.0.2:6
icmp 218.210.0.1:7    192.135.1.5:7    218.210.0.2:7    218.210.0.2:7
icmp 218.210.0.1:8    192.135.1.5:8    218.210.0.2:8    218.210.0.2:8
main#
```

DHCP

```
main(config-subif)#ip address 192.135.1.65 255.255.255.240
main(config-subif)#st
main(config-subif)#standby 14 ?
  ip      Enable HSRP and set the virtual IP address
  ipv6    Enable HSRP IPv6
  preempt Overthrow lower priority Active routers
  priority Priority level
  timers   Hello and hold timers
  track    Priority Tracking
main(config-subif)#standby 14 ip 192.135.1.14
% Warning: address is not within a subnet on this interface
main(config-subif)#standby 14 ip 192.135.1.78
main(config-subif)#standby pri
main(config-subif)#standby priority 200
main(config-subif)#standby pree
main(config-subif)#standby preempt
main(config-subif)#ip nat i
main(config-subif)#ip nat inside
main(config-subif)#ex
main(config-subif)#exit
main(config)#dhcp pool
main(config)#ip dhcp pool main-
%HSRP-6-STATECHANGE: FastEthernet0/0.5 Grp 14 state Speak -> Standby

%HSRP-6-STATECHANGE: FastEthernet0/0.5 Grp 14 state
main(config)#ip dhcp pool main-a
main(dhcp-config)#net
main(dhcp-config)#network 192.135.1.64 255.255.255.240
main(dhcp-config)#de
main(dhcp-config)#default-router 192.135.1.78
main(dhcp-config)#ex
main(config)#ip dhcp ex
main(config)#ip dhcp excluded-address 192.135.1.78
main(config)#ip dhcp excluded-address 192.135.1.65
main(config)#ip dhcp excluded-address 192.135.1.66
main(config)#acc
% Incomplete command.
main(config)#acc
main(config)#access-list 5 per
main(config)#access-list 5 permit 192.135.1.64 255.255.255.15
main(config)#
main(config)#int
main(config)#interface se
main(config)#interface serial 0/1/0
```

IOS Command Line

```
timers   Hello and hold timers
track    Priority Tracking
main(config-subif)#standby 13 ip 192.135.1.34
main(config-subif)#standby pri
main(config-subif)#standby priority 200
main(config-subif)#standby pree
main(config-subif)#standby preempt
main(config-subif)#ip nat in
main(config-subif)#ip nat inside
main(config-subif)#
%HSRP-6-STATECHANGE: FastEthernet0/0.4 Grp 13 state Speak -> Standby

%HSRP-6-STATECHANGE: FastEthernet0/0.4 Grp 13 state Standby -> Active

main(config-subif)#ex
main(config)#ip dhcp pool
main(config)#ip dhcp pool main-hu
main(dhcp-config)#net
main(dhcp-config)#network 192.135.1.32 255.255.255.224
main(dhcp-config)#de
main(dhcp-config)#default-router 192.135.1.34
main(dhcp-config)#ex
main(dhcp-config)#exit
main(config)#ip dhcp ex
main(config)#ip dhcp excluded-address 192.135.1.34
main(config)#ip dhcp excluded-address 192.135.1.33
main(config)#ip dhcp excluded-address 192.135.1.35
main(config)#acc
main(config)#access-list 3 p
main(config)#access-list 3 permit 192.135.1.0 0.0.0.31
main(config)#access-list 3 permit 192.135.1.32 0.0.0.31
main(config)#

main con0 is now available
```

PINGING

Main branch

```
C:\>tracert 218.210.0.26

Tracing route to 218.210.0.26 over a maximum of 30 hops:

 1  0 ms      0 ms      0 ms      192.135.0.2
 2  1 ms      0 ms      2 ms      218.210.0.10
 3  10 ms     1 ms      2 ms      218.210.0.26

Trace complete.

C:\>
```

Kandy Branch

```
Pinging 192.135.64.1 with 32 bytes of data:

Reply from 218.210.0.17: bytes=32 time=5ms TTL=250
Reply from 218.210.0.17: bytes=32 time=5ms TTL=250
Reply from 218.210.0.17: bytes=32 time=10ms TTL=250
Reply from 218.210.0.17: bytes=32 time=5ms TTL=250

Ping statistics for 192.135.64.1:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 10ms, Average = 6ms

Pinging 218.210.0.17 with 32 bytes of data:

Reply from 218.210.0.17: bytes=32 time=5ms TTL=250
Reply from 218.210.0.17: bytes=32 time=5ms TTL=250
Reply from 218.210.0.17: bytes=32 time=61ms TTL=250
Reply from 218.210.0.17: bytes=32 time=10ms TTL=250

Ping statistics for 218.210.0.17:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 61ms, Average = 20ms

C:\>ping 192.135.64.1
C:\>ping 218.210.0.18

Pinging 218.210.0.18 with 32 bytes of data:

Reply from 218.210.0.18: bytes=32 time=4ms TTL=251
Reply from 218.210.0.18: bytes=32 time=4ms TTL=251
Reply from 218.210.0.18: bytes=32 time=10ms TTL=251
Reply from 218.210.0.18: bytes=32 time=6ms TTL=251
```

R&D Center

```
Reply from 218.210.0.17: bytes=32 time=1ms TTL=255
Reply from 218.210.0.17: bytes=32 time<1ms TTL=255
Reply from 218.210.0.17: bytes=32 time<1ms TTL=255
Reply from 218.210.0.17: bytes=32 time<1ms TTL=255

Ping statistics for 218.210.0.17:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 218.210.0.49

Pinging 218.210.0.49 with 32 bytes of data:

Reply from 218.210.0.49: bytes=32 time=5ms TTL=250
Reply from 218.210.0.49: bytes=32 time=5ms TTL=250
Reply from 218.210.0.49: bytes=32 time=89ms TTL=250
Reply from 218.210.0.49: bytes=32 time=10ms TTL=250

Ping statistics for 218.210.0.49:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 89ms, Average = 27ms

Pinging 218.210.0.1 with 32 bytes of data:

Reply from 218.210.0.1: bytes=32 time=2ms TTL=253

Ping statistics for 218.210.0.1:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 2ms, Average = 2ms
```

Port Security

```
Switch>enable
Switch#show po
Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
  (Count)          (Count)          (Count)
-----
 Fa0/1           1              1              0      Shutdown
-----
Switch#
```

MAC Address

Vlan	Mac Address	Type	Ports
----	-----	-----	-----
30	0009.7c18.0c01	DYNAMIC	Fa0/2
30	000d.bddd.e001	DYNAMIC	Fa0/2
30	00e0.f709.a79b	STATIC	Fa0/1

```
Switch#
```

Line Security

```
Router>enable
Router#confi t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#lin
Router(config)#line con
Router(config)#line console 0
Router(config-line)#pass
Router(config-line)#password router
Router(config-line)#logi
Router(config-line)#login
Router(config-line)#ex
% Ambiguous command: "ex"
Router(config-line)#exit
Router(config)#^Z
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

53

```
User Access Verification

Password:

Router>
```

Password = router

Redundancy

From the primary router

```
c:\>tracert 218.210.0.26

Tracing route to 218.210.0.26 over a maximum of 30 hops:
  1  *          *          0 ms      192.135.0.1
  2  0 ms       1 ms       0 ms      218.210.0.2
  3  0 ms       2 ms       1 ms      218.210.0.26

Trace complete.
```

```
c:\>
```

] Top

From the secondary router

```
C:\>tracert 218.210.0.26
```

```
Tracing route to 218.210.0.26 over a maximum of 30 hops:
```

1	0 ms	0 ms	0 ms	192.135.0.2
2	1 ms	0 ms	2 ms	218.210.0.10
3	10 ms	1 ms	2 ms	218.210.0.26

```
Trace complete.
```

```
C:\>
```