

# **GROUP ASSIGNMENT**

## **LEVEL 4**

**CF2231COM– Networking Concepts and Cybersecurity**

**Instructor: Sir. Vidura Perera**

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## **Introduction**

E-gaming unlimited, a gaming company, has grown their operations into a new building and wants to completely redo their network infrastructure across 3 buildings. Building A is the HQ and contains the Server/Data Center, Games Design, Engine Development, AI, Support Services and ICT teams. Building B contains the Marketing, Events Support Services and ICT teams. Finally building C contains the E-Sports, Support Services and ICT teams.

Table 1: Summary of Network implementations

Location	Network	Number Of Hosts
A	ICT	16
	Server/Data Center	8
	Games Design	48
	Engine Development	12
	AI	8
	Support Services	40
B	ICT	10
	Marketing	16
	Events	32
	Support Services	8
C	ICT	50
	E-Sports	6
	Support Services	5

This report will contain all the required configurations, documentations and reasoning as requested by the assignment.

# **The Network Design**

## **A Three-layer Hierarchical Model**

Originally designed by CISCO, A three-layer hierarchical model was used for the network in order to connect buildings A, B and C. This network infrastructure contains 3 main layers, they are.

The Access layer – With the use of layer 2 switches and access points, this layer will connect the end users to the network.

The Distribution Layer – This layer is used for communication between the Access layer and the core layer. Some of its other key functions are routing, filtering and relocating packets so it has the fastest route to the core.

The Core Layer – Commonly known as the network backbone, this layer is designed to transports packets /network traffic at high speeds across multiple modules and components.

(CISCO Press, 2014)

## **Advantages Of A Three-Layer Model**

A Three-layer hierarchical network model has many advantages that make it far superior. This hierarchy allows better network management as the network grows and therefore has easier maintainability over time, furthermore it has impeccable troubleshooting management as it isolates and resolves situations quickly. In addition to this, three-layer models have high scalability, which allows them to efficiently work with large and increasing workloads and expand their network capacity without an issue, which means expansion will be easy to plan out and implement.

Over time as the network expands and grows, it is important to maintain availability throughout the system, this can be achieved as three-layer models, support redundancy measures. Therefore, it is almost guaranteed that there will be no points of failure as switches will have backups and be accounted for.

Overall, three-layer networks are efficient, cost-effective, trustworthy, maintain high speeds and are easily maintainable networks which will be greatly useful to E-gaming. (Omnisecu)

## Hardware Devices Used In The Network

### Access Layer:

A Catalyst 9300X copper model device was used. With 48 ports and up to 10G speed, this will be more than sufficient for E-gaming. However, there are other models that support higher speeds, yet this would drastically reduce the number of ports available. Therefore, this device was used when planning the network.

### Distribution Layer:

A Catalyst 9500 25G model device was used. With 48 ports that support 25G speeds and supports stack wise technology allowing additional devices to be added if necessary. However, there are other models that support up to 100G speeds, yet this would reduce the number of ports available. Therefore, this device was used when planning the network.

### Data Center:

A Nexus 3600 series (3636C-R) device was used. With 144 ports that support 25G speeds. However, this models also support up to 100G speeds, yet this would reduce the number of ports available to 36. Therefore, this devices configuration was used when planning the network.

### Router:

A Catalyst 8300 (2N2S-4T2X) edge platform device was used. With 12 CPU cores, up to 64GB of DRAM and supports 5G SD-WAN throughput. This device will be effective for E-gaming's organization.

The links below may be used to further show the benefits of the above selected models.

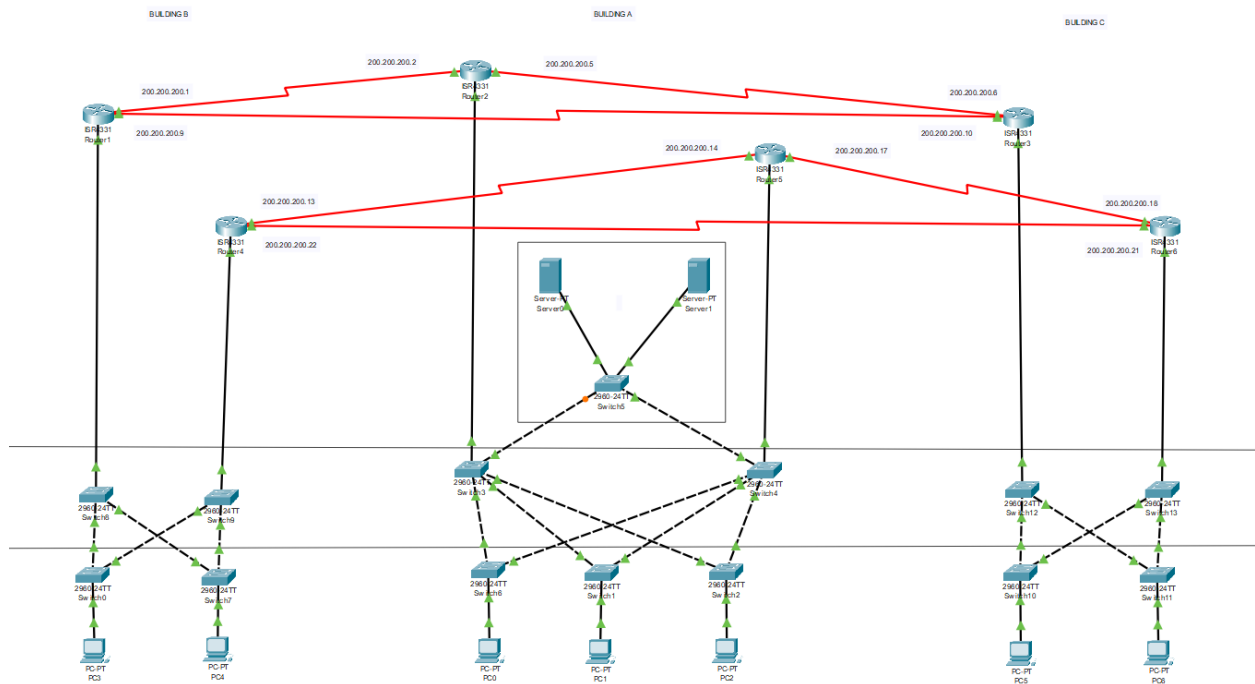
<https://www.cisco.com/c/en/us/products/switches/catalyst-9300-series-switches/index.html>

<https://www.cisco.com/c/en/us/products/switches/catalyst-9500-series-switches/index.html>

<https://www.cisco.com/c/en/us/products/switches/nexus-3000-series-switches/models-comparison.html#~tab-nexus3600>

<https://www.cisco.com/c/en/us/products/routers/catalyst-8300-series-edge-platforms/index.html>

# E-gaming Unlimited Network Layout



Summary Table

	Building A	Building B	Building C
Hosts	132	61	66
Access Layer	3 Switches	2 Switches	
Data Center	2 Servers/ 1 switch	-	
Distribution Layer	2 Switches	2 Switches	
Edge Layer	3 Routers (with Backup)		

## **Layer 2 Technologies**

### **VLAN (Virtual Local Area Network)**

A VLAN is a subnetwork and is a collection of devices or network nodes which are all located in separated physical locations and connected to separate LANs. Similar to a LAN, devices in the VLAN can communicate with each other as if it is a singular LAN connection. VLANs are usually used by large business networks so that they can change aspects of their system without having to change their infrastructure.

#### **Advantages Of A VLAN**

VLANs are cost effective as workstations communicate with each other using VLAN switches, instead of routers. While routers cause bottlenecks, the switches can take on higher amounts of data and reduce the networks overall latency as well.

Further they allow network administrators to limit access for certain users and implement security measures easily, and when users change their workstations there is no need to reconfigure the network. This makes VLANs less time consuming, easily manageable and has higher security.

VLANs are very helpful as they can identify and isolate problems and errors in each LAN as they are not directly connected to each other. Yet, they are more flexible than physical networking solutions. (N-able,2019)

#### **Disadvantages Of A VLAN**

It is still possible for there to be security issues, as a virus can keep spreading across the logical network and VLAN packets have a high chance to be leaked into another VLAN. Further a router will be required for larger workloads and Inter-VLAN communication (Tinyans, 2021)

#### **Reasoning For Using VLANS**

At E-Gaming, VLANs are used in order to utilize each of the ports on all the switches rather than purchasing and connecting a new switch for each department. This is cost effective and efficient.



## Switching

Switches are devices that will separate collision domains, and process data at high speeds. As networks are segmented by switches, it reduces the number of devices that will share bandwidth thus providing more bandwidth per user. However, switches will only forward data to designated ports based on their Mac address. GeeksForGeeks, (2022)

There are 3 types of switching methods commonly used –

1. Circuit Switching
2. Packet Switching
3. Message Switching

### **Advantages of Switching**

Switching will increase the bandwidth of the network and make more available for each user, by doing so it also increases the overall productivity and performance of the network as it reduces network traffic.

Further, the workload of each individual workstation will reduce as it sends information to only the devices that have been addressed, instead of broadcasting it all. Switches also create the collision domain for all the networks so therefore there will be less frame collision.

### **Disadvantages of Switching**

A switch will need to be properly configured and designed to handle multicast packets. Further they cannot identify and resolve network connectivity issues easily. In addition to this, if there are no redundancy measures put into place, the failure of 1 switch will disconnect the connected devices. (JavaTpoint)

### **Reasoning For Using Switching**

Switching allows interconnected nodes to transmit data between defined points in a network. This therefore allows an easier exchange of information, which is necessary for all systems, rather than connecting each device individually.

## Spanning Tree Protocol

Spanning tree protocol (STP) is an algorithm, which searches for redundant links in the LAN and then selects the fastest route for the data. This method prevents loops and therefore, allows switches to communicate with each other to find loops across layer 2. There are many different protocols of STP but most efficient and effective are, RSTP and MSTP. (CISCO Press, 2017)

### **Advantages Of Spanning Tree Protocol**

Prevents unneeded loops in the network, which removes the risk of sending the same information multiple time thus reducing network traffic. It also provides link redundancy in case of a failure, therefore if one path is not functioning correctly, a new one will open up. MSTPs are the advanced and newer versions of STP and therefore solves many problems.

### **Disadvantages Of Spanning Tree Protocol**

In the process of blocking off redundant routes, a STP reduces the available bandwidth in the network and in the long run may affect the latency of the network as well as degrading application performance. Further a STP cannot be divided into smaller domains in order for fault isolation, or multitenancy to be effective. (DeCusatis, 2014)

### **Reasoning For Using Spanning Tree Protocol**

Spanning tree protocol is a necessary algorithm which allows redundancy measures to be ready when needed but also stops loops from occurring in the network. E-gaming will find this very useful as it also reduces network traffic.

## **Layer 3 Technologies**

### **Dynamic Host Configuration Protocol (DHCP)**

Dynamic Host Configuration Protocol is a network management protocol which is used to automate details such as IP address, default gateway address and other network configurations to all the devices hosted on the network. DHCP is an efficient way of managing IP address and saving the network administrator a lot of time.

#### **Advantages of DHCP**

The implementation of DHCP means all errors caused during manual IP address configuration is reduced. As the management protocol automates it, address will be efficiently and reliably given without mistakes. Furthermore, this greatly reduces the workload of both the network administrator and the IT staff as they will not need to configure and assign IP address manually and waste time. (Microsoft, 2021)

DHCP is greatly beneficial for wireless access, and even allows more than 2 dynamic IP address pools on separate IP networks. But still allows the network administrator to configure more DHCP option types.

#### **Disadvantages of DHCP**

The automation of DHCP comes with major security risks. As users can connect to a server, which is not under control by the IT staff, but still in the network, those users can intercept and access any information passed through that channel. Therefore, violating many privacy agreements and putting user information at risk.

Further incase a DHCP server fails and does not have a backup, computers will fail to get and renew IP address and network access will be restricted until the DHCP server is function again. Finally, if the network has many subnetworks a single server will not be sufficient and will therefore require additional time, money and configurations.

## **Reasoning For Using DHCP**

E-gaming will be using DHCP, as it provides a faster and more efficient system when it comes to assigning IP addresses, with this in place the IT staff will have less to worry about and may focus on other issues.

## **Internet Protocol (IP)**

This is an address which is used to identify all the devices connected on a network. They are also a set rules and standards which must be followed when sending packets across networks.

There are 3 main types of IP address, they are –

1. Consumer IP addresses
2. Private IP addresses
3. Public IP addresses – This can be further divided into static and dynamic addresses.  
(Kaspersky)

## **Advantages Of Internet Protocol**

This is a standard protocol, which can easily be used effectively for many networking issues, and as it is not owned by any institution it can be used for any organization's needs. Further as it is highly scalable, changes can be made to the network while it is still operational.

As IP address are assigned to each device on the network, it will make them easily recognizable and therefore more manageable and easier to control and restrict. It is also important to state that cross platform communication is possible as different OS systems and hardware architectures do not affect the communication.

## **Disadvantages Of Internet Protocol**

With the use of IP, users will be vulnerable for many security risks such as hackers tracking your network and exploiting it, online stalking and harassment and much more. Furthermore, IP addresses may be given to a pool of users due to a lack of available address this therefore makes it harder to verify and trust users and mean there must be added layers of security.

## **Reasoning for using Internet Protocol**

It is an industry standard used across multiple networks for many years. E-gaming will use IPv4 in order have to communicate over their network and smoothly run their operations.

### **IP Routing**

IP routing is a set of protocol's that chooses the most efficient path for data to flow from network to network in order for it to reach its destination. The routers present in layer 3 are responsible for this and create a forwarding table which shows the final destination and hop addresses.

IP routing can be divided into many different protocols, but the most efficient are, *Open Shortest Path First* (OSPF), *Border Gateway Protocol* (BGP), *Intermediate System to Intermediate System* (IS-IS) and *Routing Information Protocol* (RIP) (Metaswitch)

### **Advantages Of IP Routing**

IP routing will determine the best route for packets to be transmitted on and will ensure that they are safely received. It is an efficient and reliable protocol which offers stability and ensures that the packets are not leaked during transmissions. IP routing also gives dynamic routing updates from the network path. Furthermore, no matter the size of the network IP routing will work well and is suitable for all types of topologies.

### **Disadvantages Of IP Routing**

Depending on the protocol the organization will follow the initial setup of IP routing will be complex and time consuming. Further, it is more likely to choose a router with higher bandwidth, even if there is more traffic on it and even if there's a router available with less traffic but less bandwidth.

### **Reasoning for using IP Routing**

This is a fast and efficient way for passing packets in the system. E-Gaming will be using RIPv2 which allows the use of VLSM and does not have a high hop count when passing data, so it will be received faster.

# **WAN Technologies**

## **Ethernet WAN**

Ethernet was first used for only connectivity and communications in a LAN, however internet service providers have evolved it, and is now available in WAN as well.

### **Advantages of Ethernet WAN**

Ethernet WAN provides layer 2 with a higher bandwidth which is capable of managing lots of data including video, voice and more all on the same system. It is therefore cost effective and allows organizations to connect multiple networks to each other. It is also easy to set up ethernet WANs from existing Ethernet LANs

### **Disadvantages of Ethernet WAN**

Ethernet may be time consuming and hard to install and configure and it is possible that the number of connections will be limited.

### **Reasoning for using Ethernet WAN**

Ethernet will be essential to connecting to the internet and interconnecting all the devices on the network which are necessary for communication.

## **Packet Switching**

This is when data is transmitted across a network by breaking it down into smaller packets so that it can quickly be transferred to its destination. Once the packets are broken down it finds the most efficient route and sends the transmission.

There are two main types of packet switching methods,

1. Connectionless – All the packets will have all the routing information, but this means they will be sent on different paths depending on the network nodes.

2. Connection-oriented – In this method data packets are assembled and numbered and then sent in a sequence on a pre-defined route

### **Advantages Of Packet Switching**

Data packets can find their destination without a dedicated channel in place, this also means that it is more cost and time effective since a dedicated channel isn't used. Further packet switching resends lost packets therefore the chances of data loss are very low. Costs are also drastically reduced as it does not need a secondary storage, and many users may use one channel.

### **Disadvantages Of Packet Switching**

Packet switching isn't ideal for constant usage such as video calls and voice calls as this may lead to loss of packets and high traffic on the network, while there is high traffic, data packets cannot be resent quickly. Furthermore, there isn't a lot of security in place for packets during the transmission, and the required protocols are complex.

(WatElectronics, 2021)

### **Reasoning For Using Packet Switching**

It is cheaper for E-Gaming to maintain packet switching rather than a network for communication, it is also efficient when sending files or large documents as they will be received quickly.

### **Frame Relay**

Frame relay is a protocol which is used to connect LANs together using virtual circuits, and then transmit the data across a WAN. It transmits data of all different sizes and even has a congestion mechanism, which is used to reduce network overheads. (GeeksForGeeks, 2021)

There are two types of frame relays,

1. Permanent Virtual Circuit
2. Switched Virtual Circuit

### **Advantages Of Frame Relay**

As there is no error detection there is less overhead and higher speeds available, with incorporation of a congestion mechanism as well overheads are drastically reduced. Making the network more efficient. Further the bandwidth is allocated dynamically, and it provides a secure connection that will protect the data.

### **Disadvantages Of Frame Relay**

There may be delays in receiving the packets while passing through each node, and different frames may cause further delays for users. It isn't optimal for real time data as delays may cause issues

(RF wireless)

### **Reasoning For Using Frame Relay**

Frame relays are the cheaper and more cost-effective options as they easily connect LANs together rather than E-Gaming buying multiple routers and building a WAN.



# Configurations

## VLAN Configurations

### Building A

A#show vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gig0/1, Gig0/2
10	ICT	active	Fa0/1, Fa0/2, Fa0/3
20	Server	active	Fa0/4, Fa0/5, Fa0/6
30	GamesDesign	active	Fa0/7, Fa0/8, Fa0/9
40	EngineDevelopment	active	Fa0/10, Fa0/11, Fa0/12
50	AI	active	Fa0/13, Fa0/14, Fa0/15
60	SupportServices	active	Fa0/16, Fa0/17, Fa0/18
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

### Building B

B>show vlan

VLAN	Name	Status	Ports
1	default	active	Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10	ICT	active	Fa0/1, Fa0/2, Fa0/3
20	Marketing	active	Fa0/4, Fa0/5, Fa0/6
30	Events	active	Fa0/7, Fa0/8, Fa0/9
40	SupportServices	active	Fa0/10, Fa0/11, Fa0/12
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

### Building C

C>show vlan

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, Fa0/21, Fa0/22, Fa0/23 Fa0/24, Gig0/1, Gig0/2
10	E-Sports	active	Fa0/1, Fa0/2, Fa0/3
20	ICT	active	Fa0/4, Fa0/5, Fa0/6
30	SupportServices	active	Fa0/7, Fa0/8, Fa0/9
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

## Sub Interface Configurations

### Building A

```
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0/0    198.229.200.1  YES manual  up          up
GigabitEthernet0/0/1    unassigned      YES unset   administratively down down
GigabitEthernet0/0/2    unassigned      YES unset   administratively down down
Serial0/1/0             200.200.200.2  YES manual  up          up
Serial0/1/1             200.200.200.5  YES manual  up          up
Vlan1                   unassigned      YES unset   administratively down down
```

### Building B

```
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0/0    192.240.156.1  YES manual  up          up
GigabitEthernet0/0/1    unassigned      YES unset   administratively down down
GigabitEthernet0/0/2    unassigned      YES unset   administratively down down
Serial0/1/0             200.200.200.1  YES manual  up          up
Serial0/1/1             200.200.200.9  YES manual  up          up
Vlan1                   unassigned      YES unset   administratively down down
```

### Building C

```
Router#show ip interface brief
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0/0    195.160.144.1  YES manual  up          up
GigabitEthernet0/0/1    unassigned      YES unset   administratively down down
GigabitEthernet0/0/2    unassigned      YES unset   administratively down down
Serial0/1/0             200.200.200.6  YES manual  up          up
Serial0/1/1             200.200.200.10 YES manual  up          up
Vlan1                   unassigned      YES unset   administratively down down
```

## DHCP Pool

### Building A

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

```
Pool bulidingA :
Utilization mark (high/low)    : 100 / 0
Subnet size (first/next)       : 0 / 0
Total addresses                 : 254
Leased addresses               : 0
Excluded addresses             : 1
Pending event                   : none

1 subnet is currently in the pool
Current index      IP address range      Leased/Excluded/Total
198.229.200.1     198.229.200.1 - 198.229.200.254  0 / 1 / 254
```

## Building B

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

```
Pool buildingB :
  Utilization mark (high/low)      : 100 / 0
  Subnet size (first/next)          : 0 / 0
  Total addresses                   : 254
  Leased addresses                  : 2
  Excluded addresses                : 1
  Pending event                    : none

  1 subnet is currently in the pool
  Current index      IP address range      Leased/Excluded/Total
  192.240.156.1      192.240.156.1 - 192.240.156.254  2 / 1 / 254
```

## Building C

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

```
Pool buildingC :
  Utilization mark (high/low)      : 100 / 0
  Subnet size (first/next)          : 0 / 0
  Total addresses                   : 254
  Leased addresses                  : 2
  Excluded addresses                : 1
  Pending event                    : none

  1 subnet is currently in the pool
  Current index      IP address range      Leased/Excluded/Total
  195.160.144.1      195.160.144.1 - 195.160.144.254  2 / 1 / 254
```

## DHCP Configurations

### Building A

IP Configuration	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
IPv4 Address	<input type="text" value="198.229.200.3"/>
Subnet Mask	<input type="text" value="255.255.255.0"/>

Gateway/DNS IPv4	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
Default Gateway	<input type="text" value="198.229.200.1"/>
DNS Server	<input type="text" value="1.1.1.1"/>

## Building B

IP Configuration	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
IPv4 Address	192.240.156.4
Subnet Mask	255.255.255.0

Gateway/DNS IPv4	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
Default Gateway	192.240.156.1
DNS Server	1.1.1.1

## Building C

IP Configuration	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
IPv4 Address	195.160.144.4
Subnet Mask	255.255.255.0

Gateway/DNS IPv4	
<input checked="" type="radio"/> DHCP	
<input type="radio"/> Static	
Default Gateway	195.160.144.1
DNS Server	1.1.1.1

## IP Routing (RIP)

### Building A

```
Router#show ip rip database
192.240.156.0/24    auto-summary
192.240.156.0/24
    [1] via 200.200.200.1, 00:00:16, Serial0/1/0
195.160.144.0/24    auto-summary
195.160.144.0/24
    [1] via 200.200.200.6, 00:00:08, Serial0/1/1
198.229.200.0/24    auto-summary
198.229.200.0/24    directly connected, GigabitEthernet0/0/0
200.200.200.0/30    auto-summary
200.200.200.0/30    directly connected, Serial0/1/0
200.200.200.4/30    auto-summary
200.200.200.4/30    directly connected, Serial0/1/1
200.200.200.8/30    auto-summary
200.200.200.8/30
    [1] via 200.200.200.1, 00:00:16, Serial0/1/0    [1] via 200.200.200.6, 00:00:08,
Serial0/1/1
```

### Building B

```
Router#show ip rip database
192.240.156.0/24    auto-summary
192.240.156.0/24    directly connected, GigabitEthernet0/0/0
195.160.144.0/24    auto-summary
195.160.144.0/24
    [1] via 200.200.200.10, 00:00:28, Serial0/1/1
198.229.200.0/24    auto-summary
198.229.200.0/24
    [1] via 200.200.200.2, 00:00:09, Serial0/1/0
200.200.200.0/30    auto-summary
200.200.200.0/30    directly connected, Serial0/1/0
200.200.200.4/30    auto-summary
200.200.200.4/30
    [1] via 200.200.200.2, 00:00:09, Serial0/1/0    [1] via 200.200.200.10, 00:00:28,
Serial0/1/1
200.200.200.8/30    auto-summary
200.200.200.8/30    directly connected, Serial0/1/1
```

## Building C

```
Router#show ip rip database
192.240.156.0/24    auto-summary
192.240.156.0/24
    [1] via 200.200.200.9, 00:00:19, Serial0/1/1
195.160.144.0/24    auto-summary
195.160.144.0/24    directly connected, GigabitEthernet0/0/0
198.229.200.0/24    auto-summary
198.229.200.0/24
    [1] via 200.200.200.5, 00:00:17, Serial0/1/0
200.200.200.0/30    auto-summary
200.200.200.0/30
    [1] via 200.200.200.5, 00:00:17, Serial0/1/0    [1] via 200.200.200.9, 00:00:19,
Serial0/1/1
200.200.200.4/30    auto-summary
200.200.200.4/30    directly connected, Serial0/1/0
200.200.200.8/30    auto-summary
200.200.200.8/30    directly connected, Serial0/1/1
```

## Trunk Ports

### Building A

```
A#show int trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/19    on         802.1q         trunking    1
Fa0/20    on         802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/19    1-1005
Fa0/20    1-1005

Port      Vlans allowed and active in management domain
Fa0/19    1,10,20,30,40,50,60
Fa0/20    1,10,20,30,40,50,60

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/19    1,10,20,30,40,50,60
Fa0/20    1,10,20,30,40,50,60
```

### Building B

```
B#show int trunk
Port      Mode      Encapsulation  Status      Native vlan
Fa0/19    on         802.1q         trunking    1
Fa0/20    on         802.1q         trunking    1

Port      Vlans allowed on trunk
Fa0/19    1-1005
Fa0/20    1-1005

Port      Vlans allowed and active in management domain
Fa0/19    1,10,20,30,40
Fa0/20    1,10,20,30,40

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/19    1,10,20,30,40
Fa0/20    1,10,20,30,40
```

## Building C

C#show int trunk

Port	Mode	Encapsulation	Status	Native vlan
Fa0/19	on	802.1q	trunking	1
Fa0/20	on	802.1q	trunking	1

Port Vlans allowed on trunk

Fa0/19	1-1005
Fa0/20	1-1005







Port Vlans allowed and active in management domain

Fa0/19	1,10,20,30
Fa0/20	1,10,20,30







Port Vlans in spanning tree forwarding state and not pruned

Fa0/19	10,20,30
Fa0/20	1,10,20,30

## Host Pings

	Successful	PC0	PC3	ICMP		0.000	N	0	(edit)	(delete)
	Successful	PC3	PC5	ICMP		0.000	N	1	(edit)	(delete)
	Successful	PC5	PC0	ICMP		0.000	N	2	(edit)	(delete)

## Router Pings

	Successful	Router2	Router1	ICMP		0.000	N	0	(edit)	(delete)
	Successful	Router1	Router3	ICMP		0.000	N	1	(edit)	(delete)
	Successful	Router3	Router2	ICMP		0.000	N	2	(edit)	(delete)

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