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1. Introduction:

The purpose of this assignment is to layout a community infrastructure for Cloud Co., a organisation that is making plans to improve its IT offerings in multiple places, which includes Kuala Lumpur (HQ), Singapore, and Australia. As a community executive, my venture is to increase a community design and configuration plan that helps the organisation's evolving needs. The aim is to create a strong, scalable, and steady community that allows the corporation to manage its operations efficaciously throughout all its websites. The network ought to additionally meet particular overall performance and protection necessities to make certain reliable communique and statistics protection.

The major goals of this mission consist of presenting and imposing network configurations that beautify the security, functionality, and scalability of Cloud Co.'s infrastructure. One of the widespread layout factors will involve the use of VLANs to segregate one of a kind departments and improve community efficiency. The community may also comprise WLAN configurations within the Australia web page, the usage of Wireless LAN Controllers (WLC) to manage wireless get entry to and security throughout the community. Additionally, the layout will consciousness on implementing Layer 2 safety mechanisms to shield against commonplace protection threats in the nearby region community (LAN), making sure the community stays resilient to assaults inclusive of MAC flooding, ARP poisoning, and VLAN hopping

The layout additionally desires to cope with some crucial networking protocols, consisting of OSPF for routing, in addition to the setup of HSRP (Hot Standby Router Protocol) for redundancy to make certain the community keeps excessive availability. The network will be configured to help diverse server packages, consisting of DNS, FTP, and Web Servers, which are crucial for the internal services of the organisation. In addition, EtherChannel can be used to enhance bandwidth and fault tolerance among switches, in addition strengthening the reliability of the community.

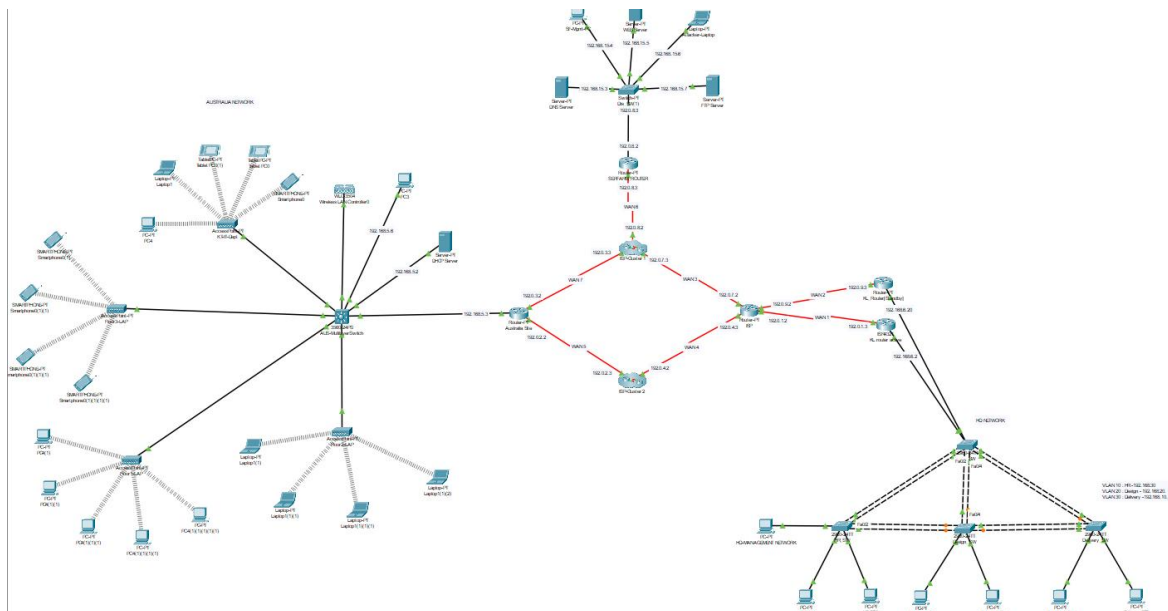
In the path of this project, the community layout and configurations may be evaluated the usage of Cisco Packet Tracer, a community simulation tool. This simulation allows for checking out the feasibility and overall performance of the proposed network layout. The intention is to make sure the entire network infrastructure, including the configuration of routers, switches, and WLAN components, supports the organization's operational and protection necessities correctly. By

following first-rate practices in network design and safety, the solution will offer Cloud Co. With a steady, green, and scalable network for all its places.

2. Network Topology Design:

In this phase, we will provide the distinctive design of the network topology for Cloud Co., protecting the Kuala Lumpur (HQ), Singapore (SG), and Australia (AU) web sites. The network design ensures green conversation throughout all locations, contains VLANs for protection and site visitors management, and addresses the key requirements for DHCP, routing, and security.

Cloud Co. Network Layout:



The community for Cloud Co. Consists of three number one locations: Kuala Lumpur (HQ), Singapore (SG), and Australia (AU). Each vicinity may have specific departments, and the network can be designed with appropriate segmentation for safety, overall performance, and scalability.

1. Kuala Lumpur (KL) – HQ Site

- The Kuala Lumpur site is the primary hub, housing critical departments which includes Management, HR, and Design.

- Each department will be assigned a completely unique VLAN to isolate visitors and enhance overall performance.
- Servers together with DNS, FTP, and Web servers will be positioned within the Server Farm, with a Router (R1) connecting the site to the far flung branches and external networks.

2. Singapore (SG) Site

- Singapore Site will host departments for finance, R&D and server farm. The Singapore server form will host important services such as DNS, FTP and web server, which will be available on all websites.
- A router (R6) will connect the SG website to HQ (KL) and Australia (AU) websites, which will ensure proper routing via OSPF.

3. Australia (AU) Site

- The Australia site will host the Delivery, Management, and IT departments. Additionally, the website would require Wireless LAN Controllers (WLC) to manipulate wireless get admission to.
- A Router (R7) will join the AU website online to the HQ and Singapore sites, using serial connections and OSPF for routing.

VLAN Design:

VLANs might be used to phase the community, providing efficient visitors control, improving safety, and simplifying community administration. Each department could be assigned a completely unique VLAN for higher traffic isolation.

The following VLANs and IP deal with ranges can be used for each department:

VLAN 10 – HR Department

- IP Range: 192.168.30.X/24
- VLAN 10 will aid the HR branch, wherein gadgets like HR employees's computers, printers, and workstations might be related. The HR department may have devoted network sources, ensuring their touchy information is remoted from the relaxation of the community.

VLAN 20 – Design Department

- IP Range: 192.168.20.X/24
- The Design Department may be assigned VLAN 20. The IP addresses for this department may be in the range 192.168.20.X/24, making sure that layout statistics and visitors are segregated from different departments to preserve high security.

VLAN 30 – Delivery Department

- IP Range: 192.168.10.X/24
- The Delivery Department might be isolated with VLAN 30, ensuring its visitors is saved break free different departments in the corporation.

Server Farm – Critical Server Infrastructure

- IP Range: 192.168.15.X/24
- The Server Farm in Singapore will host important network services like DNS, FTP, and Web servers. These offerings may be assigned static IP addresses in the 192.168.15.X variety to make sure reliable get entry to to those essential resources.

IP Addressing Table:

The following IP addressing desk provides an overview of the community's IP allocation, consisting of departments, routers, and servers:

Component	IP Address Range	Interface	VLAN
HR Department	192.168.30.x/24	FastEthernet	VLAN 10
Design Department	192.168.20.x/24	FastEthernet	VLAN 20
Delivery Department	192.168.10.x/24	FastEthernet	VLAN 30
Router (R1 - HQ)	192.168.6.2	FastEthernet	N/A
DNS Server	192.168.15.3	FastEthernet	N/A
FTP Server	192.168.15.4	FastEthernet	N/A
Web Server	192.168.15.5	FastEthernet	N/A
Router (R6)	192.0.8.2	FastEthernet	N/A
Router (R7)	192.168.5.3	FastEthernet	N/A
DHCP Range	192.168.5.6 (Start)	FastEthernet	N/A
R1 - R3 (ISP Router)	192.0.1.3	Serial	N/A
R2 - R3 (ISP Router)	192.0.9.3	Serial	N/A
R3 - R4 (ISP Cluster 1)	192.0.7.2	Serial	N/A
R3 - R5 (ISP Cluster 2)	192.0.4.3	Serial	N/A
R4 - R6 (Server Farm Router)	192.0.8.2	Serial	N/A
R5 - R7 (Australia Router)	192.0.2.3	Serial	N/A

DHCP Implementation:

DHCPv4 will be implemented to provide dynamic IP addressing throughout all places, allowing devices to routinely get hold of an IP deal with whilst linked to the network. DHCP will be installation inside the HQ and can be forwarded to the far off branches (Singapore and Australia) using DHCP Relay.

The DHCP Scope can be configured as follows:

- VLAN 10 (HR): IP address range 192.168.30.10 to 192.168.30.50
- VLAN 20 (Design): IP address variety 192.168.20.10 to 192.168.20.50
- VLAN 30 (Delivery): IP address range 192.168.10.10 to 192.168.10.50

Devices inside the HR, Design, and Delivery departments will automatically reap IP addresses based at the VLAN they may be linked to. Relay retailers will ahead DHCP requests from far off branches to the DHCP server on the HQ.

Routing Protocols and Connectivity:

To make sure green communicate between the specific branches, we can employ OSPF (Open Shortest Path First) as the routing protocol for dynamic routing. OSPF will be configured on each router at the HQ, Singapore, and Australia web sites, ensuring seamless conversation throughout all sites.

Each web page may have a completely unique OSPF area for top-rated course control. The routers will alternate routing statistics, allowing efficient direction selection for visitors between places..

Router Configuration Overview:

- R1 (HQ) will connect with R3 (ISP Router) and ahead traffic to Singapore and Australia.
- R6 (Singapore) will handle the connection to HQ and Australia.
- R7 (Australia) will offer routing offerings for the Australia web page, making sure connectivity with each the HQ and Singapore branches.

Redundancy and High Availability:

To make sure community reliability, HSRP (Hot Standby Router Protocol) will be used at the HQ and Singapore web sites. HSRP will provide router redundancy, so if the primary router fails, the secondary router will take over routing tasks, minimizing downtime.

Additionally, EtherChannel could be implemented between switches to mixture a couple of physical links into an un-attached logical hyperlink, improving bandwidth and fault tolerance.

Security Measures:

Security is a critical attention in this design, especially to guard in opposition to common threats along with MAC flooding, ARP spoofing, and VLAN hopping. To mitigate those threats:

- Port Security may be configured on all switches to save you unauthorized devices from having access to the community.
- DHCP Snooping might be enabled to save you rogue DHCP servers from distributing incorrect IP configurations.

- Dynamic ARP Inspection (DAI) can be used to prevent ARP spoofing attacks.
- WPA2 Encryption will steady wireless visitors inside the Australia web site.

3. WLAN Architecture and Configuration:

For the Australia Network, we're tasked with putting in place a WLAN (Wireless Local Area Network) that gives secure and efficient wireless access to the network. The WLAN configuration could be part of the bigger network infrastructure that helps Delivery, Management, and IT departments within the Australia workplace. Additionally, the configuration will use VLAN interfaces, set up a DHCP server for dynamic IP deal with allocation, and allow WPA2 authentication to ensure stable wi-fi conversation.

1. VLAN Configuration for WLAN Architecture:

The first essential step in setting up the WLAN within the Australia Network is to make certain proper network segmentation through VLANs (Virtual Local Area Networks). VLANs offer logical separation of community visitors, enhancing each security and efficiency by means of isolating distinct varieties of traffic.

Each branch within the Australia website online will be assigned to a separate VLAN to make sure that site visitors is contained within the branch's section of the community. By configuring VLAN interfaces on the switches and routers, every branch can have dedicated network sources which might be segregated from others.

Here are the key VLANs in order to be configured:

- **VLAN 10 for HR:**

```
HR_SW#show vlan
```

VLAN Name	Status	Ports
1 default	active	Pol, Fa0/3, Fa0/4, Fa0/7 Fa0/8, Fa0/9, Fa0/12, Fa0/13 Fa0/14, Fa0/15, Fa0/16, Fa0/17 Fa0/18, Fa0/19, Fa0/20, Fa0/21 Fa0/22, Fa0/23, Fa0/24, Gig0/1 Gig0/2
10 Delivery	active	
20 Design	active	
30 HR	active	Fa0/10, Fa0/11
40 Management	active	
99 Native	active	
1002 fddi-default	active	
1003 token-ring-default	active	
1004 fddinet-default	active	
1005 trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0

--More-- |

- The HR department wishes remoted sources to defend sensitive data. Devices in this VLAN will get hold of IP addresses within the range 192.168.30.X/24.
- **VLAN 20 for Design:**

VLAN	Name	Status	Ports
1	default	active	Pol, Po3, Fa0/7, Fa0/8 Fa0/9, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10	Delivery	active	
20	Design	active	Fa0/10, Fa0/11
30	HR	active	
40	Management	active	
99	Native	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0

The layout branch may also be assigned a devoted VLAN, ensuring that their traffic is separated from different departments for both performance and safety reasons. Devices on this VLAN could be assigned IP addresses from the range 192.168.20.X/24.

- **VLAN 30 for Delivery:**

```
show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/3, Fa0/4, Fa0/7, Fa0/8 Fa0/9, Fa0/12, Fa0/13, Fa0/14 Fa0/15, Fa0/16, Fa0/17, Fa0/18 Fa0/19, Fa0/20, Fa0/21, Fa0/22 Fa0/23, Fa0/24, Gig0/1, Gig0/2
10	Delivery	active	Fa0/10, Fa0/11
20	Design	active	
30	HR	active	
40	Management	active	
99	Native	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0

This VLAN will accommodate the gadgets within the Delivery Department, ensuring green verbal exchange and traffic control. The IP cope with variety can be 192.168.10.X/24.

VLAN Interface Configuration Commands:

The photo below indicates the configuration steps for creating VLANs at the switch, naming

them for the HR, Design, and Delivery departments. These VLANs may be configured on both the middle switch and WLC (Wireless LAN Controller) to make sure all network segments are related well.

```
DIS_SW(config)#vlan 10
DIS_SW(config-vlan)#name HR_VLAN
DIS_SW(config-vlan)#vlan 20
DIS_SW(config-vlan)# name Design_VLAN
DIS_SW(config-vlan)#vlan 30
DIS_SW(config-vlan)#name Delivery_VLAN
```

This set of commands defines the VLANs used for the respective departments and names them for this reason, which is a vital step in retaining clean community structure.

2. WPA2 Authentication for Secure Wireless Access:

Security is an crucial a part of any community, especially in relation to wi-fi get right of entry to. WPA2 (Wi-Fi Protected Access 2) is the cutting-edge popular for wi-fi encryption and gives a high stage of security for wi-fi communications. WPA2 makes use of AES (Advanced Encryption Standard) for encrypting records over wireless networks, making it difficult for attackers to intercept or decipher transmitted information.

For the Australia Network, we are able to configure the WLC (Wireless LAN Controller) to make certain WPA2 authentication is enabled for all wireless devices connecting to the network. This manner that everyone customers connecting through Wi-Fi will need to provide credentials which might be verified through a RADIUS (Remote Authentication Dial-In User Service) server, ensuring only legal users can be a part of the wireless community.

This authentication procedure helps prevent unauthorized get entry to to the wi-fi network, drastically improving community security.

By the use of WPA2 and probably integrating a RADIUS server, simplest authenticated users will be allowed get right of entry to the wireless community, making sure the security and integrity of the network.

4. Integrating Switch Ports and Access Points:

Once the WLAN and DHCP server are configured, the next step is integrating access points into the community. These access factors might be connected to the switches, and each get right of entry to factor might be assigned to the perfect VLAN based on the branch. For instance, the HR Access Point could be assigned to VLAN 10, the Design Access Point might be assigned to VLAN 20, and so forth.

```
HR_SW(config)#interface fastEthernet 0/1
HR_SW(config-if)#switchport mode access
HR_SW(config-if)#switchport access vlan 10
HR_SW(config-if)#
```

Switch ports linked to the get entry to points will need to be configured in Access Mode to make sure right VLAN tagging. Here's an example of a way to configure the switch ports:

- Port related to HR Access Point: Assign the port to VLAN 10
- Port linked to Design Access Point: Assign the port to VLAN 20
- Port related to Delivery Access Point: Assign the port to VLAN 30

This ensures that devices connecting to the wireless network are mapped to the correct VLAN and reap the right IP address from the DHCP server.

```
KLRouter(config)#interface GigabitEthernet 0/0/0.10
KLRouter(config-subif)#encapsulation dot1Q 10
KLRouter(config-subif)#ip address 192.168.30.1 255.255.255.0
```

Each access factor will broadcast the wireless signal for the respective VLAN, and wireless customers that join will mechanically get hold of the IP deal with assigned to their VLAN thru DHCP. This setup guarantees clean communicate for clients in each department and enables maintain the general protection and integrity of the network.

Summary of WLAN Configuration Steps:

1. VLAN Interface Configuration: VLANs are configured for HR, Design, and Delivery departments.
2. DHCP Server Configuration: A DHCP server is installation to offer dynamic IP addresses to WLAN customers based on their VLAN undertaking.
3. WPA2 Authentication: WPA2 with AES encryption is configured on the WLC, ensuring stable wi-fi get entry to.
4. Switch and Access Point Integration: Switch ports are configured for VLAN get admission to, and get entry to points are related to the community to provide wireless coverage.

By implementing these steps, the Australia Network can have a secure and green WLAN that supports the diverse departments and guarantees clean and remoted communicate. Each department will have its personal committed VLAN, and the network might be stable from unauthorized get right of entry to, thanks to WPA2 authentication.

4. WAN Configuration:

In this section, we can give an explanation for the WAN configuration technique for the community setup. The pics supplied supply perception into the OSPF configuration for the Wide Area Network (WAN), which incorporates interfaces, IP cope with assignments, and organising dynamic routing among routers.

1. Configuring Serial Interfaces with OSPF:

The first step in configuring the WAN is to ensure that the serial interfaces among the routers are efficiently configured. In the provided picture, we can see the configuration for a Serial 2/zero interface on a router. This interface has been assigned an IP address of 192.Zero.1.1/30 with a subnet mask of 255.255.255.252. The OSPF routing protocol will use this interface for verbal exchange between exceptional routers within the network.

- In the primary set of instructions, we are configuring the Serial 2/zero interface with the IP address and enabling it via the use of the no shutdown command. This step is essential as it ensures the interface is lively and capable of setting up verbal exchange with neighboring routers.

Command breakdown:

- Router(config)#interface serial 2/zero: This command enters the configuration mode for the Serial 2/0 interface.
- Router(config-if)#ip cope with 192.0.1.1 255.255.255.252: This command assigns the IP address 192.0.1.1/30 to the interface, and the subnet masks is 255.255.255.252.
- Router(config-if)#clock fee 64000: This command units the clock fee for the DCE (Data Communications Equipment) interface, which affords timing for the hyperlink.
- Router(config-if)#no shutdown: This command allows the interface, bringing it up for use.

```
Router(config)#interface serial 2/0
Router(config-if)#ip address 192.0.1.1 255.255.255.252
Router(config-if)#
00:39:28: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.30.1 on Serial2/0 from FULL to DOWN,
Neighbor Down: Interface down or detached

Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#
00:39:34: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.30.1 on Serial2/0 from LOADING to FULL,
Loading Done

Router(config-if)# no shutdown
Router(config-if)#
```

The first photo demonstrates the configuration commands applied to the Serial 2/0 interface of the router. These steps are critical for establishing WAN connectivity between routers.

2. OSPF Neighbors and OSPF State:

- Once the interface is configured and up, the following step is to enable OSPF (Open Shortest Path First), that is a dynamic routing protocol used to manage the routing between multiple routers. OSPF is utilized in WAN environments because it is scalable and adaptive to changes in the community.
- After allowing OSPF, the routers share OSPF friends to change routing facts. This guarantees that the network topology is up to date throughout all routers. The OSPF nation transitions from DOWN to FULL, and the OSPF friends grow to be completely adjacent. The display ip ospf neighbor command confirms this country by way of showing the OSPF friends, their state, and the interface they're related to.
- **FULL:** This nation suggests that the OSPF routers have exchanged full routing data, and their databases are synchronized.
- **Loading:** This state occurs while OSPF routers are replacing the link-country database (LSDB) information.
- **Down:** This country indicates that no OSPF neighbor relationship has been installed.

```
Router#show ip ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Address	Interface
192.0.4.2	0	FULL/ -	00:00:39	192.0.4.2	Serial7/0
192.168.30.1	0	FULL/ -	00:00:31	192.0.1.3	Serial2/0

```
Router#
```

The 2nd image displays the OSPF neighbor desk showing the router's OSPF pals. The neighbor with IP 192.0.4.2 and 192.168.30.1 are each inside the FULL nation, indicating that OSPF has efficaciously fashioned neighbor relationships between the routers.

3. Configuring OSPF Networks:

Next, OSPF wishes to be configured to allow routing between unique networks. This is finished by means of identifying the OSPF network and associating it with particular interfaces. The OSPF network command specifies which networks are to be marketed in OSPF updates.

- **Command Breakdown:**
- Router(config)#router ospf 1: This enters OSPF configuration mode for manner 1. Multiple OSPF approaches can exist, however in this example, system 1 is used.

- Router(config-router)#community 192.0.1.0 0.0.0.255 area 0: This command advertises the network 192.0.1.0/24 and associates it with Area 0 in OSPF. The 0.0.0.255 wildcard mask is used to suit the IP address variety of 192.0.1.0 to 192.0.1.255.
- Router(config-router)#network 192.168.6.0 0.0.0.255 area 0: This command advertises the 192.168.6.0/24 network and associates it with Area 0.
- Router(config-router)#network 192.168.30.0 0.0.0.255 area 0: This command advertises the 192.168.30.0/24 network to OSPF and provides it to Area 0.

```
Router(config)#router ospf 1
Router(config-router)#network 192.0.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.6.0 0.0.0.255 area 0
Router(config-router)#network 192.168.30.0 0.0.0.255 area 0
```

The 0.33 picture indicates the OSPF community configuration at the router. By the usage of the community command, we specify which IP degrees are advertised in OSPF. This is an crucial step in organising OSPF routing throughout the WAN.

4. WAN Configuration Summary:

The WAN configuration process for Cloud Co. Entails numerous key steps to set up communication among far off websites. Here's a summary of the configuration:

1. Interface Configuration: Serial interfaces have been configured with IP addresses and taken up the usage of the no shutdown command.
2. OSPF Configuration: The OSPF routing protocol turned into configured at the routers, along with the project of OSPF networks and the status quo of neighbor relationships.
3. OSPF Neighbor Formation: The routers successfully shaped OSPF pals, transitioning from Down to FULL state.
4. Dynamic Routing: By configuring OSPF networks, dynamic routing become enabled, allowing routers to proportion routing information routinely and correctly route site visitors between web sites.

By following those steps, Cloud Co. Effectively installation OSPF for dynamic routing throughout the WAN, ensuring reliable verbal exchange and scalability between its HQ in Kuala Lumpur, Singapore, and Australia branches. The use of OSPF as a dynamic routing protocol gives flexibility, as it could routinely adapt to changes in the network topology and ensure the maximum most suitable routes are continually used.

5. Proposed Wireless Network Architecture:

In this section, we will give an explanation for the proposed Wireless Network Architecture for the Australia Network of Cloud Co., focusing at the implementation of the WLC (Wireless LAN Controller), VLAN interface configuration, and DHCP server setup. The aim is to layout a community that helps wireless get admission to at the same time as keeping protection, efficiency, and scalability.

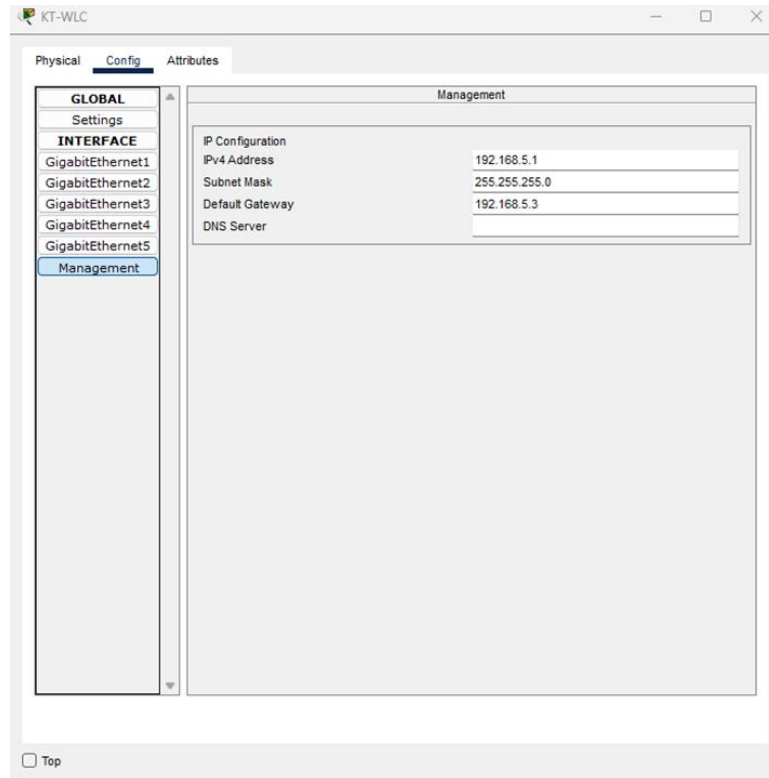
1. WLC (Wireless LAN Controller) Configuration:

The first step in setting up a wireless network is to configure the Wireless LAN Controller (WLC). The WLC is liable for handling access factors (APs), enforcing protection rules, and presenting centralized manage for the wi-fi community. It ensures that all wireless get right of entry to factors within the community are well configured and aligned with the network's dreams.

In the WLC configuration photograph, the management interface for the WLC is configured with the IP cope with 192.168.5.1, a subnet mask of 255.255.255.0, and a default gateway of 192.168.5.Three. This control interface permits network administrators to get admission to the WLC and configure the wi-fi community, in addition to display performance and troubleshoot any potential problems.

Key factors from the WLC configuration consist of:

- **IPv4 Address:** The WLC is assigned an IP deal with that falls in the control subnet to permit easy get entry to and centralized management.
- **Default Gateway:** This is the router or gateway liable for forwarding visitors from the WLC to different components of the network, specially to the internet or remote locations.
- **DNS Server:** Although now not unique in the photo, it's vital to include a DNS server for name decision, allowing clients to clear up domain names to IP addresses, especially for applications and offerings that require net get right of entry to.



The WLC serves as the nerve center for the wi-fi network. The control IP cope with guarantees administrators can configure and troubleshoot the whole wi-fi setup from a single vicinity, simplifying community maintenance and optimization.

2. VLAN Interface Configuration:

The next step within the wireless network structure is the VLAN interface configuration. This step entails creating distinctive VLANs for every branch, segmenting site visitors for better protection and performance. Each branch could be assigned its personal VLAN, and this VLAN can be used by the wireless customers to ensure that visitors is remoted based on the department.

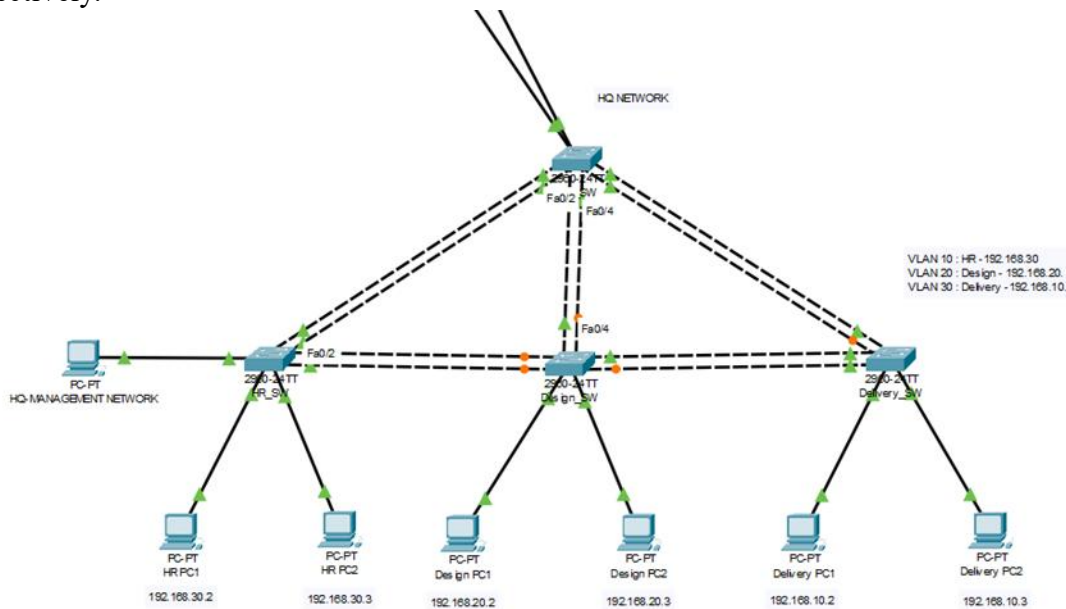
For instance, inside the proposed architecture, we will create the following VLANs:

- VLAN 10 for HR (IP deal with variety: 192.168.30.X)
- VLAN 20 for Design (IP deal with variety: 192.168.20.X)
- VLAN 30 for Delivery (IP cope with variety: 192.168.10.X)

These VLANs are configured to ensure that the HR, Design, and Delivery departments have their very own remoted networks. This segmentation improves both community overall performance by decreasing broadcast traffic and enhances security via keeping apart touchy branch statistics.

Each VLAN may be assigned a GigabitEthernet interface on the router or switch to enable routing between VLANs. The WLC may also be configured to companion specific get admission to points (APs) with the perfect VLANs. For example, the HR access point might be associated with VLAN 10, and further, Design and Delivery APs might be assigned to VLAN 20 and VLAN 30,

respectively.



Physical Config **Services** Desktop Programming Attributes

SERVICES

- HTTP
- DHCP**
- DHCPv6
- TFTP
- DNS
- SYSLOG
- AAA
- NTP
- EMAIL
- FTP
- IoT
- VM Management
- Radius EAP

DHCP

Interface: FastEthernet0 Service: ☒ On ☐ Off

Pool Name: serverPool

Default Gateway: 192.168.5.3

DNS Server: 192.168.5.2

Start IP Address: 192.168.5.6

Subnet Mask: 255.255.255.0

Maximum Number of Users: 250

TFTP Server: 0.0.0.0

WLC Address: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
serverPool	192.168.5.3	192.168.5.2	192.168.5.6	255.255.255.0	250	0.0.0.0	0.0.0.0

☐ Top

The photograph illustrates the VLAN interface configuration. Each VLAN is given an interface in order to allow communication throughout the wireless network. The VLAN interface configuration is essential to make sure the wi-fi network's traffic is segmented and routed nicely.

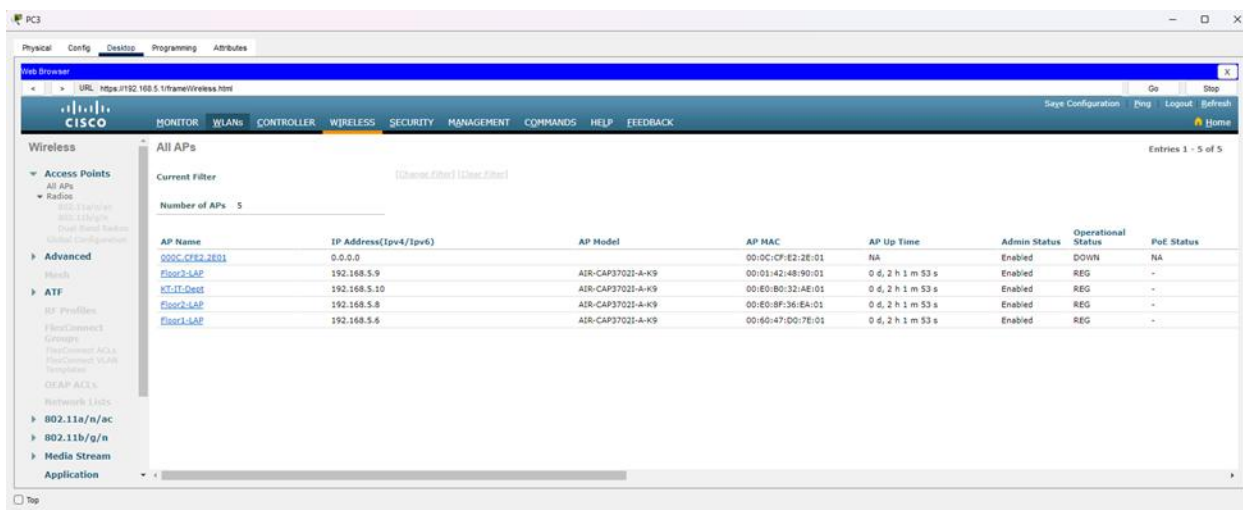
3. DHCP Server Configuration:

A important issue of a wireless network is the DHCP server. The DHCP server is chargeable for dynamically assigning IP addresses to wireless customers that connect with the network. Without DHCP, customers would want to manually configure their IP addresses, that's time-eating and errors-prone.

In the DHCP configuration photograph, the DHCP pool named serverPool is configured with the following parameters:

- Default Gateway: 192.168.5.3, which corresponds to the default gateway IP cope with for routing site visitors from wi-fi customers to different networks.
- DNS Server: 192.168.5.2, with a view to permit wireless customers to remedy domains into IP addresses.
- Start IP Address: 192.168.5.6, which marks the start line for assigning IP addresses from the DHCP pool.
- Subnet Mask: 255.255.255.0, an average subnet mask for small to medium-sized networks, making sure efficient IP address allocation.
- Maximum Number of Users: 250, indicating that up to 250 wi-fi clients can connect and reap IP addresses from the server pool.

By enabling DHCP on the wireless network, wi-fi customers inside the HR, Design, and Delivery departments will automatically acquire IP addresses in the proper variety. This eliminates the need for manual IP project and ensures efficient use of IP addresses.



The screenshot shows the Cisco WLC configuration page for the DHCP pool named 'serverPool'. The configuration is as follows:

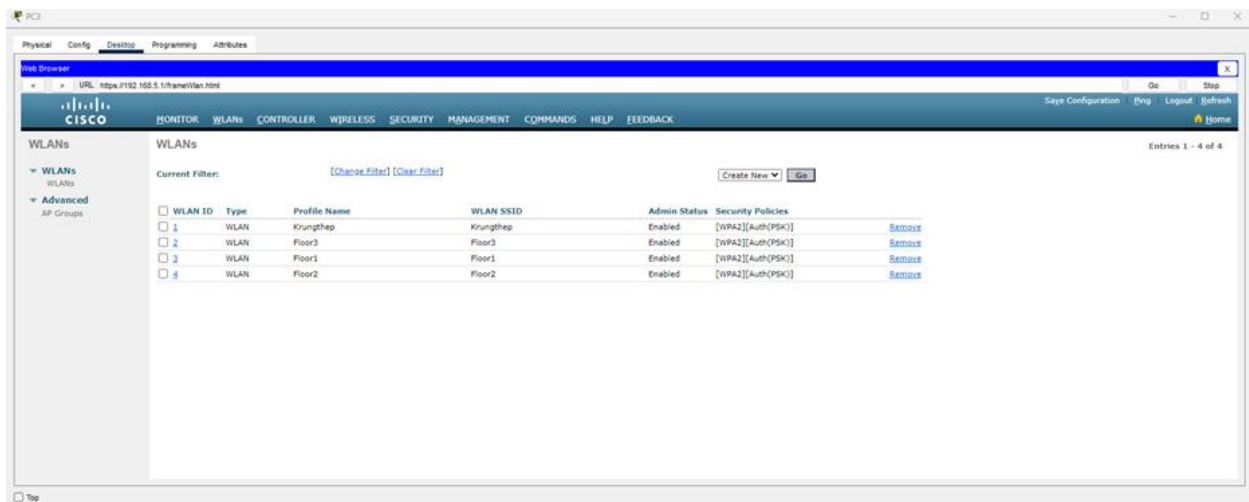
Parameter	Value
Pool Name	serverPool
Pool IP Address	192.168.5.6
Pool Subnet Mask	255.255.255.0
Pool Default Gateway	192.168.5.3
Pool DNS Server	192.168.5.2
Pool Maximum Number of Users	250

The DHCP server configuration allows dynamic IP address task for all wi-fi clients. This step is critical in ensuring that gadgets like laptops, smartphones, and drugs robotically receive IP addresses when they hook up with the wireless network, providing seamless community get entry to with out requiring guide configuration.

4. Access Point Configuration and Management:

The very last step in setting up the wi-fi network includes configuring the Access Points (APs). The APs are the gadgets that transmit and acquire wireless indicators, allowing wireless devices to connect with the community. In the photo displaying the AP configuration, five get right of entry to factors are indexed, every assigned a selected IP cope with within the 192.168.5.X variety.

The APs are managed centrally via the WLC. This centralized management permits the administrator to configure the SSIDs, protection settings, and radio parameters across all APs from a unmarried interface. The WLC guarantees that all APs are configured consistently, decreasing the risk of misconfigurations and making sure a seamless user experience across the entire wi-fi network.



The AP configuration interface suggests the AP models, MAC addresses, and IP addresses of the APs. The WLC is chargeable for monitoring and dealing with these APs, making sure that they're well incorporated into the community and are providing wireless insurance for the detailed VLANs.

Summary of Proposed Wireless Network Architecture:

The proposed wireless network for Cloud Co. In the Australia Network is designed to provide secure, dependable, and scalable wi-fi access to personnel throughout distinctive departments. The structure consists of:

1. WLC Configuration: Centralized control for all get admission to factors, imparting a single interface for tracking and configuration.
2. VLAN Interface Configuration: VLANs are installation for the HR, Design, and Delivery departments, making sure site visitors is properly segmented and isolated.
3. DHCP Server Configuration: A DHCP server is configured to dynamically assign IP addresses to wi-fi customers, ensuring seamless connectivity without the need for guide IP configuration.
4. Access Point Management: The APs are controlled thru the WLC, allowing for consistent configuration and tracking throughout the entire wireless network.

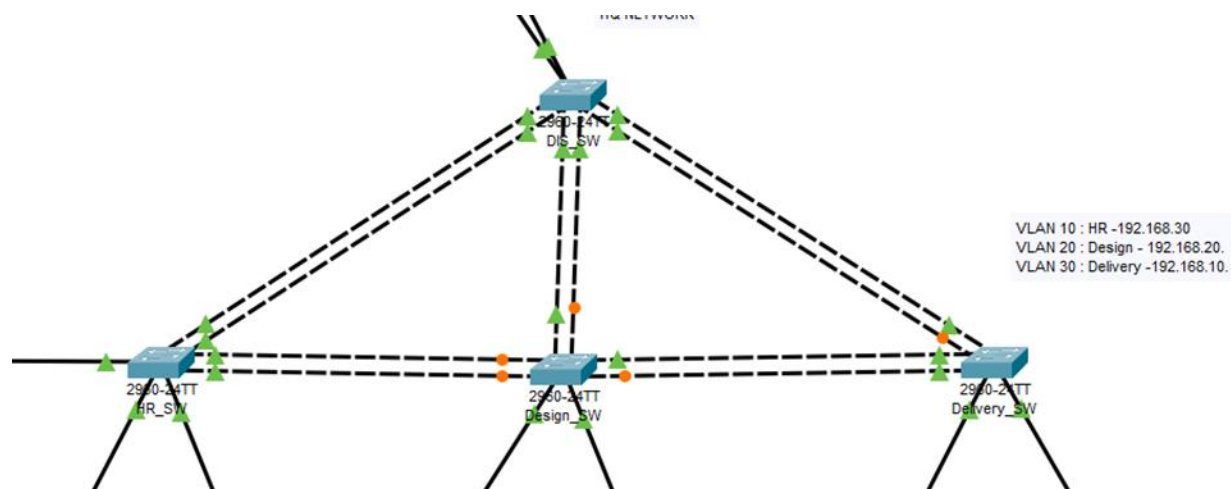
6. EtherChannel Configuration:

EtherChannel is a way used to mix more than one bodily Ethernet links right into a single logical link to increase bandwidth and provide redundancy. This generation is commonly used to improve the overall performance and reliability of the community by using bundling multiple hyperlinks into a unmarried logical connection. It enables make sure that visitors distributed throughout multiple links, enhancing bandwidth utilization and presenting fault tolerance in case of link failure. The configuration and status of **EtherChannel** can be checked using the show etherchannel command on the switches.

In this section, we will go through the EtherChannel configuration for the HR, Design, and Delivery switches based totally at the photos furnished, which show the configuration of the EtherChannel across those switches.

1. Network Topology Overview:

The community topology offered within the photo includes more than one switches for the HR, Design, and Delivery departments. Each branch's switch is attached to a relevant switch thru a couple of Ethernet links that are bundled collectively to shape a single logical hyperlink the usage of EtherChannel. The EtherChannel configuration permits for improved bandwidth and redundancy among the switches.



The main additives of the topology:

- HR Switch (HR_SW): Connected to the middle switches through EtherChannel.
- Design Switch (Design_SW): Similar to the HR Switch, it's also linked to other switches thru EtherChannel.
- Delivery Switch (Delivery_SW): Similarly configured to apply EtherChannel to link with core community switches.

The network topology uses VLANs to segment traffic between unique departments:

- VLAN 10 for HR (IP Range: 192.168.30.X)
- VLAN 20 for Design (IP Range: 192.168.20.X)
- VLAN 30 for Delivery (IP Range: 192.168.10.X)

2. EtherChannel Configuration on HR Switch (HR_SW):

In the HR switch image, the EtherChannel configuration is regarded using the show etherchannel summary command. This precis gives an outline of the EtherChannel repute and the links worried in the channel.

- Port-channel: The channel institution is recognized as Pol(SD), that means that the transfer is configured to apply the LACP (Link Aggregation Control Protocol), and the bodily interfaces involved in the EtherChannel are Fa0/5 and Fa0/6.
- Protocol: LACP (Link Aggregation Control Protocol) is used to dynamically aggregate the hyperlinks. LACP guarantees that the transfer automatically adjusts and adapts the hyperlink package based totally on the link repute, enhancing redundancy and lowering the possibilities of misconfiguration. LACP additionally enables manipulate multiple links inside the package, that's beneficial for massive networks.
- State: The kingdom of the EtherChannel organization is marked as in use, that means that it is actively being used to bypass traffic.

```
HR_SW#show etherchannel summary
Flags:  D - down          P - in port-channel
        I - stand-alone  s - suspended
        H - Hot-standby (LACP only)
        R - Layer3       S - Layer2
        U - in use       f - failed to allocate aggregator
        u - unsuitable for bundling
        w - waiting to be aggregated
        d - default port
```

```
Number of channel-groups in use: 1
Number of aggregators:           1
```

Group	Port-channel	Protocol	Ports
1	Pol(SD)	LACP	Fa0/5(I) Fa0/6(I)

This photo highlights the configuration of EtherChannel the use of LACP, ensuring that the HR department's transfer utilizes two physical links to boom bandwidth and provide fault tolerance. If one hyperlink fails, the alternative can nonetheless preserve the relationship.

3. EtherChannel Configuration on Design Switch (Design_SW):

- The Design transfer is configured further to the HR transfer in phrases of EtherChannel. The display etherchannel command output indicates the subsequent:
- The configuration is in L2 (Layer 2) kingdom, indicating that the EtherChannel is running at Layer 2 for site visitors forwarding.
- There are 3 channel organizations, with Group 1, Group 2, and Group 3 being assigned to distinct interfaces. Each institution is configured with PAgP (Port Aggregation Protocol), a Cisco-proprietary protocol for EtherChannel negotiation.
- Each group includes one bodily hyperlink with a most of eight possible ports available for aggregation. The Protocol for Group 1, Group 2, and Group three is PAgP, that's used to robotically package links between switches.

```
Design_SW#show etherchannel
Channel-group listing:
-----

Group: 1
-----
Group state = L2
Ports: 1 Maxports = 8
Port-channels: 1 Max Portchannels = 1
Protocol: PAgP

Group: 2
-----
Group state = L2
Ports: 1 Maxports = 8
Port-channels: 1 Max Portchannels = 1
Protocol: PAgP

Group: 3
-----
Group state = L2
Ports: 1 Maxports = 8
Port-channels: 1 Max Portchannels = 1
Protocol: PAgP
```

The picture indicates that the Design transfer makes use of PAgP to configure more than one businesses for EtherChannel. This setup affords flexibility in aggregating multiple hyperlinks and optimizing the community's overall performance.

4. EtherChannel Configuration on Delivery Switch (Delivery_SW):

The Delivery transfer configuration follows the equal common sense as the HR and Design switches. It makes use of PAgP for EtherChannel and is about to Layer 2 mode.

- Group 1 at the Delivery transfer has two physical ports (Fa0/5 and Fa0/6) bundled together to shape the EtherChannel.
- The kingdom of Group 1 is marked as L2, indicating that the EtherChannel is configured for Layer 2 operations.
- PAgP is the protocol used to establish and manage the EtherChannel among the Delivery transfer and different connected switches.

```
Delivery_SW#show etherchannel
Channel-group listing:
-----

Group: 1
-----
Group state = L2
Ports: 2 Maxports = 8
Port-channels: 1 Max Portchannels = 1
Protocol: PAgP
Delivery_SW#
```

The photo suggests the configuration of EtherChannel at the Delivery switch, ensuring that ports are aggregated to improve bandwidth and offer redundancy for the Delivery department's visitors.

5. Summary of EtherChannel Configuration:

In summary, EtherChannel configuration across the HR, Design, and Delivery switches follows a regular technique, however every switch has specific configurations relying at the variety of hyperlinks and the protocol used. The configuration can be broken down into the subsequent steps:

1. Protocol Selection: Both LACP and PAgP protocols are used to configure EtherChannel. LACP is dynamic, bearing in mind computerized adjustment, at the same time as PAgP is a Cisco proprietary protocol for managing the aggregation of hyperlinks.
2. Link Aggregation: Physical hyperlinks between switches are grouped together to form logical links that offer higher bandwidth. For example, Fa0/five and Fa0/6 are bundled to shape a unmarried EtherChannel on the HR and Delivery switches.
3. Layer 2 Configuration: The switches operate in Layer 2 mode for EtherChannel, that means that the switches forward Ethernet frames throughout the aggregated hyperlinks. This helps make certain green visitors distribution and redundancy.
4. Fault Tolerance: The use of EtherChannel ensures that even if one bodily hyperlink goes down, visitors can nevertheless float via the remaining lively hyperlinks, imparting fault tolerance and minimizing the threat of downtime.

The EtherChannel configuration throughout the HR, Design, and Delivery switches ensures that these vital departments have reliable, excessive-velocity hyperlinks among their respective switches. This configuration improves network performance, fault tolerance, and bandwidth usage, that is crucial for retaining seamless connectivity throughout the Cloud Co. Network.

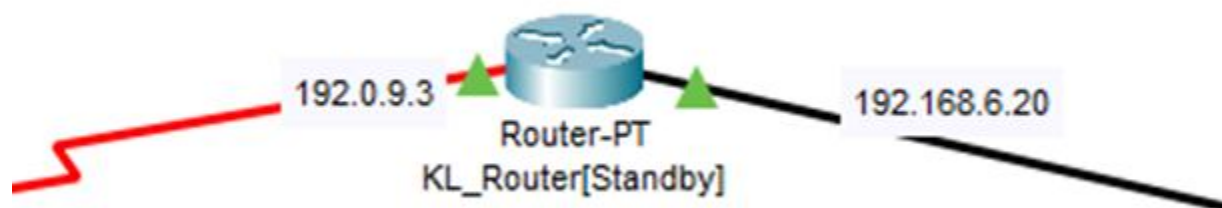
7. HSRP Implementation:

HSRP (Hot Standby Router Protocol) is a Cisco proprietary redundancy protocol designed to make certain excessive availability and prevent a unmarried factor of failure in a network. In this phase, we are able to stroll thru the implementation of HSRP, primarily based at the configuration and output furnished, that specialize in achieving router redundancy between routers, KL_Router and Router-PT.

The implementation guarantees that even supposing one router fails, the community maintains to function easily, with the standby router taking over automatically, ensuring minimal downtime for customers.

1. HSRP Overview:

HSRP permits two or extra routers to work collectively to offer the appearance of a single digital router to the network. The protocol designates one router because the Active Router, which handles all the traffic for the virtual IP cope with, at the same time as the other router(s) remain in a standby kingdom. The standby router is ready to take over in case the energetic router fails. This setup enhances network reliability by providing fault tolerance.



In the community configuration shown within the photo 1, we've got the subsequent setup:

- The virtual IP cope with: 192.168.6.20

- The bodily interfaces of the routers are 192.0.9.3 (Router-PT) and 192.168.6.20 (KL_Router).

These routers are configured to paintings together the use of HSRP to create a virtual router that offers the digital IP address (VIP) to users. The routers will work as a pair to deal with the routing responsibilities for the community even as making sure no single factor of failure.

2. HSRP Group Configuration and Router Roles:

```
Router#show standby
FastEthernet0/0 - Group 1
  State is Active
    13 state changes, last state change 00:13:12
  Virtual IP address is 192.168.6.20
  Active virtual MAC address is 0000.0C07.AC01
    Local virtual MAC address is 0000.0C07.AC01 (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 0.259 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
  Priority 100 (default 100)
  Group name is hsrp-Fa0/0-1 (default)
Router#
```

The HSRP configuration in picture 2 is related to Group 1 on FastEthernet0/0 interfaces, as shown within the output of the show standby command.

- State: The active kingdom indicates that Router-PT is the modern energetic router, meaning it is managing the site visitors for the virtual IP address (VIP) 192.168.6.20.
- Virtual IP address: The digital IP deal with used for the HSRP configuration is 192.168.6.20, that's shared among the two routers.
- Active Router: In this example, Router-PT is the active router.
- Standby Router: The KL_Router is in a standby position, waiting to take over if Router-PT fails.

The subsequent hi there time is zero.259 seconds, which refers to how regularly the active router sends HSRP howdy messages to the standby router. If a hiya message isn't always acquired within the precise time, the standby router takes over as the active router.

3. HSRP MAC Addresses and Virtual MAC Address:

The virtual MAC address used in HSRP for conversation among the two routers is:

- Active digital MAC deal with: 0000.0C07.AC01
- Local digital MAC deal with: 0000.0C07.AC01 (v1 default)

These MAC addresses are essential because they allow routers to forward visitors supposed for the virtual IP cope with. The digital MAC cope with is used by both the lively and standby routers for communicate, ensuring that devices in the network keep to send site visitors to the identical MAC deal with no matter which physical router is currently energetic.

The digital MAC deal with also allows in the failover manner. When the active router fails, the standby router takes over the digital MAC address, making sure that network gadgets do no longer need to update their ARP tables.

4. HSRP Preemption:

The configuration also includes the preemption feature, which lets in the standby router to take over as the active router if it has a higher precedence than the present day lively router. Preemption is enabled on this configuration, which means that that if KL_Router turns into available and has a higher precedence, it can take over the role of the active router.

- Priority: one hundred (default precedence for each routers).

This preemption feature is useful in cases in which the administrator desires to ensure that the primary router (KL_Router) always takes over because the energetic router whilst it will become to be had, despite the fact that there's an active router going for walks at that time.

5. HSRP Hello and Hold Time:

The good day time is ready to 3 seconds, and the maintain time is ready to 10 seconds. These are the default values within the HSRP protocol and outline the timing for the HSRP hey messages among the routers:

- Hello Time (three seconds): This is the time c program languageperiod between hiya messages despatched via the lively router to inform the standby router that it's far nevertheless energetic.
- Hold Time (10 seconds): This is the maximum time the standby router will wait earlier than it assumes the active router has failed. If no howdy messages are received at some stage in the preserve time, the standby router will take over.

By default, HSRP uses these values to preserve the communication between the routers and make sure that the digital IP deal with is constantly to be had to the network, even in case of a router failure.

6. HSRP Failover Process:

In the occasion that the lively router fails, HSRP permits the standby router to take over seamlessly, making sure minimum disruption to the network. The failover method works as follows:

1. **Router Failure:** If the active router (Router-PT) fails or stops sending hiya messages, the standby router (KL_Router) will word this after the preserve time expires.
2. **Takeover:** After the expiration of the preserve time, the standby router routinely takes over the virtual IP deal with (VIP) and becomes the energetic router.
3. **Restoration:** When the failed router (Router-PT) recovers and starts offevolved sending hey messages once more, if preemption is enabled, it's going to take over the lively function, assuming it has a higher precedence.

HSRP ensures that the digital IP address is usually available, even in the event of router screw ups. The failover technique occurs seamlessly with out requiring any guide intervention.

7. Conclusion of HSRP Implementation:

In conclusion, HSRP (Hot Standby Router Protocol) is carried out on this network to offer excessive availability and router redundancy. The configuration guarantees that the digital IP cope with (VIP) 192.168.6.20 is always available to community gadgets, even if one router fails. The key factors of the HSRP implementation encompass:

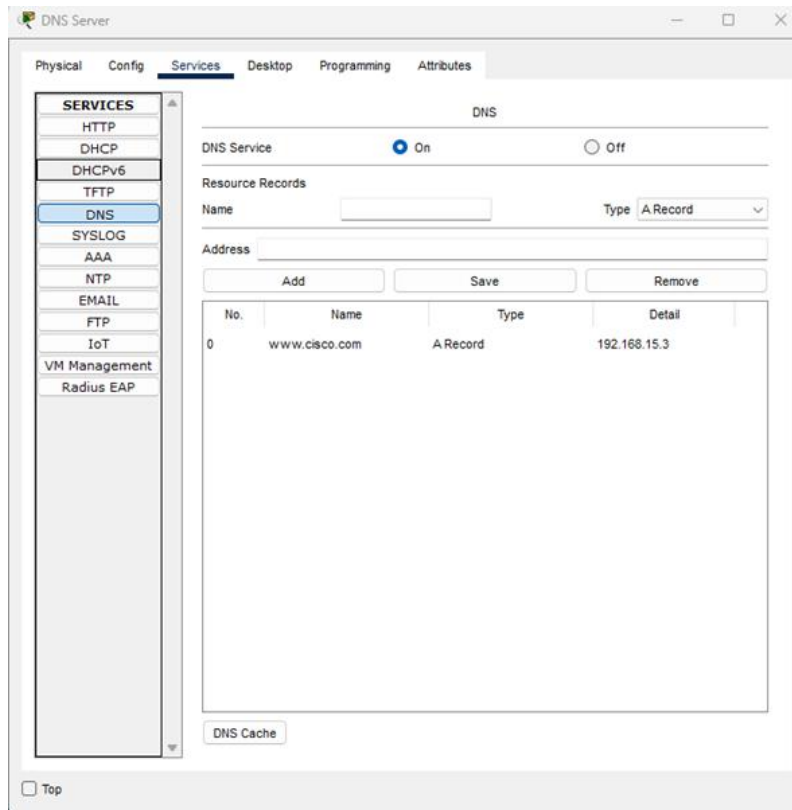
- Virtual IP address shared among the lively and standby routers.
- Preemption enabled, permitting the standby router to take over as the energetic router if it has a better priority.
- The active router (Router-PT) handles the visitors for the digital IP cope with till it fails, at which point the standby router (KL_Router) takes over.
- The HSRP hey time and hold time ensure that the routers are capable of discover disasters and perform a easy failover manner.

This configuration provides network fault tolerance and guarantees minimum downtime, that is vital for maintaining the reliability and availability of Cloud Co.'s network infrastructure.

8. Server Farm Configuration:

In this segment, we are able to give an explanation for the configuration of various services furnished by way of the server farm in Cloud Co.'s network. Specifically, we are able to discuss the configuration of DNS, FTP, and Web offerings. These offerings are vital for imparting numerous network functionalities such as domain name decision, document transfers, and hosting net pages, respectively.

1. DNS Server Configuration:



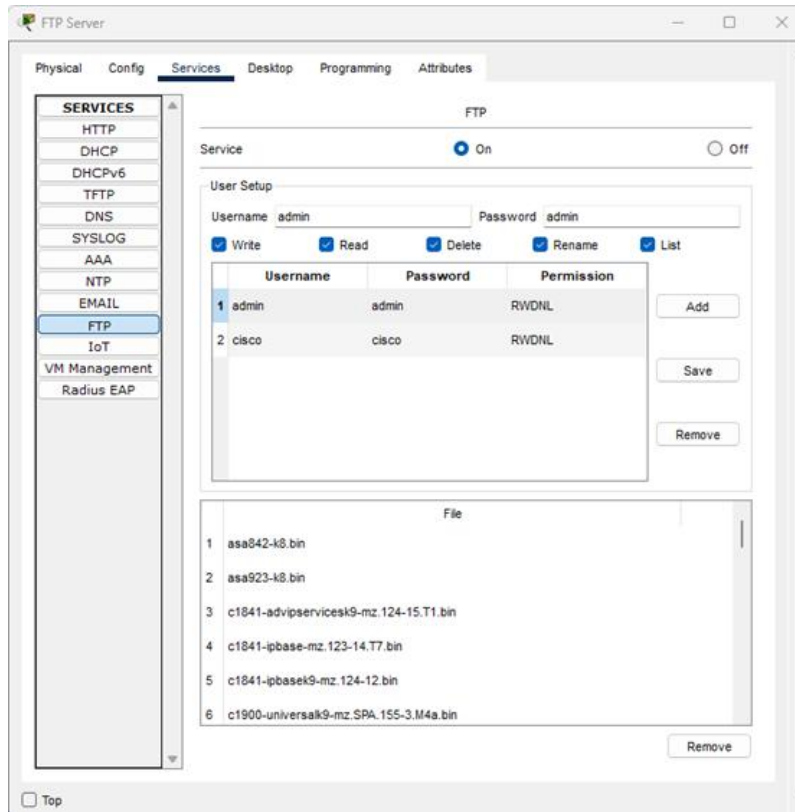
The DNS Server is configured to provide area call decision services for the community. DNS is vital as it allows gadgets on the network to remedy human-readable domain names (e.G., www.Cisco.Com) into device-readable IP addresses (e.G., 192.168.15.Three). This permits users and devices to access assets the usage of without difficulty remembered names in place of IP addresses.

In the DNS Server configuration picture, we can have a look at the subsequent information:

- **DNS Service:** The DNS service is enabled, which means that that this server will reply to DNS queries from customers within the community.
- **Resource Record:** An A file is created for the domain www.Cisco.Com, which maps this area name to the IP address 192.168.15.3.
- **Type:** The record type is A Record, that's used to map a site call to an IPv4 cope with.

This DNS configuration is essential as it ensures that gadgets in the network can remedy the www.Cisco.Com area and talk with the corresponding server using its IP address. The server allows seamless web surfing and communication by way of translating person-friendly domains into IP addresses.

2. FTP Server Configuration:



The FTP Server is configured to offer File Transfer Protocol (FTP) services. FTP allows for the switch of files among devices on the network. It may be used for uploading or downloading documents from the server to the customers. FTP is broadly used for shifting big files inclusive of software updates, configuration documents, or backups.

In the FTP Server configuration picture, we have a look at the following:

- Service Status: The FTP carrier is grew to become on, that means the server is actively imparting record transfer services.

User Setup: Two customers are set up with FTP access:

- admin with the password admin. This consumer has the permissions to examine, write, delete, rename, and list documents, that's represented by using the RWNDL permission set.
- cisco with the password cisco, having the identical permissions (RWNDL).

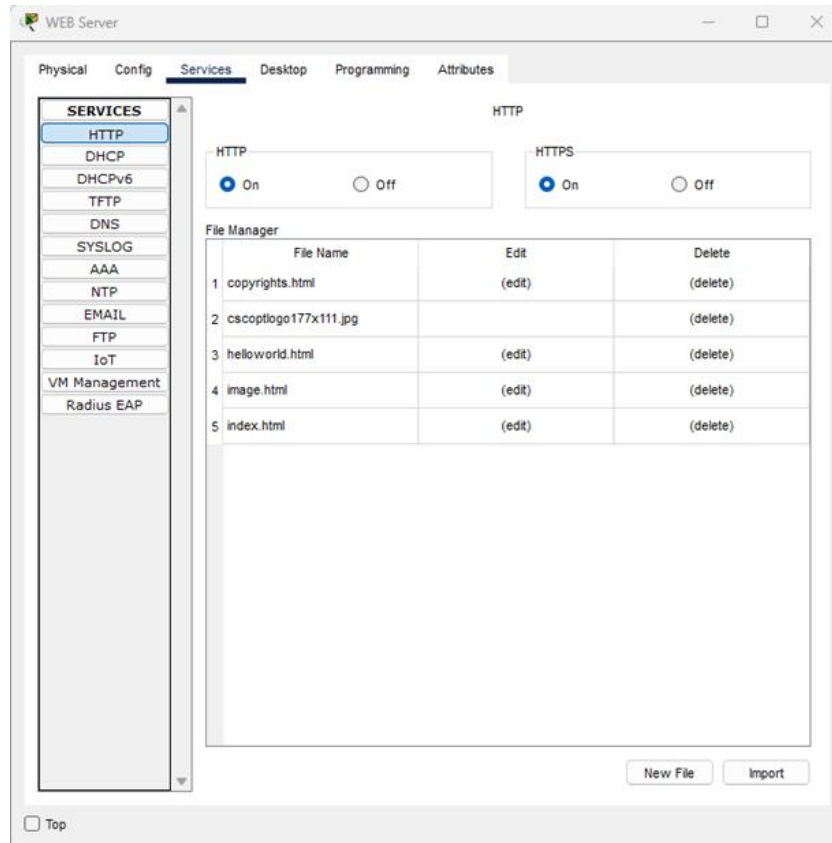
File Listing: Several documents are to be had at the FTP server for down load, inclusive of:

- asa842-k8.Bin (in all likelihood an image for a Cisco ASA firewall)
- c1841-adviserservicesk9-mz.124-15.T1.Bin
- c1900-universalk9-mz.SPA.15.Three.S.M4a.Bin

These documents are critical for community renovation, along with tool firmware updates or configuration backups.

This FTP Server setup is vital for the network because it permits customers and administrators to change documents, control configurations, and update community devices in a green way.

3. Web Server Configuration:



The Web Server offers hosting services for HTTP (Hypertext Transfer Protocol) visitors. It serves internet pages, HTML content material, and other forms of media files to clients within the network, making sure that users can get admission to internal net applications, sources, or documentation hosted at the server.

In the Web Server configuration photograph, we see:

- Service Status: The HTTP carrier is enabled, which means that the server is ready to host and serve internet content material over HTTP.

File Manager: Several net files are hosted on the server:

- copyrights.Html: This document probably carries legal or copyright information.
- helloworld.Html: A easy take a look at page, regularly used for initial setups to confirm the server is operating.
- index.Html: The major access point for the web software.
- cscoptlogo177x111.Jpg: A emblem photograph used within the internet site.

These files are used to supply internet pages to customers, ensuring that users can get admission to applicable resources hosted on the Web Server.

This Web Server setup is essential for hosting inner or public net applications, documentation, or sources. It ensures that users have get entry to to the most up-to-date content and may engage with internet-based totally gear.

Summary of Server Farm Configuration:

The server farm configuration affords crucial services to make sure easy operation throughout Cloud Co.'s network. The DNS, FTP, and Web services paintings collectively to facilitate communicate, record management, and net hosting. Here's a quick precis:

1. DNS Server:

- Provides area call decision to make sure devices can communicate using user-friendly names instead of raw IP addresses.
- The A Record for www.Cisco.Com maps the domain to an IP address, permitting customers to get right of entry to internet sources.

2. FTP Server:

- Enables green report transfers between devices, essential for uploading and downloading configuration files, firmware, and backups.
- The FTP server is configured with multiple user accounts and report permissions, ensuring steady report get right of entry to and management.

3. Web Server:

- Hosts internet content, presenting internal sources, documentation, and net packages.
- The HTTP provider is enabled, and several key HTML documents and pictures are available for customers to get admission to.

9. Network Testing:

Network trying out is crucial to ensure that the community services are operating as expected. This segment explains the effects of several community assessments including ping, traceroute, FTP, DNS, and HTTP checks. These exams are used to affirm connectivity, diagnose troubles, and confirm that the server and network configurations are correct.

1. Ping Test:

```

C:\>ping 192.168.15.5

Pinging 192.168.15.5 with 32 bytes of data:

Reply from 192.168.15.5: bytes=32 time=5ms TTL=122
Reply from 192.168.15.5: bytes=32 time=60ms TTL=122
Reply from 192.168.15.5: bytes=32 time=5ms TTL=122
Reply from 192.168.15.5: bytes=32 time=54ms TTL=122

Ping statistics for 192.168.15.5:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 5ms, Maximum = 60ms, Average = 31ms

C:\>

```

In the first image showing the ping take a look at, the ping command is used to check the connectivity between two gadgets on the network. The command was achieved to ping the IP deal with 192.168.15.5, and the output indicates the following:

- The ping sent four ICMP packets to the target IP cope with.
- The response from the target become a hit, with the TTL (Time to Live) set to 122 and spherical-trip times (RTT) starting from five ms to 60 ms, with a median of 31 ms.
- No packet loss became found, indicating that the community is stable, and the gadgets can speak with none troubles.

The ping test is one of the most primary methods of network checking out. It helps determine whether a tool is handy over the network and gives simple overall performance metrics like round-trip time and packet loss.

2. Traceroute Test:

```

Cisco Packet Tracer PC Command Line 1.0
C:\>tracert 192.168.15.5

Tracing route to 192.168.15.5 over a maximum of 30 hops:

  1  0 ms    0 ms    0 ms    192.168.20.1
  2  1 ms    1 ms    1 ms    192.0.1.2
  3  2 ms    1 ms    1 ms    192.0.4.2
  4  2 ms    53 ms   15 ms   192.0.2.2
  5  6 ms    3 ms    2 ms    192.0.3.3
  6  2 ms    9 ms    2 ms    192.0.8.3
  7  2 ms    5 ms    3 ms    192.168.15.5

Trace complete.

C:\>

```

The 2nd photograph suggests the traceroute command getting used to trace the path taken by using packets to attain the vacation spot IP deal with 192.168.15.5. The output information the following:

- The traceroute indicates each hop between the supply device and the destination. Each hop represents a router or transfer the packet travels via on its way to the vacation spot.
- The traceroute shows the IP deal with of each router along the path and the time taken (in milliseconds) to attain every hop. For example, 192.168.20.1 is the primary hop with a reaction time of 1 ms, and the destination 192.168.15.5 is the final hop with a reaction time of 5 ms.
- Round-ride time increases as the packets move through every hop, however the network indicates low latency, indicating a quick and responsive community.

This traceroute take a look at facilitates discover the route taken through the network packets and troubleshoot capability routing or community latency troubles.

3. FTP Test:

```
Cisco Packet Tracer PC Command Line 1.0
C:\>ftp 192.168.15.7
Trying to connect...192.168.15.7
Connected to 192.168.15.7
220- Welcome to FT Ftp server
Username:admin
331- Username ok, need password
Password:
230- Logged in
(passive mode On)
ftp>dir

Listing /ftp directory from 192.168.15.7:
 0 : asa842-k8.bin                5571584
 1 : asa923-k8.bin                30468096
 2 : c1841-advipservicesk9-ms.124-15.T1.bin 33591768
 3 : c1841-ipbase-ms.123-14.T7.bin 13832032
 4 : c1841-ipbasek9-ms.124-12.bin 16599160
 5 : c1900-universalk9-ms.SPA.155-3.M4a.bin 33591768
 6 : c2600-advipservicesk9-ms.124-15.T1.bin 33591768
 7 : c2600-i-ms.122-28.bin        5571584
 8 : c2600-ipbasek9-ms.124-8.bin  13169700
 9 : c2800nm-advipservicesk9-ms.124-15.T1.bin 50938004
10 : c2800nm-advipservicesk9-ms.151-4.M4.bin 33591768
11 : c2800nm-ipbase-ms.123-14.T7.bin 5571584
12 : c2800nm-ipbasek9-ms.124-8.bin 15522644
13 : c2900-universalk9-ms.SPA.155-3.M4a.bin 33591768
14 : c2950-i6q412-ms.121-22.EA4.bin 3058048
15 : c2950-i6q412-ms.121-22.EA8.bin 3117390
16 : c2960-lanbase-ms.122-25.FX.bin 4414921
17 : c2960-lanbase-ms.122-25.SEE1.bin 4670455
18 : c2960-lanbasek9-ms.150-2.SE4.bin 4670455
19 : c3560-advipservicesk9-ms.122-37.SE1.bin 8662192
20 : c3560-advipservicesk9-ms.122-46.SE.bin 10713279
21 : c800-universalk9-ms.SPA.152-4.M4.bin 33591768
22 : c800-universalk9-ms.SPA.154-3.M6a.bin 83029236
23 : cat3k_caa-universalk9.16.03.02.SPA.bin 505532849
24 : cgr1000-universalk9-ms.SPA.154-2.CG 159487552
25 : cgr1000-universalk9-ms.SPA.156-3.CG 184530138
26 : ir800-universalk9-bundle.SPA.156-3.M.bin 160968869
27 : ir800-universalk9-ms.SPA.155-3.M 61750062
28 : ir800-universalk9-ms.SPA.156-3.M 63753767
29 : ir800_yocto-1.7.2.tar        2877440
30 : ir800_yocto-1.7.2_python-2.7.3.tar 6912000
31 : pt1000-i-ms.122-28.bin       5571584
32 : pt3000-i6q412-ms.121-22.EA4.bin 3117390
ftp>
```

In the third photo, an FTP (File Transfer Protocol) connection became installed to an FTP server at 192.168.15.7. FTP is a commonplace approach used for transferring files between computer systems over a network. Here's what the FTP test shows:

- Username and Password: The login credentials were successfully entered for the admin and cisco customers, granting get admission to to the FTP server.

- **Directory Listing:** After successfully logging in, the ftp dir command was used to listing documents available on the FTP server. The listing consists of several firmware files including asa842-k8.Bin and c1900-universalk9-mz.SPA.15.3.S.M4a.Bin, which might be to be had for down load.
- **Active Connection:** The FTP server efficiently replied to instructions, showing that the report transfer carrier is up and strolling.

The FTP take a look at confirms that the document switch carrier is operational and allows for clean report sharing among devices on the community.

4. DNS Test:



The fourth photo demonstrates the use of the DNS check. The DNS (Domain Name System) service translates domain names into IP addresses. In the instance, the area www.Cisco.Com changed into resolved to the IP address 192.168.15.3.

- **Resource Record:** An A document for www.Cisco.Com become created inside the DNS server, linking the area name to the server's IP address (192.168.15.3).
- **Successful Resolution:** The DNS server efficaciously resolved the domain call to its corresponding IP deal with, demonstrating that DNS is functioning nicely.

This DNS take a look at confirms that the community can correctly resolve domains, permitting users to access net assets via person-pleasant names in place of IP addresses.

5. HTTP Test:



The 5th photo shows an HTTP check using a web browser. The take a look at become conducted to check the net carrier hosted on the server and the connectivity to the URL www.Cisco.Com. Here's what the HTTP take a look at suggests:

- The browser correctly masses the Cisco Packet Tracer web page, showing textual content like "Welcome to Cisco Packet Tracer" and links to one of a kind pages which includes A small page, Copyrights, Image web page, and Image.
- The internet server is energetic, serving HTML content and permitting customers to navigate via specific hyperlinks and get entry to pages hosted at the server.
- The person can engage with the net page, confirming that the HTTP service is operational, and the net server is functioning as anticipated.

This HTTP take a look at ensures that the internet server is serving net pages and providing access to users, confirming the capability of net-based offerings on the network.

Summary of Network Testing:

In end, the following network services have been efficiently tested:

1. Ping Test: Verified connectivity and latency between gadgets, confirming no packet loss and acceptable response instances.
2. Traceroute Test: Traced the route of community packets to their destination, assisting discover any routing issues or community latency.
3. FTP Test: Confirmed that the FTP server is operational and files may be transferred among devices.
4. DNS Test: Ensured that domain names may be resolved to IP addresses, enabling users to get admission to websites and services with the aid of name.
5. HTTP Test: Verified that the net server is functioning and serving net pages to customers as anticipated.

These tests collectively make sure that the community is fully practical, supplying the vital services for communication, file transfer, and net get admission to. Network performance, routing, and server capability are showed to be foremost.

L2 Security Mechanism Implementation

Layer 2 (L2) protection is important for protective the community from attacks that focus on the statistics hyperlink layer, along with MAC deal with spoofing, DHCP hunger, and ARP poisoning. Implementing sturdy Layer 2 safety mechanisms ensures that the community is covered from unauthorized get entry to and capability assaults. This section will explain the L2 protection mechanisms applied within the configuration based on the Configurations.

1. Port Security Configuration:

```

Delivery_SW(config)#interface fastEthernet 0/1
Delivery_SW(config-if)#switchport mode access
Delivery_SW(config-if)#
%EC-5-CANNOT_BUNDLE2: Fa0/2 is not compatible with Fa0/1 and will be suspended (dtp
mode of Fa0/2 is on, Fa0/1is off )

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to down

%LINK-3-UPDOWN: Interface Port-channell, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface Port-channell, changed state to down

%EC-5-CANNOT_BUNDLE2: Fa0/1 is not compatible with Fa0/2 and will be suspended (dtp
mode of Fa0/1 is off, Fa0/2is on)

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to down

Delivery_SW(config-if)#switchport port-security
Delivery_SW(config-if)#switchport port-security maximum 3
Delivery_SW(config-if)#switchport port-security violation restrict
Delivery_SW(config-if)#switchport port-security mac-address sticky
Delivery_SW(config-if)#

```

The first step in L2 security is configuring Port Security, which restricts get entry to to the network by means of restricting the range of MAC addresses learned on a port. Port protection guarantees that most effective authorized gadgets can connect with the transfer.

In the primary screenshot, we see the subsequent configuration steps applied to the Delivery Switch:

- Port Security Activation: The command switchport port-protection is used to permit port protection at the interface.
- Maximum MAC Addresses: The command switchport port-protection most three restricts the variety of allowed MAC addresses at the interface to a few. This limits the number of devices that may be linked to a port.
- Violation Action: The command switchport port-security violation restrict is used to specify the movement while the port safety violation takes place. In this situation, the transfer will limit site visitors from unauthorized gadgets but will not close down the port completely.
- Sticky MAC Addresses: The command switchport port-security mac-address sticky permits the transfer to dynamically research the MAC addresses of related gadgets and shop them inside the strolling configuration.

This configuration guarantees that no extra than three gadgets can connect with a port and that the switch will handiest allow the devices with known MAC addresses. If any tool with an unauthorized MAC deal with tries to get right of entry to the port, it is going to be restricted primarily based at the violation motion.

2. Dynamic ARP Inspection (DAI):

```
DIS_SW(config)#ip arp inspection vlan 10
DIS_SW(config)#interface fastEthernet 0/1
DIS_SW(config-if)#ip arp inspection trust
DIS_SW(config-if)#interface fastEthernet 0/2
DIS_SW(config-if)#ip arp inspection untrust
```

Dynamic ARP Inspection (DAI) is every other essential L2 protection mechanism that protects the community from ARP poisoning attacks. In an ARP poisoning assault, a malicious device sends fake ARP messages to the network, associating its MAC deal with with the IP deal with of every other tool, including the default gateway. This allows the attacker to intercept or alter traffic.

In the second one screenshot, the Dynamic ARP Inspection configuration is implemented:

- ARP Inspection for VLAN 10: The command `ip arp inspection vlan 10` allows ARP inspection for VLAN 10, which guarantees that handiest valid ARP requests and responses are allowed on the network.
- Trusting Interfaces: On the believe interface (i.E., the one connected to the valid DHCP server), the command `ip arp inspection believe` is configured. This guarantees that the ARP messages coming from this interface are relied on.
- Untrusted Interfaces: For other interfaces (along with the ones related to give up gadgets), the command `ip arp inspection untrust` is carried out. These interfaces will have their ARP messages validated against the DHCP snooping binding table to prevent ARP spoofing.

By enabling ARP inspection on trusted and untrusted interfaces, DAI ensures that malicious ARP messages are blocked, for that reason shielding the community from man-in-the-center attacks.

3. DHCP Snooping:

```
DIS_SW(config)#ip dhcp snooping
DIS_SW(config)#ip dhcp snooping vlan 10
DIS_SW(config)#interface fastEthernet 0/1
DIS_SW(config-if)#ip dhcp snooping trust
DIS_SW(config-if)#interface fastEthernet 0/2
DIS_SW(config-if)#ip dhcp snooping limit rate 10
DIS_SW(config-if)#
```

DHCP Snooping is any other essential L2 security characteristic that facilitates save you DHCP starvation assaults. In this type of assault, a malicious device sends DHCP requests with fake MAC addresses, hard the pool of to be had IP addresses at the DHCP server.

In the 0.33 screenshot, the DHCP Snooping configuration is as follows

- Enabling DHCP Snooping: The command `ip dhcp snooping` is used to permit DHCP snooping on the transfer.
- Enabling DHCP Snooping on VLAN 10: The command `ip dhcp snooping vlan 10` enables DHCP snooping for VLAN 10, making sure that DHCP requests in this VLAN are monitored and confirmed.
- Trusting DHCP Ports: The interfaces linked to DHCP servers are relied on the use of the command `ip dhcp snooping believe`. These depended on interfaces will permit DHCP responses to be forwarded to clients.
- Limiting DHCP Requests: The command `ip dhcp snooping restrict fee 10` limits the quantity of DHCP requests allowed in step with 2nd at the interface to 10 requests. This facilitates to save you DoS (Denial of Service) assaults because of flooding the network with excessive DHCP requests.

DHCP snooping is essential for protecting the community from unauthorized DHCP servers and hunger attacks, making sure that most effective valid DHCP responses are allowed.

4. VLAN Trunking Security:

```
HR_SW(config)#interface fastEthernet 0/1
HR_SW(config-if)#switchport mode trunk
HR_SW(config-if)#switchport nonegotiate
HR_SW(config-if)#switchport trunk allowed vlan 10,20
HR_SW(config-if)#switchport trunk native vlan 99
```

VLAN Trunking lets in multiple VLANs to be carried over a unmarried link among switches. However, it can additionally be a ability attack vector if not configured securely. In the fourth screenshot, the configuration for VLAN trunking at the HR Switch is as follows:

- **Trunk Mode:** The command switchport mode trunk configures the interface to permit multiple VLANs to be transmitted over the identical link.
- **Non-Negotiation of Trunking:** The command switchport nonegotiate prevents the interface from negotiating the trunking mode with the alternative side. This provides an additional layer of safety, as it prevents the automatic negotiation of trunk links, that may doubtlessly be manipulated by using an attacker.
- **Allowed VLANs:** The command switchport trunk allowed vlan 10,20 restricts the trunk link to handiest convey VLANs 10 and 20. This prevents different VLANs from being transmitted over the trunk, reducing the attack surface.
- **Native VLAN:** The command switchport trunk native vlan ninety nine configures VLAN ninety nine as the native VLAN. The local VLAN is used for untagged traffic at the trunk hyperlink, and placing this properly can help save you VLAN hopping assaults.

By configuring VLAN trunking securely, you make sure that most effective authorized VLANs are allowed over trunk hyperlinks, reducing the risk of unauthorized get admission to and VLAN hopping.

10. Recommendations for Improving Network Security:

While the Layer 2 safety mechanisms defined earlier drastically decorate the safety of the community, there are extra measures that may similarly enhance usual community protection and reduce the danger of capacity assaults. Below are numerous pointers for improving community protection in Cloud Co.'s infrastructure:

1. Implementing 802.1X Authentication:

One of the most effective methods to decorate community protection is through enforcing 802.1X port-based authentication. This wellknown is designed to provide an authentication mechanism for gadgets trying to connect to the community.

- How it works: When a device tries to connect to the network, the 802.1x device needs to confirm itself using the radius server before it can access the network. This ensures that only authorized equipment is allowed in the network and prevents unauthorized access.

Benefits:

- Ensures that simplest valid users and gadgets can access network resources.
- Protects against MAC address spoofing and unauthorized get entry to by way of imposing device and consumer authentication.

The implementation of 802.1X on switches can save you attackers from getting access to the network via without a doubt connecting to an open port, considerably improving port security.

2. Using Private VLANs (PVLANS):

In large network infrastructures, the use of Private VLANs (PVLANS) can decorate protection with the aid of setting apart devices in the same VLAN whilst nonetheless permitting them to speak with every different through a gateway device. This isolation can lessen the assault floor inside a VLAN.

- How it works: PVLANS assist you to create sub-VLANs inside a number one VLAN. Devices in a PVLAN can't talk immediately with gadgets in different PVLANS unless routed through a Layer three device (inclusive of a router or firewall).

Benefits:

- Restricts communication between devices within the equal VLAN, making it more difficult for attackers to transport laterally in the network.
- Provides greater control over which gadgets can talk with each other.

By implementing Private VLANs, you may appreciably improve internal community segmentation, in particular in environments with sensitive facts or high-protection wishes.

3. Regular Software and Firmware Updates:

Ensuring that all community gadgets, inclusive of routers, switches, and firewalls, are walking the modern-day software and firmware versions is important for retaining protection.

- How it really works: Network devices frequently release updates to fix protection vulnerabilities and enhance overall performance. Regularly checking for and putting in these updates ensures that the network is included from recognized exploits.

Benefits:

- Fixes regarded safety vulnerabilities that attackers would possibly make the most.
- Improves the overall stability and overall performance of community gadgets.

An automated patch control device must be applied to make certain that gadgets are up to date on a ordinary basis, minimizing the risk of safety breaches because of previous software program.

4. Use of Firewalls and Intrusion Prevention Systems (IPS):

While Layer 2 security mechanisms protect against neighborhood network threats, a firewall and Intrusion Prevention System (IPS) are vital for detecting and stopping attacks that originate from outside the community.

- Firewalls: Implement Next-Generation Firewalls (NGFWs) among the internal network and the outside internet to filter out malicious traffic and limit unauthorized get right of entry to.
- Intrusion Prevention Systems (IPS): An IPS can locate suspicious site visitors styles and mechanically block malicious sports. By analyzing site visitors and evaluating it in opposition to recognized attack signatures, IPS systems offer real-time chance mitigation.

Benefits:

- Protects the network from external threats and attacks.
- Unauthorized access effort and service refusal (DOS) Explore and stop.

By combining firewalls and IPS, Cloud Co. Can create a sturdy protection perimeter towards external threats, ensuring that malicious site visitors is filtered before it is able to cause harm.

5. Enabling Syslog and SNMP Monitoring:

- Having complete tracking and logging structures is important for detecting and reading capability safety incidents. Syslog and Simple Network Management Protocol (SNMP) can be used to collect and shop logs of network interest.
- Syslog: Syslog servers can accumulate and save logs from various network devices, such as switches, routers, and firewalls. These logs provide a detailed file of all activities, making it less difficult to hit upon any unusual sports, including failed login tries or unauthorized access.
- SNMP: SNMP can be used to display community gadgets in real-time. Configuring SNMP to alert directors while atypical sports occur, including spikes in visitors or unauthorized tool connections, can help prevent security incidents.

Benefits:

- Provides visibility into community traffic and device activity.
- Facilitates quicker incident reaction by allowing directors to hit upon safety breaches in actual-time.

Regularly reviewing Syslog and SNMP logs will assist the community directors to identify capacity protection threats and take immediate action.

6. Redundant Network Design with High Availability:

Designing the network with excessive availability in mind is another crucial step to improve community security. Implementing redundant gadgets (such as routers, switches, and power components) ensures that the community stays operational even within the event of hardware failure.

- How it works: Implementing HSRP or VRRP (Virtual Router Redundancy Protocol) guarantees that if one router fails, every other can take over seamlessly without disrupting community connectivity.
- **Benefits:**
 - Ensures non-stop community uptime, lowering the effect of hardware failures.
 - Protects towards assaults that might goal a single point of failure, increasing the resilience of the network.

By ensuring high availability and redundancy, Cloud Co. Can maintain a continually-on, stable community that resists each inner and outside disruptions.

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