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Designe and implement a small office network

Presented by

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Origin of the idea

Throughout our learning journey in the networking field, we have observed that a significant number of job opportunities for junior network engineers are centered around the implementation and design of office networks for startup companies. These roles provide an excellent opportunity for us to further develop and refine our skills in real-world environments.

We will delve into the technical aspects and specific details of the project at a later stage.

Problem

A company with two branches is facing challenges in implementing a Local Area Network (LAN) for each branch. Each branch requires segmentation into multiple VLANs to efficiently manage network traffic and enhance security. Additionally, the company aims to activate the DHCP protocol on the LAN routers to dynamically assign IP addresses to devices within each branch.

Moreover, the company needs to establish a connection between the two branches as well as provide internet access. This would involve configuring the appropriate routing protocols and ensuring secure and reliable communication between the branches and the external network.

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Solution steps

01	Network topology
02	Switches configuration & VLANs
03	routers configration & DHCP

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Topology

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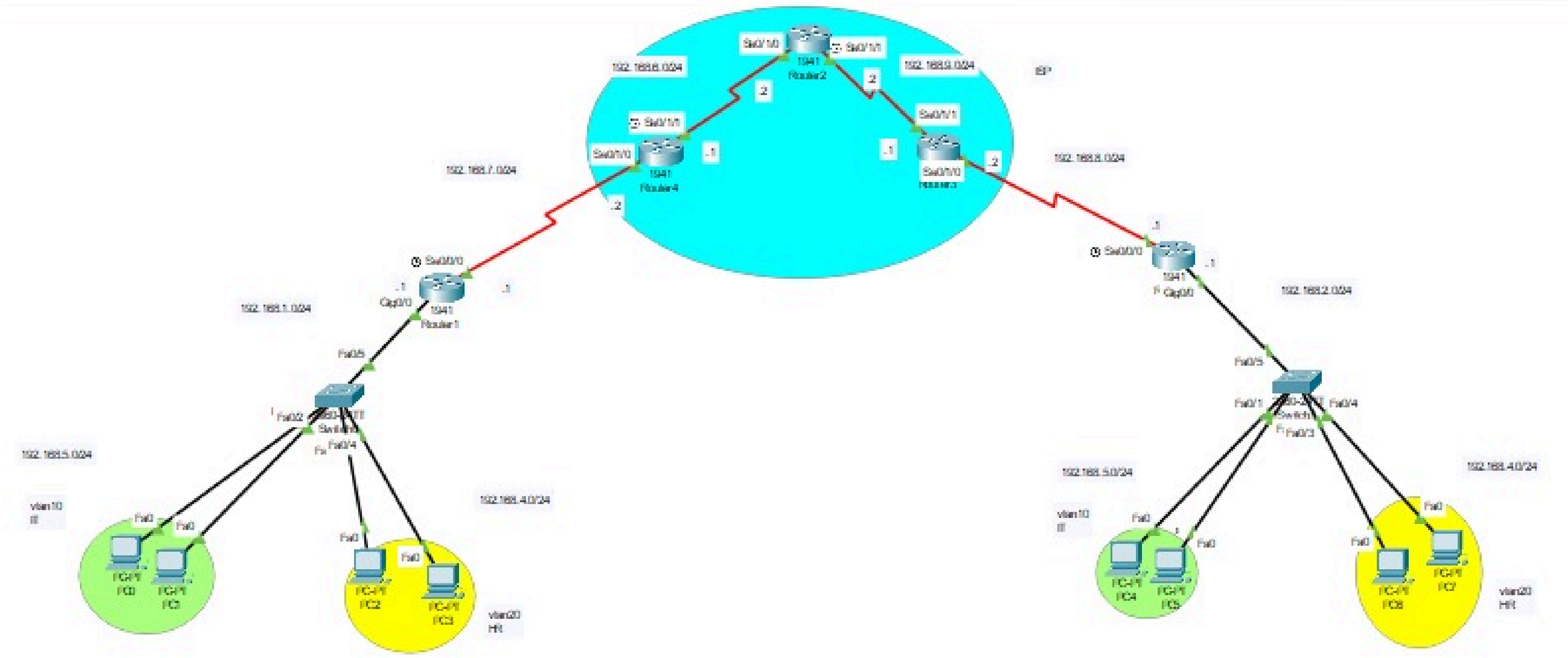
192.168.6.0/24
Se0/1/0
Se0/1/1
1941
Router2
192.168.9.0/24
ISP
Se0/1/1
Se0/1/0
1941
Router4
192.168.7.0/24
Se0/1/1
Se0/1/0
192.168.8.0/24
Se0/3/0
Gig0/0
1941
Router1
192.168.1.0/24
Fa0/5
Fa0/2
Fa0/4
192.168.5.0/24
vlan10
IT
Fa0
PC-PT
PC0
PC-PT
PC1
192.168.4.0/24
Fa0
PC-PT
PC2
PC-PT
PC3
vlan20
HR
Se0/3/0
Gig0/0
1941
192.168.2.0/24
Fa0/5
Fa0/1
Fa0/4
Fa0/3
192.168.5.0/24
192.168.4.0/24
vlan10
IT
Fa0
PC-PT
PC4
PC-PT
PC5
Fa0
PC-PT
PC6
PC-PT
PC7
vlan20
HR

Configuration on switch

We began by accessing the switch's Command Line Interface (CLI) and entering configuration mode to initiate the setup process. Once in configuration mode, we navigated to the specific switch ports and proceeded to assign each port to the appropriate VLANs that we had previously created. This step was essential for logically segmenting the network and ensuring that each VLAN could operate independently, aligning with the network design and security requirements.

```
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/4
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/5
 switchport mode trunk
```

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Configuration on router

We write a configuration for DHCP pools on a network router. Each DHCP pool defines a set of IP addresses that will be dynamically assigned to devices within specific VLANs or subnets. In this configuration, there are three distinct DHCP pools: "cisco," "HR," and "IT." Each pool specifies a unique network address range, subnet mask, default gateway (or router), and DNS server. For instance, the "cisco" pool is configured for the 192.168.1.0/24 network, with a default router of 192.168.1.1 and a DNS server of 8.8.8.8.

The "HR" and "IT" pools are configured similarly, each with their respective network ranges: 192.168.4.0/24 for HR and 192.168.5.0/24 for IT. Both pools also point to the same DNS server (8.8.8.8), with default routers specific to their network ranges—192.168.4.1 for HR and 192.168.5.1 for IT. These settings ensure that devices within each VLAN are assigned appropriate IP addresses, gateways, and DNS information for network connectivity and communication.

```
ip dhcp pool cisco
 network 192.168.1.0 255.255.255.0
 default-router 192.168.1.1
 dns-server 8.8.8.8
 domain-name w
ip dhcp pool HR
 network 192.168.4.0 255.255.255.0
 default-router 192.168.4.1
 dns-server 8.8.8.8
ip dhcp pool IT
 network 192.168.5.0 255.255.255.0
 default-router 192.168.5.1
 dns-server 8.8.8.8
```

Configuration on router cont.

The image shows the configuration of network interfaces on a Cisco router. The router's GigabitEthernet0/0 interface is assigned the IP address 192.168.1.1 with a subnet mask of 255.255.255.0, indicating that it is part of the 192.168.1.0/24 network. The duplex and speed settings are set to auto, meaning the router will automatically negotiate the best settings with connected devices. There is also a "no IP address" command under GigabitEthernet0/0.1, indicating that no IP address is assigned to this subinterface.

The configuration also defines two subinterfaces: GigabitEthernet0/0.4 and GigabitEthernet0/0.5. These subinterfaces are used to manage VLAN traffic, as indicated by the encapsulation dot1Q command, which specifies the VLAN IDs 20 and 10, respectively. The subinterfaces are assigned IP addresses (192.168.4.1 and 192.168.5.1) with appropriate subnet masks to support VLAN 20 and VLAN 10. Finally, the GigabitEthernet0/1 interface is configured with no IP address, set to duplex and speed auto, and marked as shutdown, meaning it is currently disabled.

```
interface GigabitEthernet0/0
 ip address 192.168.1.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/0.1
 no ip address
!
interface GigabitEthernet0/0.4
 encapsulation dot1Q 20
 ip address 192.168.4.1 255.255.255.0
!
interface GigabitEthernet0/0.5
 encapsulation dot1Q 10
 ip address 192.168.5.1 255.255.255.0
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 shutdown
```

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Configuration on router cont.

a configuration of serial and VLAN interfaces on a router. The Serial0/0/0 interface is assigned the IP address 192.168.7.1 with a subnet mask of 255.255.255.0, and a clock rate of 2000000 is set, indicating this is likely part of a point-to-point WAN connection. The Serial0/0/1 interface is not assigned an IP address and is marked as shutdown, meaning it is disabled and not in use, but its clock rate is still configured at 2000000.

Additionally, there are three VLAN interfaces: Vlan1, Vlan10, and Vlan20. None of these VLAN interfaces have IP addresses, but each is associated with a unique MAC address, which allows them to handle traffic for specific VLANs. The configuration also includes a static route using the ip route command, routing traffic from the 192.168.6.0/24 network to the 192.168.7.2 next hop. The ip flow-export version 9 command is present, indicating that NetFlow is enabled on the router to monitor and export traffic data for .network analysis

```
interface Serial0/0/0
 ip address 192.168.7.1 255.255.255.0
 clock rate 2000000
!
interface Serial0/0/1
 no ip address
 clock rate 2000000
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
interface Vlan10
 mac-address 0040.0b94.c101
 no ip address
!
interface Vlan20
 mac-address 0040.0b94.c102
 no ip address
!
ip classless
ip route 192.168.6.0 255.255.255.0 192.168.7.2
!
ip flow-export version 9
'
```

Conclusion

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In summary, we successfully designed and implemented a comprehensive office network project. The DHCP was activated on the router to dynamically allocate IP addresses, and VLANs were meticulously configured on the switch to ensure efficient network segmentation. Additionally, this branch was seamlessly connected to another branch, mirroring the same configurations. This inter-branch connectivity was achieved through a reliable Internet Service Provider, ensuring robust and continuous network communication.

The project

https://drive.google.com/file/d/1da-QRX-KBZWew4RpBSlZTJvS87ynAc7j/view?usp=sharing

Thank You